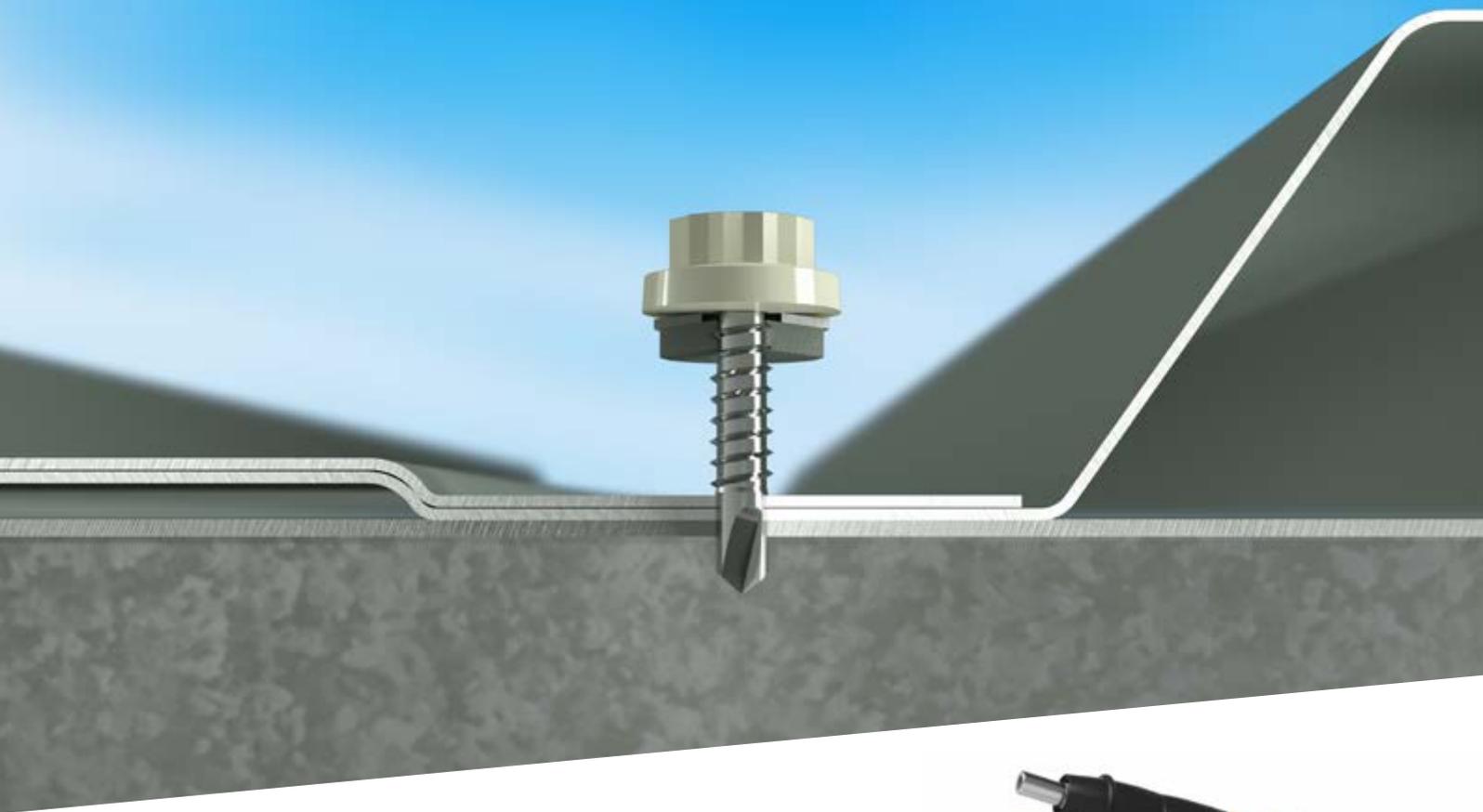


Installing self-drilling fasteners the right way



A Technical Guide from the
EJOT UK Applitec Centre



EJOT® The Quality Connection



This technical guide takes you through the process of choosing the correct installation tool once a correct self-drilling fastener specification has been made.

