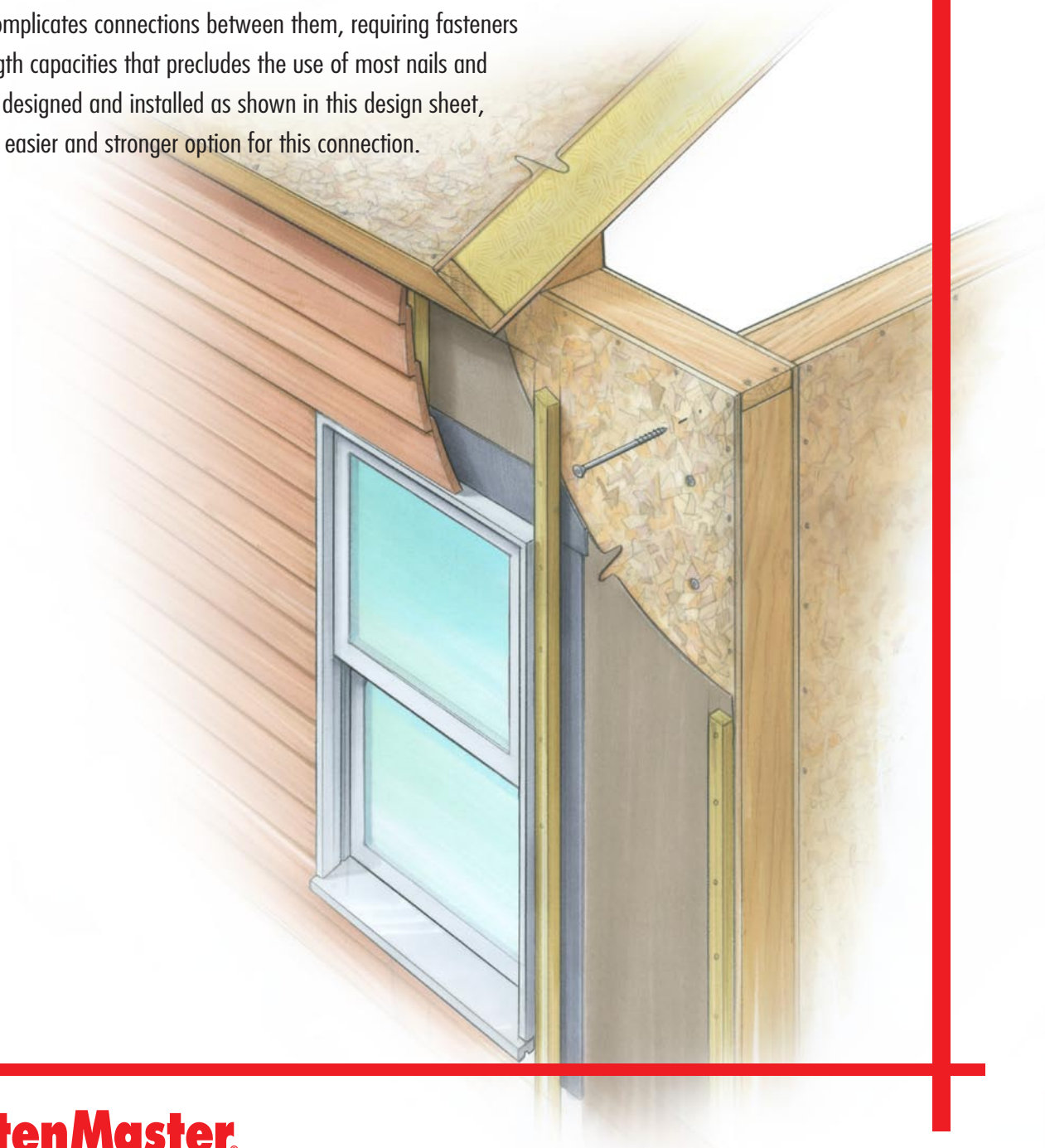
Structural Insulated Panel (SIP) connections using HeadLok® fasteners.

SIPs are an increasingly common form of panel construction primarily being utilised in wall and roof constructions. SIPs comprise two parallel wood-based facings (usually Oriented Strand Board) sandwiching a rigid insulation core (usually Polyurethane Foam or Expanded Polystyrene). SIPs are lightweight, quick to erect, minimise compression shrinkage and can provide greatly improved thermal insulation by reducing cold bridges within the insulation layer. However the presence of the insulation layer and the overall thickness of the panels greatly complicates connections between them, requiring fasteners of lengths and strength capacities that precludes the use of most nails and wood screws. When designed and installed as shown in this design sheet, Headlok provides an easier and stronger option for this connection.



