

EAST COAST RAILWAY

PCE's Circular No. 2 /2020 Dated: 22 /07/2020

Subject: Fixing of wind ties to Sheet roofing.

In the past, roofing to Passenger Platform covers, open sheds, workshops etc. in Railway establishment was done predominantly with AC sheets, & Corrugated Galvanized steel (CGS) sheets. The use of AC sheets has been discouraged due to health hazardous Asbestos fiber used in its manufacturing. Hence, the same been replaced slowly with Galvalume profile sheets over the last about 20 years which are fixed using self-driven screws with the help of hand drilling machine, whereas AC/CGS sheets are with "J" or "L" hook bolts.

Galvalume profile sheets render nice appearance but, they blow away to heavy winds during cyclones. East Coast Railway incurred huge losses due to that the Galvalume sheet roofing blown away/ damaged during frequent cyclones in coastal area.

Under these circumstances, it is advised to follow the guidelines as under: -

- a. Provide wind ties to all sheet roofing to PF Covers, open sheds, workshops etc. as an additional precautionary measure to secure the sheets in fixed position. Length of hook bolts shall be sufficiently long so as to accommodate thickness of wind tie flat.
- b. Workmanship and the methods adopted in laying & fixing of sheets including quality of all materials used should be certified by Engineer in-charge.
- c. All the relevant specifications & tests should strictly be adhered.

Further, as painted GI Sheets or even Galvalume sheets do not provide a useful life closer to that of Aluminum sheets. Railway Board vide their letter No.2019/SD-II/22/1/2 Dt.31/05/2019 advised to give preference of using Aluminum sheets in coastal areas and corrosion prone areas in view of its benefits like longer life, less maintenance, higher resale value, green metal and saving in foreign currency.

1. Galvalume profile sheet roofing:

1.1 Material:

As per Para 10.44.1 of IR Unified Standard Specifications, Vol.1, 2010 material should be pre-painted Al-Zn alloy coated (Galvalume) sheet base metal i.e. CRCA steel thickness shall be 0.50 (+/- 0.02) mm and steel shall comply with requirements of Gr.60 as per ASTM A 792 M in terms of yield strength, ultimate tensile strength and percentage elongation. Basic steel shall be coated with an alloy of 55% Aluminum plus 43.5% Zinc by hot dip process to grade AZ 150 (150 gms of alloy mass total both sides) as per ASTM A 792 M, skin passed to suitability for colour coating to achieve uniform high class paint finish.

1.1.1 Pre-treatment process shall be exclusively through dip tanks without use of any chemical water at any stage and shall comprise of pre-cleaning by chemical soap water rinse, hot-air-jet drying, tension leveling, activation dip, water cleaning, chromate conversion and final activation dip in sequence. Pre-treatment shall be followed by a coat of special flexible primer (non-epoxy) of average DFT 5 microns each on both surfaces and finished with a coat of special polyether with anti-dirt property of average DFT 20 micron of standard column shade on the exposed surface and special polyester hard coat grade polyester paint of standard gray shade to an average DFT 5 micron on unexposed surface.

1.1.2 Coil coating mill test certificate registered for EPG-20 grade paint system shall be furnished. Further, for better quality control, it is advised that the material with the process of manufacturing & colour coating shall be inspected at factory site by the authority not lower than ADEN in-charge.

1.2 Purlins:

In the absence of any guidelines on fixing Galvalume sheet in USSOR-2010 specifications & CPWD specifications, it is recommended that the Max. clear Spacing of purlin if exceeds 1.25 m, an intermediate Runner should be provided. This intermediate runner shall be a suitable member of lighter section Angles (Ls) or Channels (C s) than that of Purlin.

1.3 Slope:

Galvalume sheet is suitable for any slope as the length of sheet is available to any requirement (mostly, up to 12.00 m due to transportation feasibility). So, end overlapping of sheet should be avoided to the extent possible. If unavoidable, end overlapping shall be kept min. 200 mm and the centre of end lap shall be provided over purlin.

