Technical Bulletin

1005 – Silicone Butt Joints

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Australian Glass Group®

1005 – Silicon Butt Joints

Cited National Standards

- **AS 1288:** Glass in Buildings – Selection and installation.

Other Cited Documents

- Dow Corning Asia Pacific Manual
- AGG Technical Bulletin: TB 1009 - Wind Loads
- AGG Technical Bulletin: TB 1015 - Glass Fins

Introduction

Under the right circumstances, a silicone butt joint can be considered as a full edge support. These circumstances are for an included angle of 90° to 160° however the silicone joint and glass must be designed appropriately. First we will consider single glazing, then the more complex double glazing.

Silicone itself has some minimum requirements as per Dow Corning's Manual: a minimum glueline and bite of 6mm, and a joint aspect ratio of between 1:1 to 3:1 in cross section. These silicone requirements may determine the glass thickness. Also, the gap between glass panes for glass thicker than 12mm must be a minimum of half that thickness.

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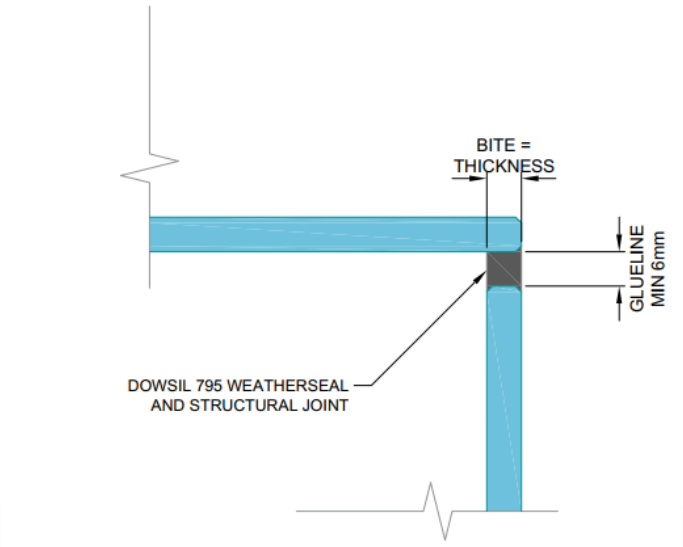
Single Glazing

To design a 90° single glazed butt joint, the silicone shall be designed as per **AS 1288** Appendix F for structural glazing.

The formula is: 0.5 x span (mm) x ULS wind pressure (kPa) divided by silicone tensile strength (kPa).

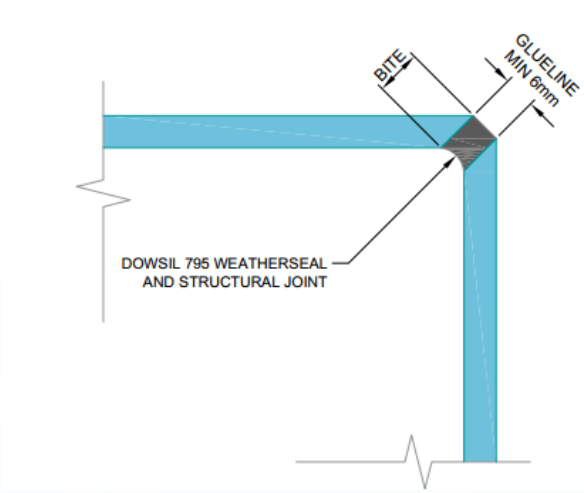
For example, a window pane that is 3000mm high, 1400mm wide in an N3 wind zone has a 2.03kPa corner wind pressure and using DowSil 795 structural silicone with a tensile strength of 210kPa...
The resulting minimum silicone bite is 0.5 x 1400 x 2.03 ÷ 210 = 6.767mm. As this is the minimum silicone bite, the next size up glass thickness must be used which is 8mm. Now the glass itself can be designed as 4 edge supported as per **AS 1288** Section 4.

Diagram 1:
- SG Passing Butt Joint



To increase the available structural bite, a mitre joint can be used instead of a passing butt joint, see below detail. With the above example of 3000h x 1400w, using a mitre joint now gives an available structural bite of 8mm whilst still using 6mm thick glass. Mitred edges are an additional production process.