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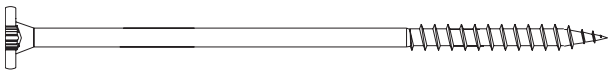
HEADLOK DIMENSIONAL DATA

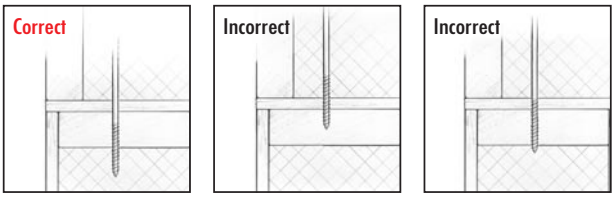
TABLE 1

Available Lengths	175mm, 200mm, 225mm, 250mm		
Thread Length	51mm		
Head Diameter	15.9mm	Outer (Major) Thread Diameter	6.5mm
Plain Shank Diameter	4.8mm	Inner (Minor) Thread Diameter	4.4mm



FASTENER HEAD DEPTH

THREAD ENGAGEMENT



DESIGN DATA FOR SIP-TO-TIMBER CONNECTIONS FORMED USING HEADLOK FASTENERS

Design data for SIP-to-timber connections formed using Headlok fasteners is provided firstly generically, secondly for SIP wall corner connections and finally for SIP roof connections. In all three cases the recommendations are only applicable for the following SIP and timber specifications:

- SIPs of overall thickness between 125mm and 195mm, having 11-15mm thick facings of OSB/3 to EN300. The rigid insulation core may be either Polyurethane Foam or Expanded Polystyrene.
- Timber of strength class C16 or better and of size such that the edge distance, end distance and spacing provisions of BS5268-2 are met.

Long-term permissible lateral loads, for use in designs to BS5268-2, are given in table 2 for Headlok fasteners used in the SIP-to-timber connections described below and illustrated in Figures 1-2:

- The headside member is a SIP.
- The Headlok screw head should be lightly embedded into the surface of the outer OSB/3 facing of the SIP.
- The pointside member is solid timber and may be the end stud of an adjacent SIP.
- The Headlok fastener is inserted such that its plain shank just penetrates the solid timber member. In those cases where the point of the Headlok fastener exits the far side of the timber a minimum of 38mm of thread length must still be in the timber. See figure 1.

TABLE 2

Description of panel/facings	Long-term permissible lateral load (N) for a single Headlok screw	Slip modulus (N/mm) of a single Headlok screw
SIPs of 125-195mm thickness and having 15mm thick OSB/3 facings	760	640
SIPs of 125-195mm thickness and having 11mm thick OSB/3 facings	570	480

- BS5268-2 load-duration factors for OSB-to-timber joints *(1.40 for medium-term and 2.10 for short-term and very short-term load durations)* may be applied.

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SIP WALL CORNER CONNECTIONS FORMED USING HEADLOK FASTENERS

FASTENER SIZE SELECTION

- Minimum length of HeadLok fastener (mm) = Thickness of SIP + 51
- Maximum length of HeadLok fastener (mm) = Thickness of SIP + 13 + End stud thickness
- The thickness of SIP end studs must be a minimum of 44mm

INSTALLATION PROCEDURE

- Determine the appropriate fastener length based on the SIP thickness.
- Using a drill set to low speed, install the HeadLok fastener perpendicular to the OSB facing of the headside SIP on the centreline of the end stud of the receiving SIP.
- Install fasteners according to required spacings of Table 3. Do not install fasteners closer than 100mm to the top or bottom of the SIPs.
- Drive the fastener so that the top of the head is lightly embedded into the surface of the outer OSB facing of the headside SIP. Do not over-drive through the OSB facing.