1.4 Laying & Fixing:

- i. Galvalume profile Sheets shall be laid over purlins to a true plane, with the profile line of the adjacent sheets be parallel.
- ii. Fixing shall be with self-tapping screws meeting requirements of Class-3 of AS 3566 with EDPM washers.
- iii. The entire roof structure should be made ready in all sides including all coatings of painting etc. well before the action of sheet fixing starts.
- iv. Cutting of sheets, laying & fixing in roofing/walling shall be as directed by ADEN concerned.
- v. Projection of sheet beyond the edge of last purlin to be restricted to 270 mm. (as illustrated in RDSO Drg. No. RA-10631)
- vi. All screws shall be driven at right angles to the sheet. Marking of purlin/runners on top sheet laid will help driving screw directly to penetrate into purlin/runners.
- vii. One crest of adjacent sheets to be (side) overlapped and stitched with self-driven screws meeting requirements of Class-3 of AS 3566 with EDPM washers at an interval of 500mm at the centre of the crest.
- viii. Length of self-tapping screw shall be varying depending on height of crest, thickness of roof member and finally not less than 25mm or 4 pitches of screw(whichever is more) should be left over.

1.5 Wind ties:

The wind tie shall be of 40 x 6 mm flat iron section which shall be fixed on the purlins as described at Item No.103040 IN USSOR-2010. Wind tie should be preferably of Galvanized Iron (GI) flats; in case of MS flats it should be painted with suitable paint before put in use. **(Typical Sketch is enclosed at Annexure-1 for reference).**

2. Corrugated Galvanized Steel (CGS) sheet roofing:

Para 12.1 of CPWD specifications, vol. 1- 2009, present about CGS sheets.

2.1 Material:

As per Para 12.1.1 of CPWD specifications, vol. 1-2009, CGS sheets shall conform to IS 277 and shall govern by the properties as given below.

- i. Thickness: 1.00 mm, 0.80 mm, 0.63 mm.
- ii. Free from cracks, split edges, twists, surface, flaws etc.
- iii. Clean, bright & smooth.
- iv. Not showing signs of rust or powdery deposits on surface.
- v. Corrugation shall be uniform in depth and pitch and parallel to side.

Manufacturers test certificate shall be supplied with each consignment of every 500 sheets and Railway official/Purchaser shall carryout tests on any sample selected at random from the delivery.

2.2 Purlins:

- i. Purlins' spacing with respect to thickness of sheet:

Thickness of C.G.S. Sheet (mm)	Maximum Spacing of Purlins (metre)
1.00	2.00
0.80	1.80
0.63	1.60

- ii. Surface of purlins shall be uniform & plain.
- iii. Painting schedule to purlins, rafters and all the steel fabricated work should be completed before fixing the sheet.

2.3 Slope:

Roof shall not be pitched at a flatter than 1 vertical to 5 horizontal and the normal pitch be 1 vertical to 3 horizontal.

2.4 Laying & Fixing:

- i. CGS Sheets should be laid on the purlins to a true plane, with the lines of corrugations parallel or normal to the sides of the area to be covered.

ii. Minimum lap:

- a) For slopes of 1 vertical to 2 horizontal and steeper: 15 cm at the ends and 2 ridges of corrugation at each side.
- b) For slopes flatter than 1 vertical to 2 horizontal: 20 cm at the ends and 2 ridges of corrugation at each side.
- c) For sheets with ridge, hip and valley: 20 cm measured at right angles to the line of the ridge, hip and valley respectively.

iii. Lapping in C.G.S. sheets shall be painted with a coat of approved steel primer and two coats of painting with approved paint suitable for G.S. sheet, before fixing it.

iv. Sheets shall not generally be fixed into gables and parapets. Sheets shall be bent up along their side edges close to the wall and junction shall be protected by flashing or by a projecting drip course (to cover the junction by at least 7.5 cm).

v. Sheets shall be fixed to the purlins or other roof members such as hip of valley rafters etc. with "J" or "L" hook bolts and nuts, 8 mm diameter, with bitumen and G.I. limpet washers or with a limpet washers filled with white lead.

vi. "J" hooks are used for fixing sheets on angle iron purlins, and "L" hooks are used for fixing the sheet to R.S. Joist, timber or precast concrete purlins.

vii. Bolts shall be sufficiently long so that after fixing they project above the top of the nuts by not less than 10 mm. The grip of "J" or "L" hook bolt on the side of the purlin shall not be less than 25 mm.