Diagram 2:
- SG Mitre Butt Joint



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For faceted glazing with an angle between 90° to 160°, glass and silicone shall be designed as per section 9 of AS 1288. The formula is more complex for faceted silicone design compared to a 90° butt joint. As the angle increases from 90° up to 160° the joint and glass combined provide less support, so glass thickness will increase. Using a mitred joint increases the amount of silicone bite available, but is an additional process that must be done to the glass during manufacture.

Bite = angle factor F x panel width B (mm) x wind pressure ULS (kPa) ÷ silicone tensile strength (kPa)
F = 1 ÷ (2 x cos(ϑ÷2)) where ϑ = angle between panes in degrees.

For a faceted make up that's 3000mm high, 1400mm wide, in an N3 wind zone and has an angle of 130° between panes:

F = 1 ÷ (2 x cos(130÷2)) = 1.183
Bite = 1.183 x 1400 x 2.03 ÷ 210 = 16.01mm. This is significantly larger than the required bite for the 90° silicone butt joint calculated above.

Diagram 3:
- SG On-Centreline Butt Joint
- angle from 90° to 160°

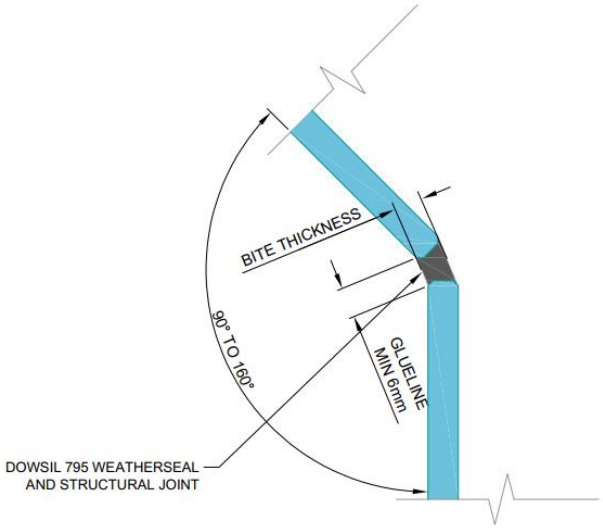
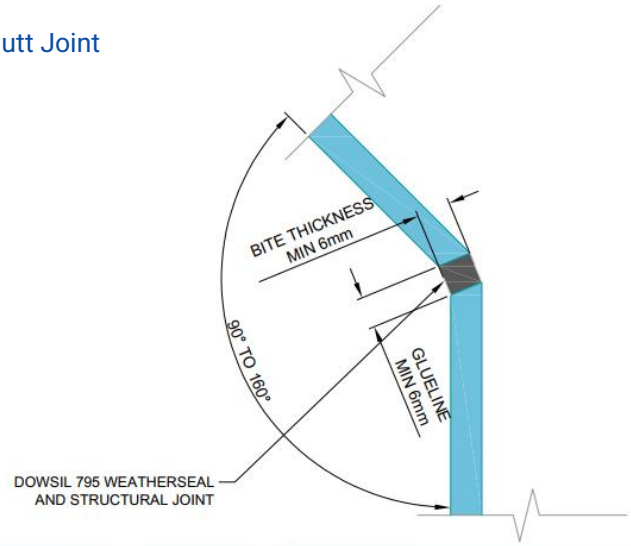