We review the correct installation tools generally available and highlight some of the known consequences when the wrong installation tool is used. To support recommendations, we illustrate the right way to use a depth 'nosepiece' in order to establish the correct installation settings to meet the most common site applications.

The guide summarises best practice by providing a combined specification and installation check list in order to gain best product performance and thereby the best possible result.



Make sure self-drilling fasteners are ALWAYS installed correctly. Scan here to watch our short guide to best results and best practice.



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Screw guns: The right installation tool

Choosing the correct installation tool is absolutely essential for the fastener to drill and tap in the way it has been designed to perform.

The selected screw gun will need to be equipped with a variable trigger to deliver a controlled overall speed without end loading, of between 1700 and 2000 rpm. It will need to provide torque of up to 30 Nm allied to a clutch mechanism to ensure that excessive torque and speed is not retained, causing damage or the 'stripping out' the fastener.

There are a number of screwguns available on the market, but the correct drilling speed, clutch and torque needs to be suitable for the fasteners to be installed. See recommended drill speeds and end loads on page 9.

We recommend either of the following tools:



FEIN ASCS 6.3 Select

Li-ion battery powered screwgun supplied with a depth stop nosepiece.

See our website or current Roofing & Cladding fastener catalogue for full specification.



W8VB2 TEKS® 110V Screwdriver

Supplied with a depth stop nosepiece.

See our website or current Roofing & Cladding fastener catalogue for full specification.



The selected screw gun will need to be equipped with a variable trigger to deliver a controlled overall speed without end loading, of between 1700 and 2000 rpm.

The wrong tools

Installation tools that are outside our recommended parameters will have a detrimental effect by reducing the performance of the fastener or damaging the material that the fastener is being installed into.



Impact drivers

Revolve at high speeds delivering a hammer action of around 3,500 Impacts Per Minute. Installation torque can be between 110 Nm - 650 Nm, way in excess of dedicated screwguns that operate up to 30 Nm.

These 'impacts' affect the drilling performance of self-drilling fasteners and can reduce the friction between thread and substrate - increasing the chances of 'back-out' and reducing the actual clamp load.



Drill drivers

Deliver low rotational speeds between 700 - 1500 rpm and can also have a low torque rating. Whilst ideal for drilling with HSS drill bits and installing wood screws, these are not substantial enough for the installation of self-drilling fasteners.



Dry Lining Screwguns

Generally deliver rotational speeds from 2,500 - 6,000 rpm. At these speeds the excessive friction and heat will cause self-drilling fasteners to burn-out. In thinner materials the fastener can easily be overdriven or stripped.

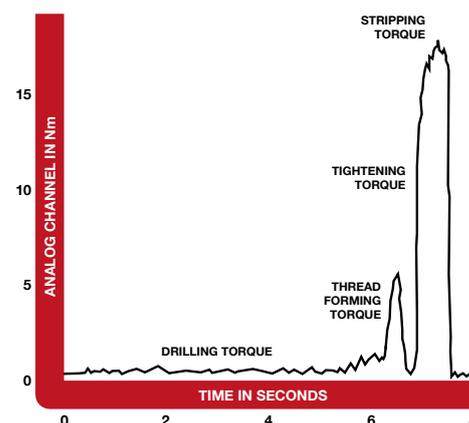
Nosepiece: depth over torque

Self-drilling and self-tapping fasteners are installed by depth rather than torque. That means that an approved depth-adjustable nosepiece is essential.

Torque requirements are affected by various factors which include the material grade and thickness including its yield strength. The substrate hardness and the same parameters of the material being secured also come into play. Within the application itself, gaps tolerances and any sealants will also affect the installation torque. Sealant type, thickness, position in relation to the application, together with temperature and weather conditions will be a key factor of compressibility and the force/torques required.