viii. Minimum of 3 hook bolts should be placed at the ridges of corrugations in each sheet on every purlin and spacing shall not exceed 30 cm.

ix. Galvanized coating should confirm to IS 1367 (Pt. XIII). Mass of coating per square meter of the surface shall be as under

Minimum Mass (g/m ²)	Average Thickness (μm)	Minimum Mass (g/m ²)	Individual Thickness (μm)
375	54	300	43

- x. For slopes of roofs less than 21.5 degree (1 vertical to 2.5 horizontal) sheets shall be joined together at the side laps by galvanized iron bolts and nuts 25x 6 mm size, each bolt provided with bitumen and a G.I. limpet washer or G.I. limpet washer filled with white lead. As the overlap at the sides extends to two corrugations, these bolts shall be placed zig-zag over the two overlapping corrugations, so that the ends of the overlapping sheets shall be drawn tightly to each other. The spacing of these bolts shall not exceed 60 cm along each of the staggered rows. Holes of all bolts shall be drilled (not punctured) while the sheets are on ground.

2.5 Wind ties:

Wind ties shall be of 40 X 6 mm flat iron section as described at Item No.103040, USSOR-2010 and fixing shall be done with the same hook bolts which secure the sheets of the purlins. Wind tie flats shall be preferably of GI flats. In case of MS flats, it should be painted with suitable paint before put in use.

3. Aluminum Sheet Roofing:

3.1 Material:

As per description of item No. 109140 in IRUSSOR – 2010 the sheets of 0.91mm thick shall govern by the properties as given below;

- i. Sheets made of 988 alloys conforming to IS 737-1974 (or 2008) in full hard (H4) temper.
- ii. Profile tolerance conforming to IS: 1254-1975 (or 2007).
- iii. Sheet should be mill finish & of 1000mm width.

It is mentioned in the Railway Board's Lr. No.2019/SD-II/22/1/2 Dt.31/05/2019 that to ensure quality, sheets from primary producers (Indian manufacturers) should only be considered confirming to relevant code and material test certificate.

3.2 Purlins:

In the absence of any guideline in IR Unified Standard Specifications, vol.1-2010 & CPWD specification - vol.1-2009, it is recommended that the max. Clear spacing of purlin if exceeds 1.80m, an intermediate runner should be

provided. This runner shall be a suitable member of lighter section Angles (Ls) or Channels ([s]) than that of purlin.

3.3 Laying & Fixing :

Laying and fixing of aluminum sheets shall be in the same lines of CGS sheets as both are to be fixed with 8 mm dia. "J" or "L" hook bolts to Purlins.

- i) Aluminum sheets shall be laid over purlins to a true plane, with the profile line of the adjacent sheets is parallel.
- ii) Minimum lap:
 - a. For slopes of 1 vertical to 2 horizontal and steeper: 15 cm at the ends and 2 ridges of corrugation (general purpose sheet)/one crest (Industrial sheet) at each side.
 - b. For slopes flatter than 1 vertical to 2 horizontal: 20 cm at the ends and 2 ridges of corrugation (general purpose sheet)/one crest (Industrial sheet) at each side.
 - c. For sheets with ridge, hip and valley: 20 cm measured at right angles to the line of the ridge, hip and valley respectively.
- iii. As per Para 10.43 of IR Unified Standard Specification Vol-1-2010, fixing sheet to purlins or to other roof members shall be with GI "J" or "L" hook bolts (8 mm dia & in suitable length) with nuts and GI washer along with standard fiber washer etc. complete in all respects to make the entire roofing leak proof.
- iv. "J" hooks are used for fixing sheets on angle iron purlins and "L" hooks are used for fixing the sheet to R.J. Joist, timber or precast concrete purlins.
- v. Bolts shall be sufficiently long so that after fixing they project above the top of the nuts by not less than 10 mm. The grip of "J" or "L" hook bolt on the side of the purlin shall not be less than 25 mm.
- vi. Minimum of 3 hook bolts should be placed at the ridges of corrugations in each sheet on every purlin and spacing shall not exceed 30 cm.
- vii. For slopes of roofs less than 21.5° (1 vertical to 2.5 horizontal) sheets shall be joined together at the side laps by galvanized iron bolts and nuts

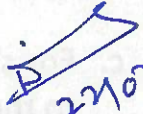
25x 6 mm size, each bolt provided with bitumen and a G.I. limpet washer or G.I. limpet washer filled with white lead.