Diagram 4:
- SG On-Centreline Mitred Butt Joint
- angle from 90° to 160°



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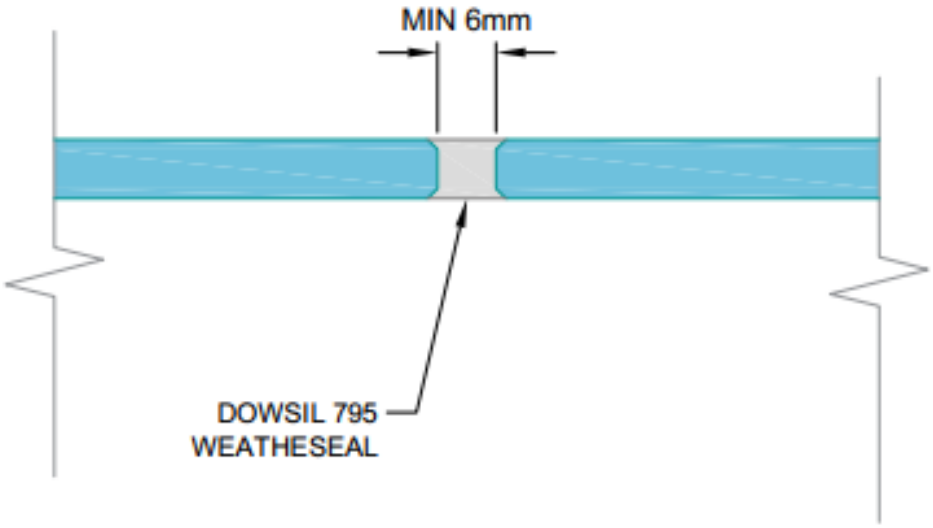
Once the angle between glass is above 160°, there is no support gained from the silicone. All the silicone is now doing is keeping the weather out and is known as a weatherseal. Glass must then be designed as two edge supported, with the span (typically height) being the distance between framed edges.

Diagram 5:
- SG Butt Joint
- angle 180°



Double Glazing

Silicone butt joints can also be accomplished with Double Glazed Units (DGU), but DGU's do have more stringent performance criteria and additional detailing. As per **AS 1288** section 3, wind pressures are shared between both panes of a double glazed unit. As load from this will be transferred to the frame, the load path from the glass through the silicone butt joint to the frame is typically within the head and sill. For a 90° butt joint, this load path is relatively simple. Take the previous example we used above where the minimum silicone bite required was 6.767mm and it required an 8mm glass pane. If this was a double glazed unit instead, the maximum available silicone bite is the combined thickness of the inner and outer panes. So for a 6/12/6 DGU, the maximum available silicone bite is 6 + 6 = 12mm. As this is comprised of two small silicone joints, each one must still meet the silicone constraints. Therefore, each pane must be a minimum of 6mm to ensure these constraints are met. The IGU can then be designed as 4 edge supported as per **AS 1288**.

There are several options for constructing a 90° double glazed silicone butt joint. These are: a passing butt joint, single stepped and double stepped. The passing butt joint is the simplest option and is therefore the easiest to manufacture. When using/specifying Softcoat LowE glass, care must be taken for any stepped option to ensure the coating is not on the stepped lite of the DGU as the coating cannot be exposed. Hardcoat LowE can be used for such application however, but may have some aesthetic issues when in contact with silicone. Contact AGG for assistance when specifying Hardcoat LowE stepped units.

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Diagram 6:
- DG Passing Butt Joint