Torque generation during the correct installation of a self-drilling fastener produces peaks and troughs in the torque range applied. These include the drilling and tapping of the material as the thread 'runs through' the hole, and the final tightening torque.

The tightening torque needs to be gauged/calculated so that the torque level is sufficient to tighten the fastener assembly before reaching a point at which stripping occur. The variables detailed above mean that torque attributes of every fastener in the application could potentially be different. *Installing by depth negates these torque variables.*



Indicative torque analysis graph

Further considerations: composite panel applications

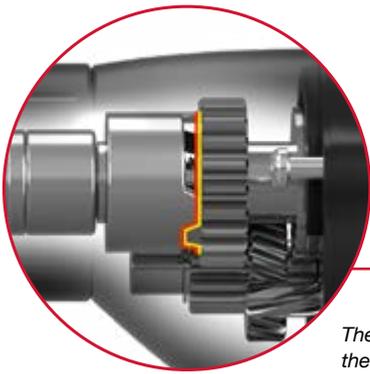
There are further considerations when selecting torque. For example, with composite applications the run-through torque can be higher than the tightening torque in order to set the washer. That means that the screwgun torque cannot be adjusted to set the washer as a higher torque level will already have been reached.

Even when securing a single skin sheet to a spacer bar, due to the swaged profile of the bar the position of the fastener within the swages will affect the torque generated during installation. Torque will also differ between single sheet thickness and end lap details. This can apply even within the end lap, depending upon the position of the sealant - therefore the operative would need to readjust the torque setting for each instance.

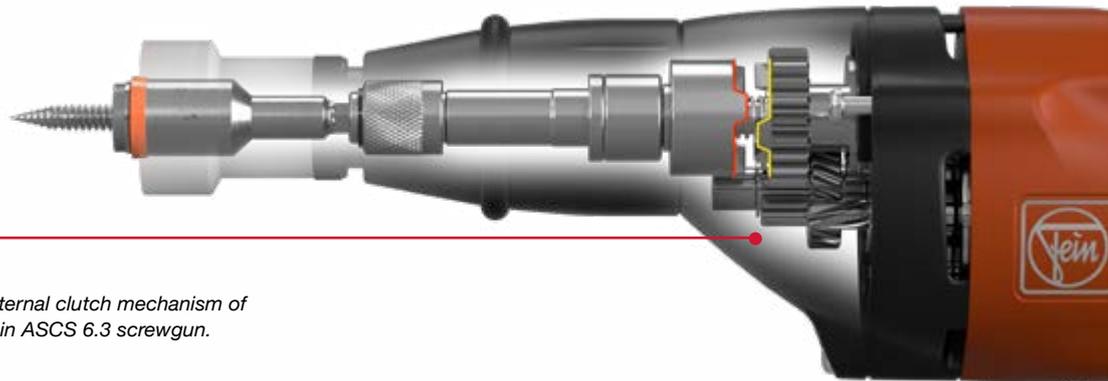
Therefore, setting to a depth is the most accurate and consistent way to install fasteners for Roofing and Cladding applications, including main and stitching fasteners for composite panels.



An approved depth adjustable nosepiece is essential.



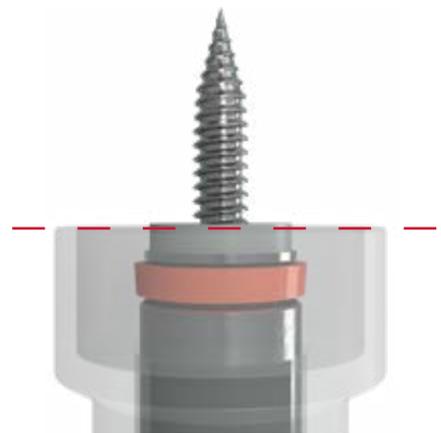
The internal clutch mechanism of the Fein ASCS 6.3 screwgun.