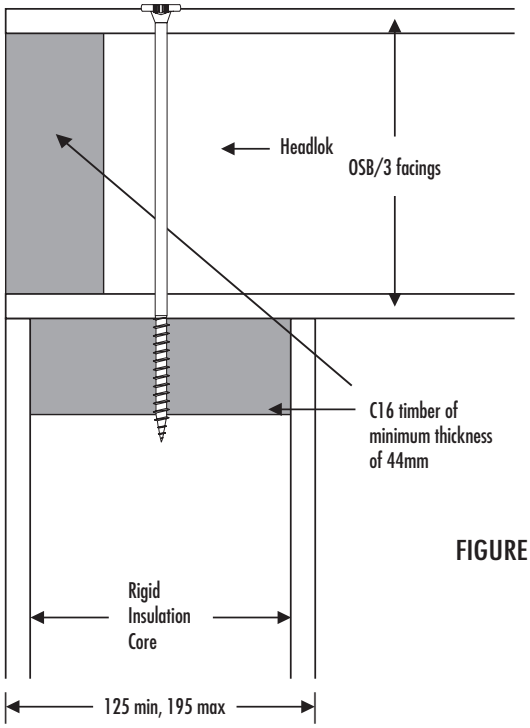

FIGURE 1

REQUIRED SPACINGS FOR HEADLOK FASTENERS IN SIP WALL CORNER CONNECTIONS

The spacings for Headlok fasteners given in Table 3 for SIP wall corner connections provide a joint capacity at least equivalent to that of the minimum nailing specification for panel-to-panel joints in conventional timber frame given in BS5268-6.1, clause 4.9.2.

TABLE 3

Description of panel/facings	Spacing of Headlok fasteners in SIP wall corner connections (mm)
SIPs of 125-195mm thickness and having 15mm thick OSB/3 facings	400
SIPs of 125-195mm thickness and having 11mm thick OSB/3 facings	300

NOTES

1. In view of the presence of the rigid insulation, the permissible lateral load-carrying capacity of the Headlok connection between the SIP and the timber member cannot be evaluated using annex G of BS5268-2 as it is not a direct timber-timber connection. Instead the permissible lateral load-carrying capacity of this Headlok connection is derived, using safety factors appropriate to BS5268-2, from a bespoke testing programme undertaken in June 2009 at Brighton University and described in TimberSolve report no. OLY.01-OMG2-01revA entitled 'Headlok screws manufactured by Fastenmaster. Derivation of permissible loads for connections involving TEK142 panels as part of the Kingspan TEK building system.'

Structural Insulated Panel (SIP) connections using HeadLok® fasteners

CONNECTIONS BETWEEN SIPs AND ROOF PURLINS / WALLPLATES FORMED USING HEADLOK FASTENERS

HEADLOK INSTALLATION PROCEDURE

- From table 4 select the appropriate fastener length based on the thickness of the SIP.
- Using a drill set to low speed, install the HeadLok fastener perpendicular to the OSB facing of the headside SIP on or close to the centreline of the underlying purlin or wallplate construction.
- Ensure that the BS5268-2 provisions for edge distance, end distance and spacing in the underlying purlin/ wallplate are met.
- Drive the fastener so that the top of the head is lightly embedded into the surface of the outer OSB facing of the headside SIP. Do not over-drive through the OSB facing.

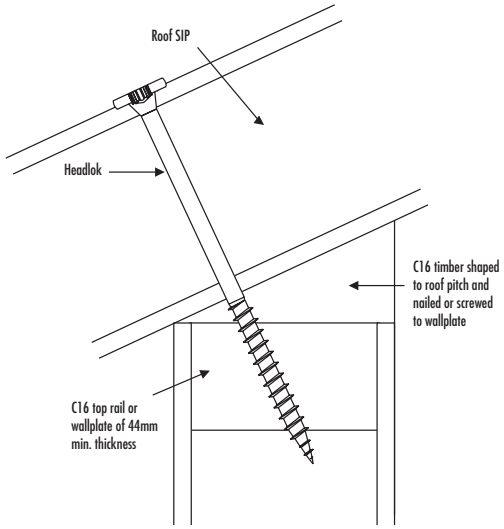

FIGURE 2

FASTENER SIZE SELECTION

- Minimum length of Headlok fastener = Thickness of SIP + 51
- The length of the Headlok fastener should be such that at least 38mm of thread length is in the receiving purlin or wallplate construction.

PERMISSIBLE LOADS FOR HEADLOK FASTENERS IN SIP ROOF CONNECTIONS

Recommended medium-term permissible loads for Headlok fasteners in connections between SIPs and roof purlins / wallplates are shown in Table 5. These permissible loads limit the slip in the connection to around 1.5mm.

TABLE 5

Description of panel/facings	Medium-term permissible load for a single Headlok fastener (kN)
SIPs of 125-195mm thickness and having 15mm thick OSB/3 facings	1.0
SIPs of 125-195mm thickness and having 11mm thick OSB/3 facings	0.75

FOR FURTHER TECHNICAL DATA PLEASE CONTACT:

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