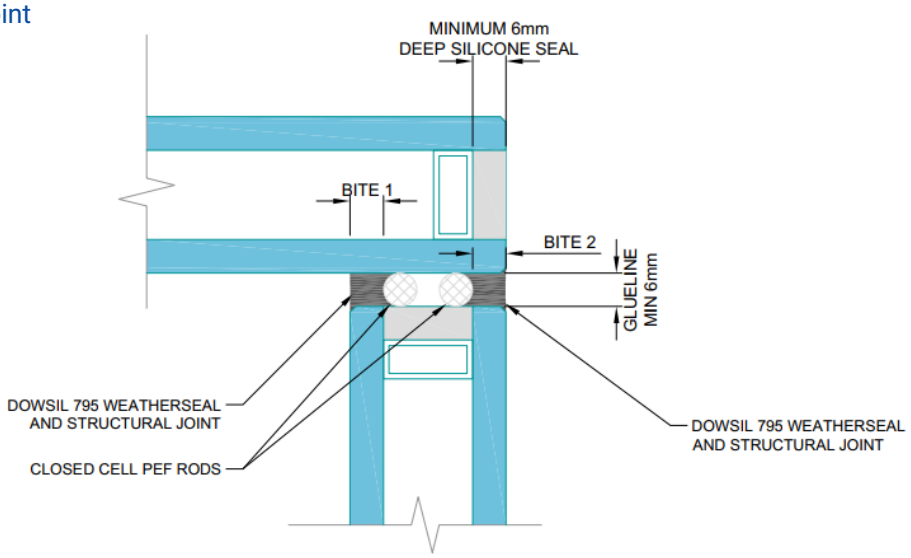


Diagram 7:
- DG Single Stepped Butt Joint

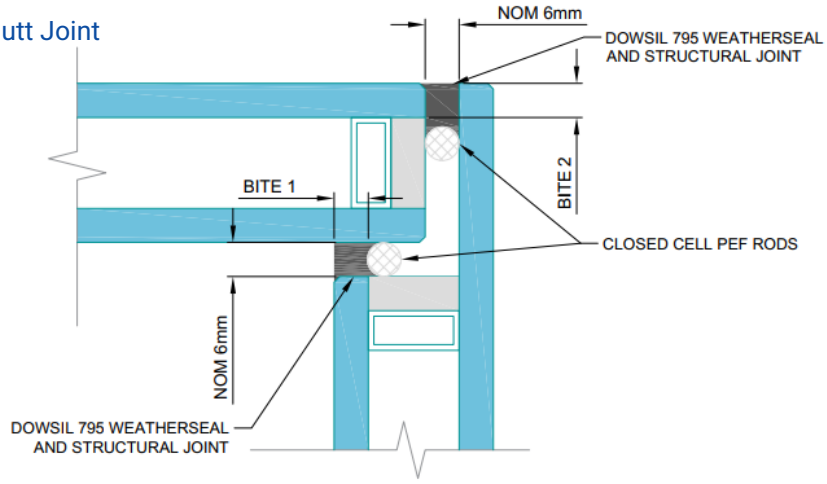
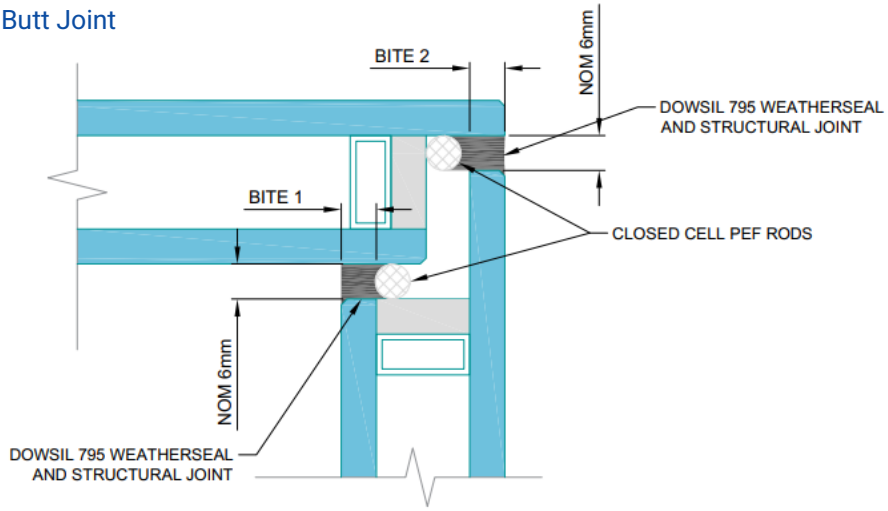