**Installation:
Setting the depth nosepiece**

As demonstrated on the previous pages, correct installation of self-drilling fasteners is achieved by depth in order to maximise the stitching properties of the fastener - and to ensure an effective sealing of the washer. This is achieved by using an approved depth-sensing nosepiece. These are available with both of the recommended installation tools recommended on Page 4.

The illustrations above demonstrate the internal clutch mechanism of the FEIN ASCS 6.3 cordless screwgun. The screwgun rests with the clutch in the engaged position. Setting the nosepiece is done by pushing the fastener into the drive socket as far as the socket will go, then retracting it back into the body of the screwgun. This means you are setting the depth in order to disengage the screwgun's clutch as the fastener seals correctly at the head, thread and sheet.



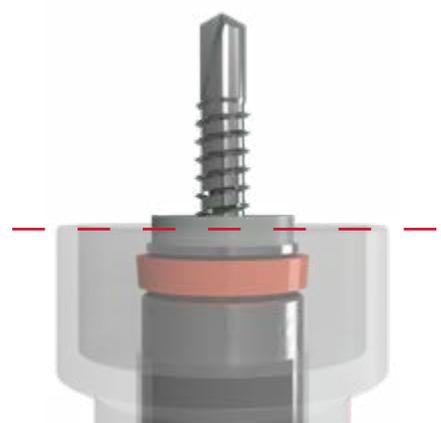
Setting for Thin Sheet Steel

When stitching thin sheet steel, the material isn't able to offer the same resistance as thicker metals. In this instance, we set the nosepiece almost visually flush with the EPDM seal.



An effective seal does NOT mean flattening the washer

The EPDM seal needs to compress into the gap between the metal washer and the nylon head and should just be starting to spread/bulge for an effective seal.



Setting for Light to Heavy Section

When fastening thicker materials, the setting is adjusted to account for a greater resistance.

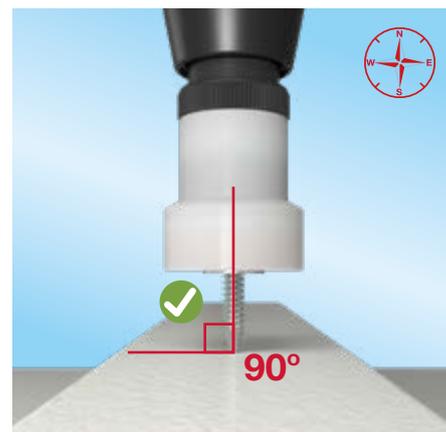
The right installation process

With the nosepiece set and fastener in the drive socket (11mm Bi-hex for EJOT Colorfast) position the fastener point where the component is to be fixed. The screwgun should be perpendicular to the component and **should not deviate** from this by any more than 5 degrees.

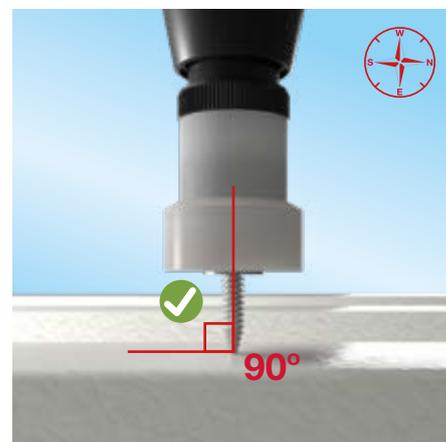
When the required speed and end load is achieved the fastener advances and drills the component and the substrate. It is essential to maintain a constant speed so that a correctly shaped installation hole is achieved through the whole application. The fasteners drill point length should be sufficient to be able to drill through the application prior to the threads tapping into the material.