In case of 'general purpose sheet' (Ref. IS: 1254), the overlap at the sides extends to two corrugations and bolts shall be placed zig-zag over the two overlapping corrugations, so that the ends of the overlapping sheets shall be drawn tightly to each other. The spacing of these bolts shall not exceed 60 cm along each of the staggered rows.

In case of 'Industrial sheet' (Ref. IS: 1254), the overlap extends to one crest and spacing of these bolts shall not exceed 50 cm at the centre to centre of the crest. Holes of all bolts shall be drilled (not punctured) while the sheets are on ground.

3.4 Wind Tie:

Wind tie shall be 25mm x 6mm flat as described at Item No.109140, USSOR-2010 and Fixing shall be done with the same hook bolts which secure the sheets with purlins/roof members. Wind tie should preferably be of GI flats; incase of MS flats, it should be painted with suitable paint before put in use.


22/07/2020

(Narottam Singh Uikey)
Principal Chief Engineer

No.W.1/221/Passenger Amenities/Pt.VII/3529

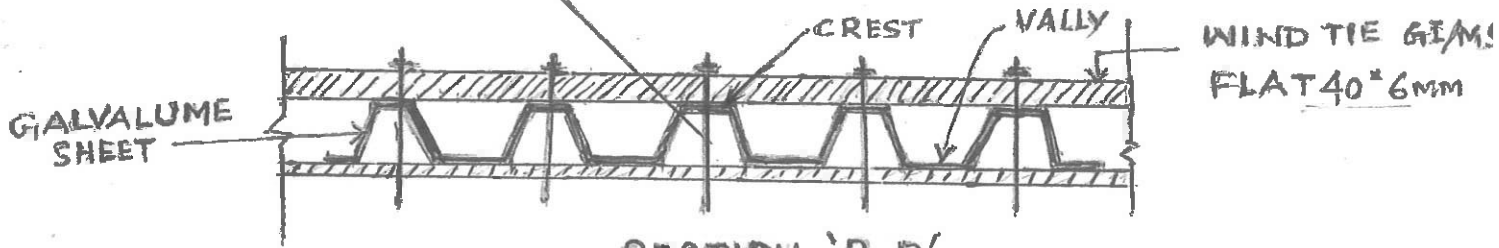
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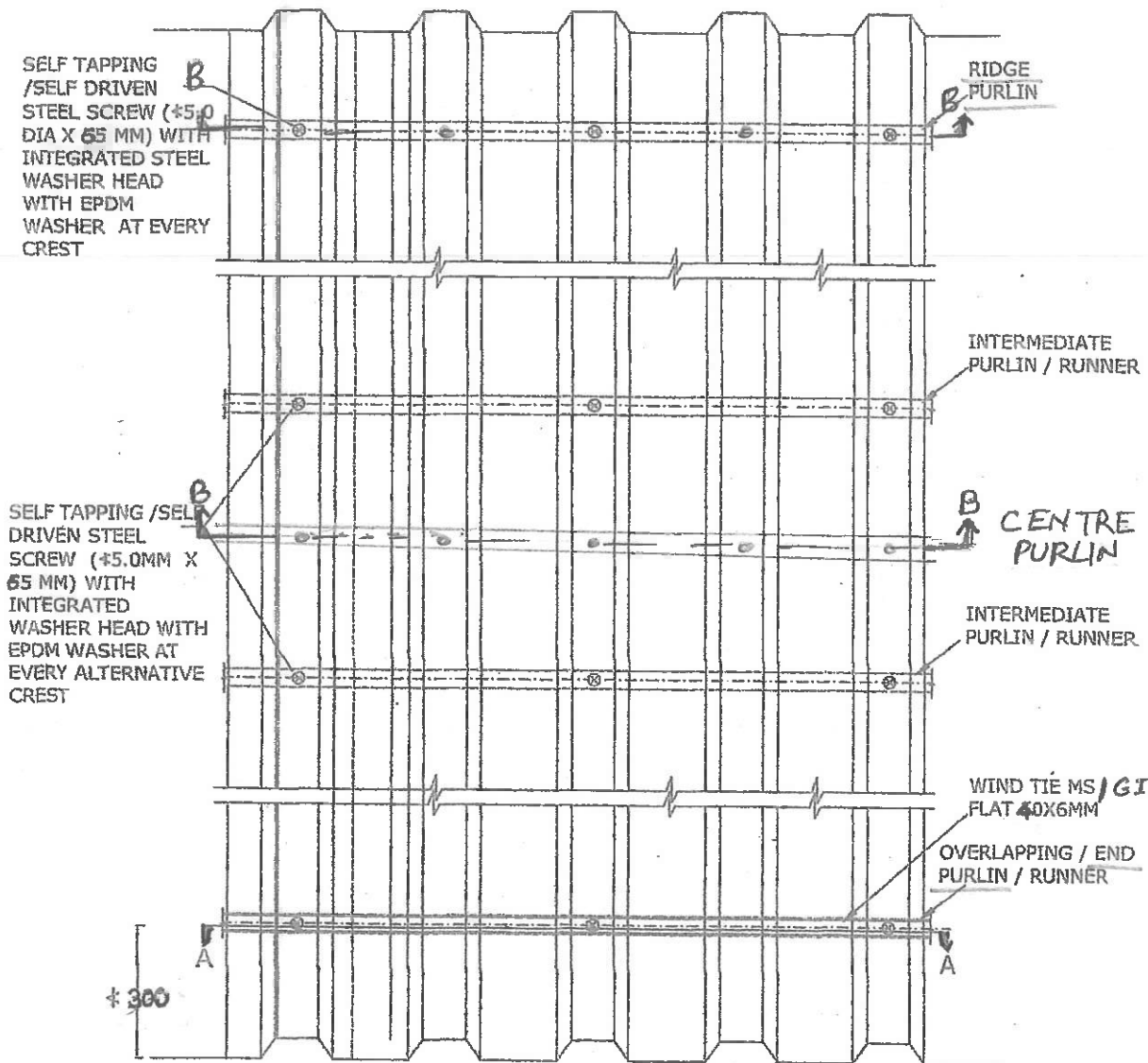
1. CAO (Con)/BBS
2. All PHODs of ECoR
3. CPD/BW/BBS
4. CTE,CBE,CPDE,CE/Br.Reh,CGE,CE/RSW, CE/TP,CE/TM,CE/Wks
5. DRM/KUR,SBP&VSKP
6. ED/RVNL/BBS
7. CPM/RVNL/I & II/BBS, CPM/RVNL/I & II/VSKP & CPM/RVNL/R
8. Sr.DEN(Co)/KUR SBP & VSKP