Diagram 8:
- DG Double Stepped Butt Joint



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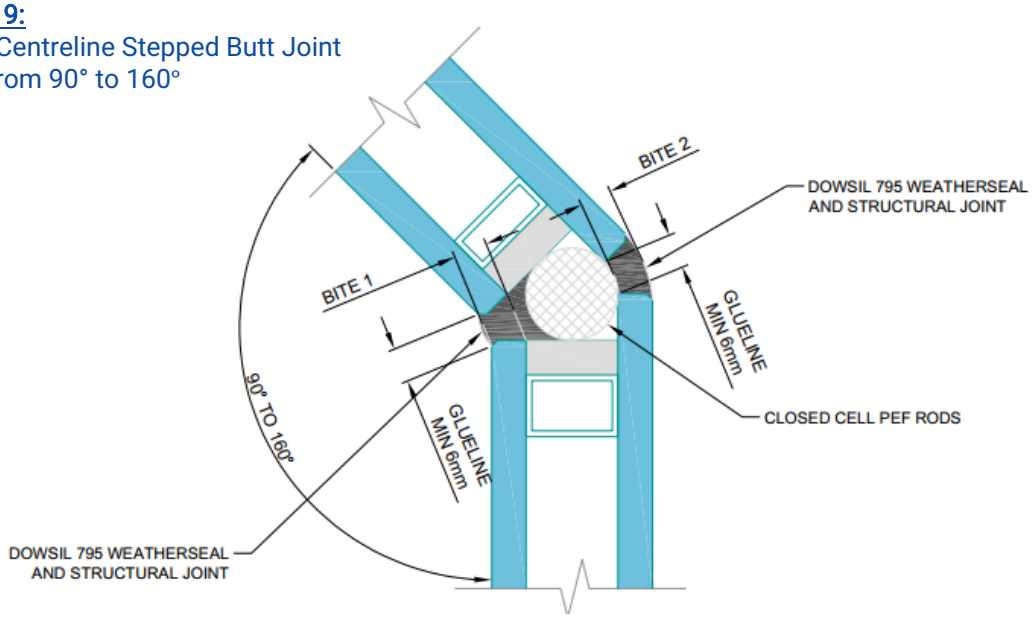
For faceted DGU's the load path though the silicone joint is far more complex. Email AGG Technical for design at **technical@agg.com.au**.

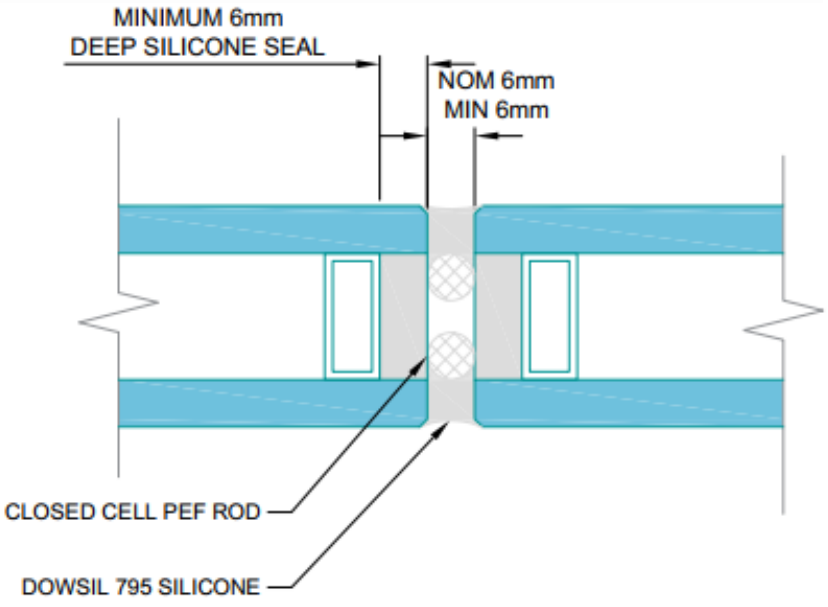
Note that Mitred glass is not an option for faceted DGU's.

Diagram 9:
- DG On-Centreline Stepped Butt Joint
- angle from 90° to 160°



For an IGU with a 160° to 180° degree silicone butt joint, much like the single glazed version there is no support gained from the silicone joint. The IGU's must be designed as two edge supported. Unlike two edge supported monolithic glass which has a deflection limit of span/60mm, two edge supported IGU's have a deflection limit of span/150mm. This often requires thicker glass which can often result in a IGU make-up which is not commercially viable.

Diagram 10:
- DG Butt Joint
- angle 180°



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Fin Glazing

Finally, there is the option of glass Fins. For both single and double glazed glass, the calculation for the silicone bite is the same as Section 9 of **AS 1288**. The double glazed option requires a minimum Fin thickness of 19mm as PEF rods are required between the DGU's to protect the DGU secondary seal; meaning a minimum gap of 6mm between panes is recommended.