Once the hole has been drilled the lead thread will tap into the material creating a mating thread or in thinner materials the material will flow into the thread to support the join. The torque generated will reduce the drilling speed as material is moved to form the connection during the “tapping process”.

The torque will reduce as the remainder of the thread passes through the application - referred to a “thread run-through”. The speed can now be reduced as the head of the fastener approaches the component being installed. When the nosepiece setting is correct, it is easy to hear and ‘feel’ the internal clutch dis-engage.



The screwgun needs to be perpendicular to the component from all points of the compass.



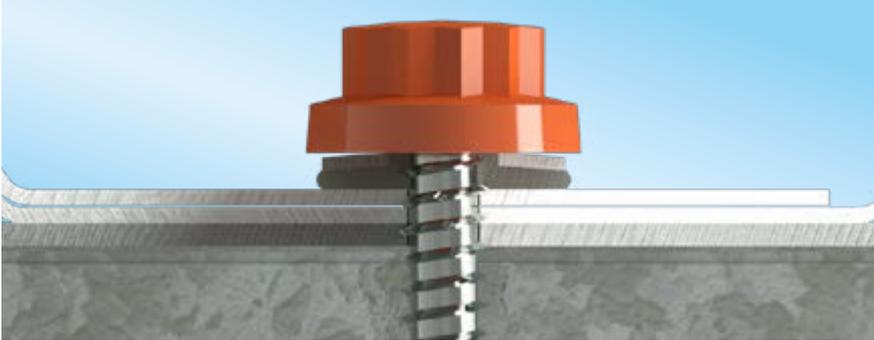
When the fastener deviates from the perpendicular this will increase the risk of the fastener skidding on the component surface and increase the risk of the washer not seating correctly.

Now to test the seal: VACUtest

It is important that initial drive trials are carried out on spare materials before commencing installation. This is to ensure that the screwgun's clutch disengages at the point that the correct mechanical joint is achieved. We recommend that all fasteners are vacuum tested regularly during the installation process.



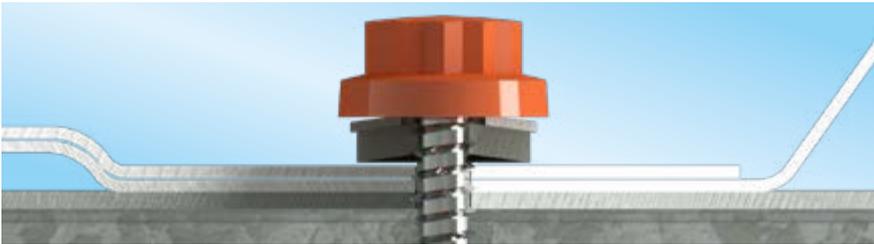
Troubleshooting: Rights and wrongs to look for



Nosepiece correctly set

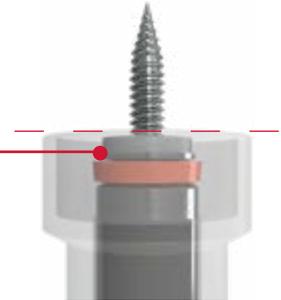
The fastener head will interface with the component to be installed clamping it to the substrate. Any sealants between the component and the substrate will compress as the fastener advances, securely clamping the components together.

The bonded washer will compress as the clamp load is achieved. The EPDM will flow into the threads of the fastener and will flow from the circumference of the bonded metal backing. The compression required will slightly bulge the EPDM as shown to the full perimeter of the washer, without flattening the washer.

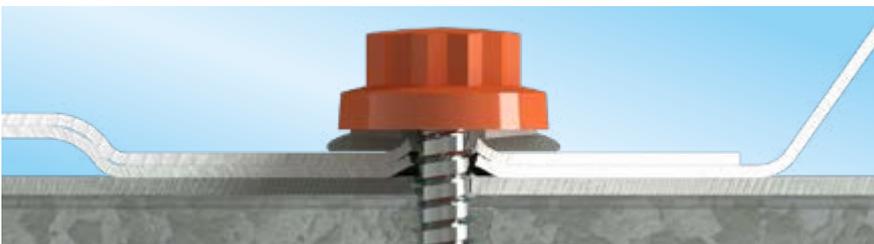


Fastener is **UNDER-driven**

When the above does not occur, then the fastener will be deemed to be under-driven therefore an effective seal will not be achieved.



