Nailing the fit

Builders shouldn't make do with a poor fit as this can bring a range of problems. If the fit is less than perfect, what amount of variation can be tolerated before rework is required?

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WHEN ONE searches the internet for 'getting a good fit', the first information listed relates to physical fitness, shoes, bikes, clothes, college planning, data points and jobs. Nothing about building.

My first hit of anything remotely building-related 'Getting a good fit - selecting the right shaft and housing tolerance' was on page 3. And even by page 10 of the Google search, there was nothing more remotely related to building.

Building parts need a good fit

Where I am heading is that construction of all building types requires a good fit - whether it's a window into an opening, glazing into the frame or a cladding panel installed between or in front of columns. All construction work must incorporate an allowance for inherent variances in construction materials and workmanship skills.

It is not uncommon to hear of building projects where elements or components that are meant to fit together don't. How that problem is viewed depends on the affected parties. For example, a component manufacturer may say the opening provided was too small but the builder says the component was made too big.

Consequences of a poor fit

A poor fit can result in:

- installation damage where the item is force-fitted
- rework to ensure a good fit - this may require a new element of the component to be manufactured, which is not uncommon
- incorrect width of sealant joint where openings or gaps are too tight
- restriction of a material's ability to move under loading (wind or earthquake) or movement (thermal or moisture).

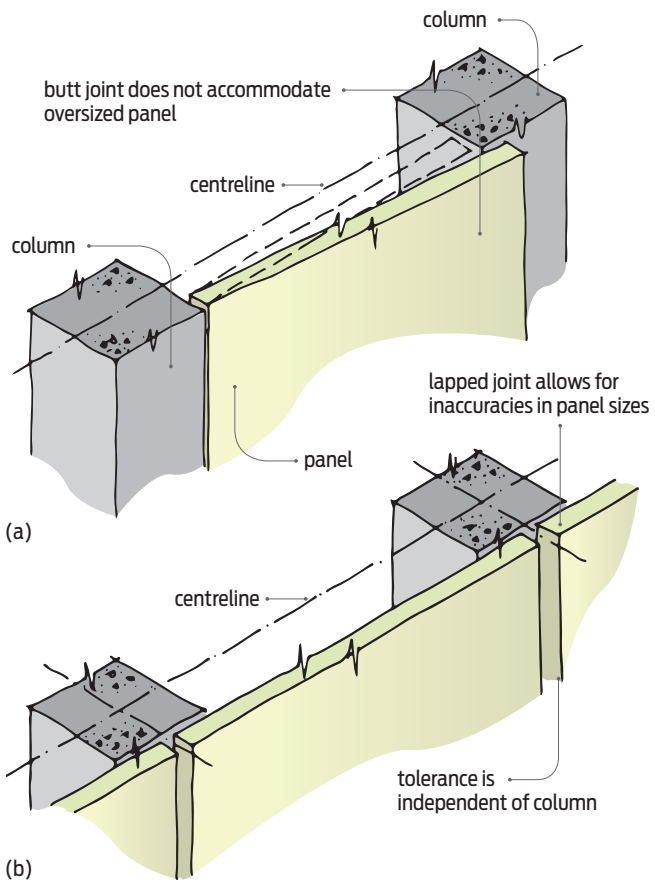

Figure 1: Overlapping joints allow for greater tolerance provided the vertical components align.

What are fitting tolerances?

Fitting tolerance is the amount of variation permitted to allow the correct installation in:

- dimensions
- sizes of individual building elements
- relative positions of building elements.

Specify the right tolerances

The accuracy limits should be specified in the contract documentation. Where they are not specified, refer to the MBIE *Guide to tolerances, materials and workmanship in new residential construction 2015* and relevant standards (NZS 3604:2011 *Timber-framed buildings*, NZS 3109:1997 *Concrete construction*, BS 6954:1988 *Tolerances for building*). Table 1 has some typical set-out tolerances.

When specifying fitting tolerances, consider the permitted minimum and maximum sizes of components and in situ construction. Fitting tolerances generally should be increased with element size.

Think about the precision with which the element can be manufactured or built on site. For example, precast concrete can be manufactured to tighter tolerances than in situ concrete.

Avoid situations where an element that can be manufactured to a tight tolerance is used adjacent to one that cannot.

When specifying joint widths for given jointing methods and materials, check the joint design parameters, width and depth for the specified sealant.

Tighter tolerances are required where a design features a clean look, such as detailing without the use of scotias and architraves. Also consider:

- basing the design on actual rather than nominal sizes
- using detailing that does not have a specific fit requirement (Figure 1)
- detailing junctions with an allowance for adjustment when being erected - for example, the fitting gap around windows being installed into timber framing
- avoiding fixings that use preformed holes or rebates.

On site, double check site set-out and site measurements.

Be proactive to avoid issues

Potential tolerance issues can be mitigated where:

- acceptable tolerances are clearly specified in the contract documentation
- items are supplied within the specified tolerances
- the impact of thermal and moisture movement has been factored in to the tolerances
- attention is paid to achieving an accurate on-site set out
- coordination meetings are part of the construction process
- periodic checks on the accuracy of construction are carried out as the building is erected
- variability between materials and systems is recognised and allowed for.

Tolerances are not to hide poor work

Tolerances should not be relied on to accommodate:

- poor dimensional coordination at design and detailing stages of a project
- insufficient detail of junctions and intersections
- poor quality set-out and workmanship on site
- a lack of on-site measuring before manufacture
- poorly manufactured components or elements.

Table 1

Typical set-out tolerances for construction other than concrete

IN SITU COMPONENT SET-OUT/ CONSTRUCTION	DIMENSIONAL LIMITS	BLOCKWORK	STEEL	TIMBER
Dimensions between	walls up to 7 m apart columns up to 7 m apart	± 16 mm	 ± 12 mm	± 27 mm ± 12 mm
Window/door openings	width up to 3 m height up to 3 m	± 20 mm ± 20 mm		
Columns	verticality (up to 3 m) verticality (up to 7 m)		6 mm 8 mm	10 mm (8 mm over 2.4 m) 20 mm over total height
Beam straightness	maximum deviation over 6 m		8 mm	10 mm
Variation from dimension on plan for structural frame length and width	buildings up to 8 m over 8 m and up to 15 m over 15 m and up to 25 m	± 12 mm ± 16 mm ± 18 mm	± 12 mm ± 16 mm ± 18 mm	± 12 mm ± 15/16 mm ± 18 mm
Relative displacement between loadbearing timber walls in adjacent storeys				5 mm
Position in plan relative to nearest reference or grid line for each element at each grid			± 10 mm	± 10 mm