For the single glazed option, the minimum gap between panes is 3mm as no PEF rods are required. Including the silicone bite requirements, the minimum Fin thickness for monolithic glass is 15mm.
Note: with a 3mm gap between glass panes installation may prove difficult.
For more information see **Technical Bulletin 1015 - Glass Fins**.

Diagram 11:
- SG Butt Joint with Fin

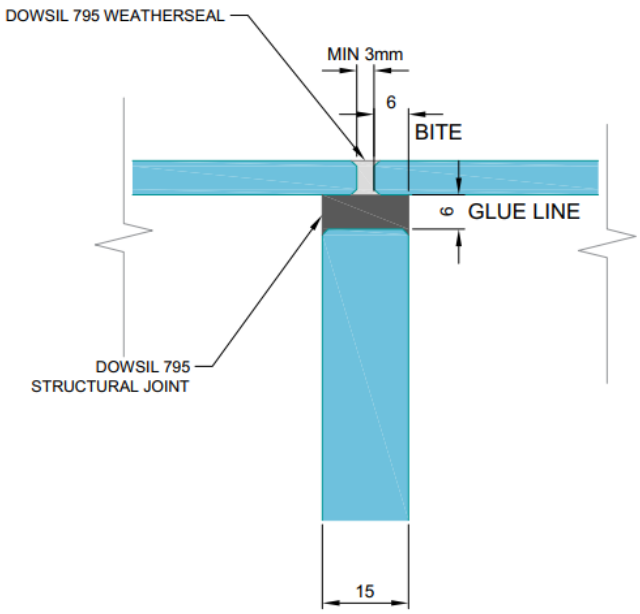
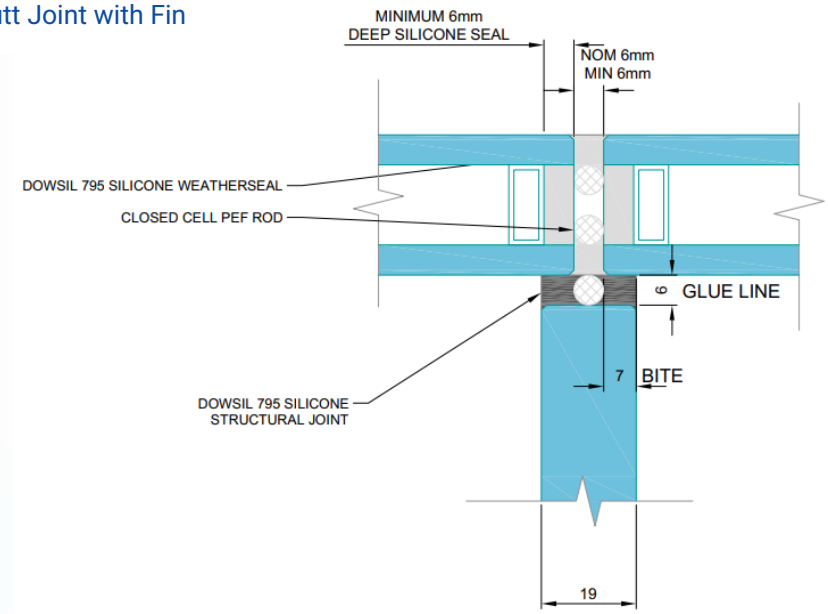


Diagram 12:
- DG Butt Joint with Fin



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4. This document has been produced on the basis that Dowsil 795 structural silicone will be used. If a different structural silicone is desired, email AGG technical for advice at **technical@agg.com.au.**

5. Only structural silicone to be used for structural bite. The same silicone can be used for a weatherseal.

6. Only silicone DGU's are to be used as the DGU secondary seal is exposed to UV light. Polysulphide is not suitable for situations where it is exposed to UV.

7. Flat ground edges only for silicone butt joints to ensure adequate adhesion. Other edges can be flat polished.

8. For all double glazed options, the DGU primary seal (surrounding the spacer bar), DGU secondary seal and the silicone butt joint are all black coloured. As the DGU primary and secondary seals are viewed through glass they will appear different to the silicone butt joint upon close inspection. Also, depending on joint type this region of black components can be up to 50mm wide.

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