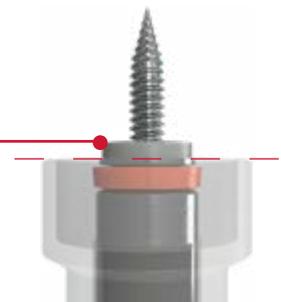
Nosepiece **UNDER-set**



Fastener is **OVER-driven**

If excessive EPDM is seen to exceed the perimeter of the washer then the fastener will be deemed to be overdriven. This may therefore diminish the effectiveness of the seal and also result in the fastener “stripping” within the component and the substrate - reducing the clamping properties of the fastener and reducing the pull-out performance.

In composite panel applications, the overdriving of the fastener can also dimple the outer skin of the panel resulting in the potential for water to pond around the fastener.



Nosepiece **OVER-set**

Recommended Drill Speeds and End Loads

JT2 Carbon Steel Self-Drilling Fasteners					
Product Code	Ø x L mm	Drilling Speeds			End Load kg
		1300 RPM	1500 RPM	1800 RPM	
JF2-2	5.5 x All				17
SF	6.3 x All				25
SFMS	8.0 x All				25
LS	5.5 x All				25
JT2 - 3-	4.8 x All				17
JT2 - 3 -	5.5 x All				25
JT2 - 6 -	6.3 x All				27
JT2 - D6 -	5.5/6.3 x All				27
HS	5.5 x All				35
JT2-D12	5.5/6.3 x All				35
JT2-12-	6.3 x All				35
JT2-18-	5.5 x All				35

JT3/JT6 Stainless Steel Bi-Metal Self-Drilling Fasteners					
Product Code	Ø x L mm	Drilling Speeds			End Load kg
		1300 RPM	1500 RPM	1800 RPM	
JF3 - 2	5.5 x All				17
JT3 - 2	4.9 x All				17
JT3 - 2	5.6 x All				25
JT3 - 2	6.0 x All				25
JT3 - X2	6.0 x All				25
JT3 - 2	6.3 x All				25
JT3 - 2	6.5 x All				25
RLS	- x All	Install by hand only			
JT3 - 3	5.5 x All				25
JT3 - 3	6.3 x All				25
JT3 - 6	5.5 x All				27
JT3 - 6	6.3 x All				27
D-6H	5.5/6.3 x All				27
JT3 - 12	5.5 x All				35
JT3 - 18	5.5 x All				35
D-12H	5.5/6.3 x All				35