SELF TAPPING / SELF DRIVEN SCREW
WITH INTEGRATED WASHER HEAD WITH
EPDM WASHER.

Annexure-1
29C

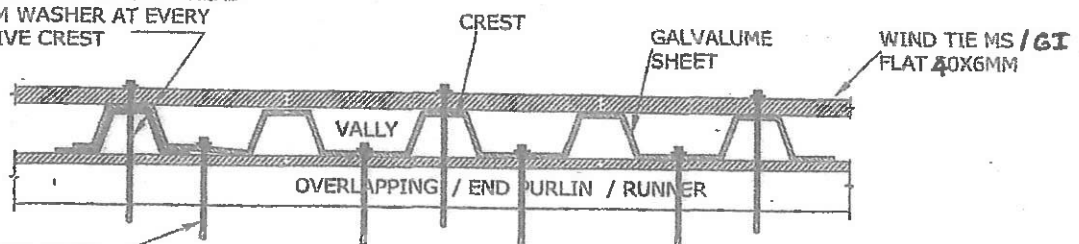


SECTION - 'B-B'
TYPICAL SCREW FIXING DETAILS.



PLAN

SELF TAPPING / SELF DRIVEN
STEEL SCREW (5.0MM X 65 MM)
WITH INTEGRATED WASHER HEAD
WITH EPDM WASHER AT EVERY
ALTERNATIVE CREST



SELF TAPPING / SELF
DRIVEN STEEL SCREW
(5.0MM X 32 MM)

SECTION AT A-A
TYPICAL SCREW FIXING DETAILS