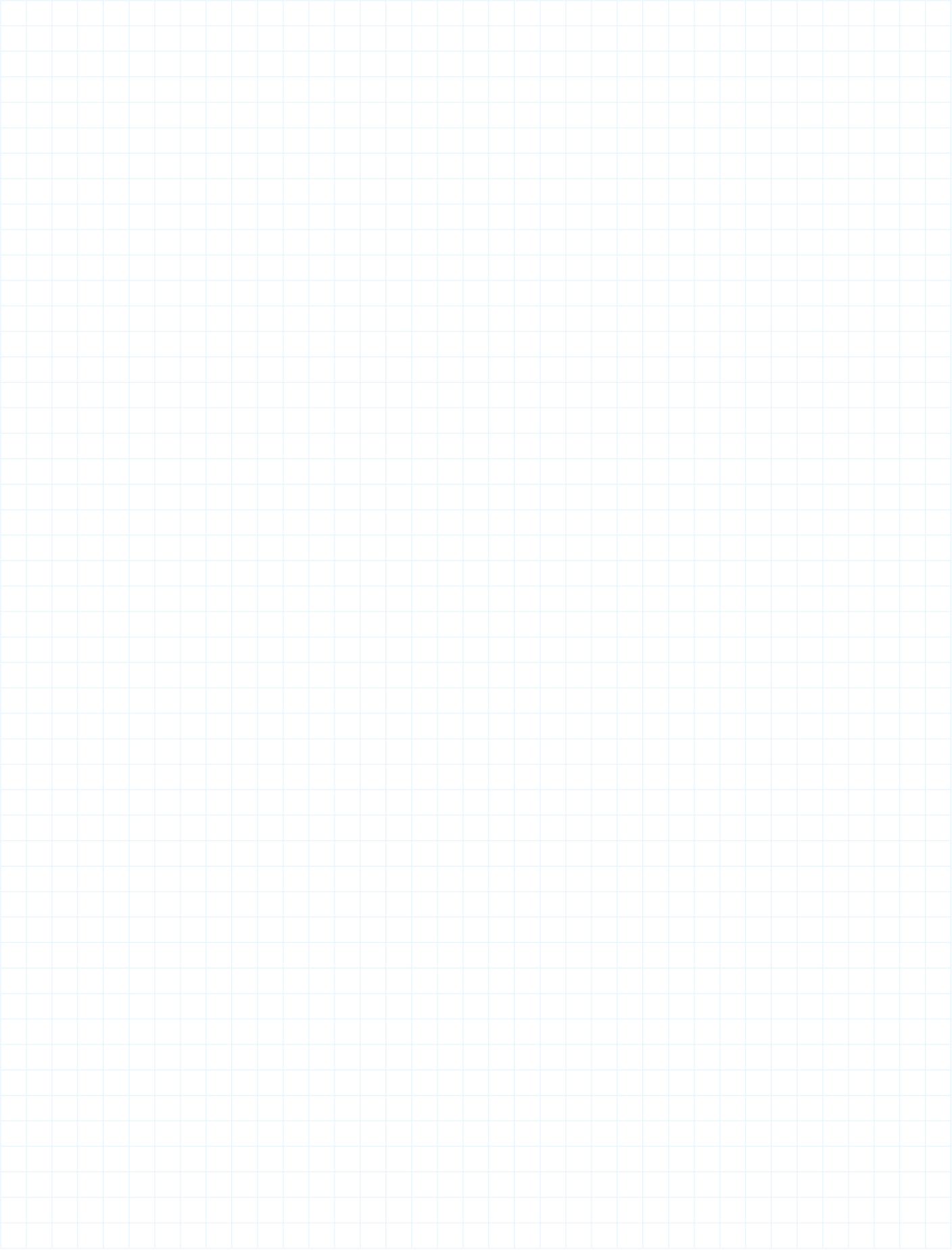
Specification and installation check list

Fastener suitability:

- ✓ Fastener type and length appropriate for the application?
- ✓ Fastener material suitable for the application environment and the warranty period?
- ✓ Head type ECT clamping range?
- ✓ Drilling capacity for application?
- ✓ Washer, Colorfast size and colour for the application?
Powder coated fastener colour and washer size for the application?

Drive socket and bit?

- ✓ Correct installation tool and depth nosepiece?
- ✓ Correct fastener position within the application?
- ✓ Correct number of fasteners to suit the design/engineers requirements?
- ✓ Installed perpendicular to substrate?
- ✓ Washer compressed correctly to its full perimeter and not over or under driven?
- ✓ Washer sealed and seal tested?
- ✓ The fastener tight against the application and not loose?
- ✓ Composite panels and bonded flashings - is the fastener seated against the outer material without dimpling or distorting the material?
- ✓ Has all swarf and debris removed and cleaned after installation and fastener?
- ✓ Have any incorrectly installed or stripped fasteners been rectified?





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