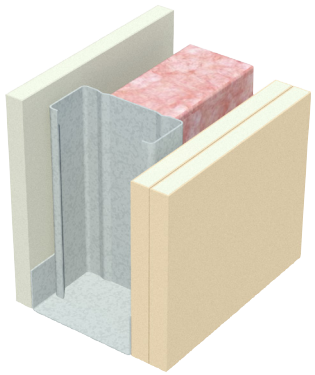
6.6 X-Ray Protection Systems

GIB **x-block**® is a lead free plasterboard system used as an effective radiation barrier. Barium Sulphate in the GIB **x-block**® plasterboard and compound provide protection against X-rays.

X-ray shielding requirements are usually specified as a thickness of lead. The lead equivalence of GIB **x-block**® systems depend on the energy level of the radiation. Tables 1 and 2 state the lead equivalence of GIB **x-block**® systems at various X-ray energy levels. Always seek advice from a Health Physicist to ensure that the requirements for radiation shielding are met.

This section contains radiation test results, shielding requirements, systems, installation instructions and construction details for GIB **x-block**® systems. [Refer to Section 2.3 for more information on X-ray resistance]

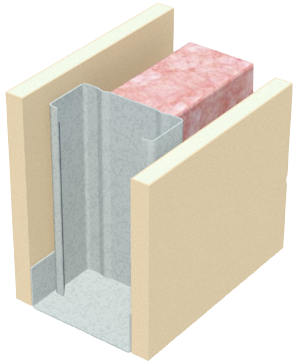
XRP1



- 1 layer of 13mm **masta**shield
- Steel or timber stud framing at 600mm maximum centres
- 2 layers of 13mm GIB **x-block**®

Stud Depth (mm)	Width (mm)	Airborne Sound Insulation Rw (Rw + Ctr)		
		No insulation	Pink® Partition 50mm 11kg/m³ R1.2	Report Day Design 3094-4
64 steel	103	44 (38)	51 (42)	
70 timber	109	42 (37)	46 (41)	

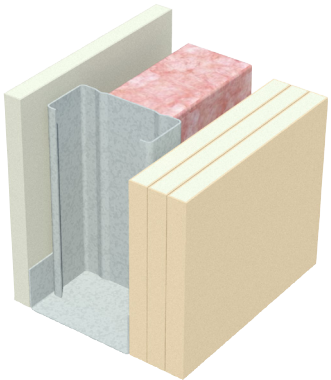
XRP2



- 1 layer of 13mm GIB **x-block**®
- Steel or timber stud framing at 600mm maximum centres
- 1 layer of 13mm GIB **x-block**®

Stud Depth (mm)	Width (mm)	Airborne Sound Insulation Rw (Rw + Ctr)		
		No insulation	Pink® Partition 50mm 11kg/m³ R1.2	Report Day Design 3094-4
64 steel	90	40 (35)	49 (40)	
70 timber	96	38 (33)	42 (38)	

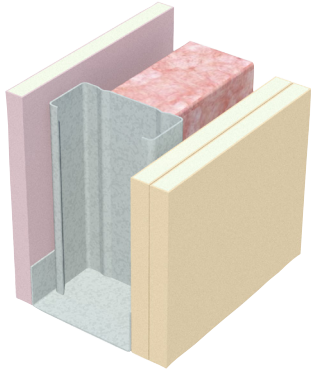
XRP3



- 1 layer of 13mm **masta**shield
- Steel or timber stud framing at 600mm maximum centres
- 3 layers of 13mm GIB **x-block**®

Stud Depth (mm)	Width (mm)	Airborne Sound Insulation Rw (Rw + Ctr)		
		No insulation	Pink® Partition 50mm 11kg/m³ R1.2	Report Day Design 3094-4
64 steel	116	47 (41)	55 (45)	
70 timber	124	45 (40)	49 (44)	

XRP5



- 1 layer of 13mm **fire**shield
- Steel or timber stud framing at 600mm maximum centres
- 2 layers of 13mm GIB **x-block**®

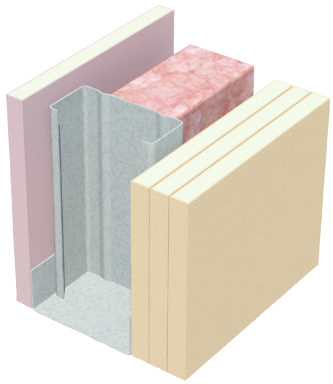
Fire Resistance Level

-/60/60
rated from both sides

Report
FAR 2320

Stud Depth (mm)	Width (mm)	Airborne Sound Insulation Rw (Rw + Ctr)		
		No insulation	Pink® Partition 50mm 11kg/m³ R1.2	Report Day Design 3094-4
64 steel	103	45 (39)	52 (43)	
70 timber	109	43 (37)	46 (41)	

XRP6



- 1 layer of 13mm **fire**shield
- Steel or timber stud framing at 600mm maximum centres
- 3 layers of 13mm GIB **x-block**®

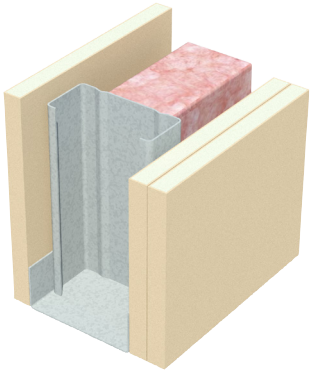
Fire Resistance Level

-/60/60
rated from both sides

Report
FAR 2320

Stud Depth (mm)	Width (mm)	Airborne Sound Insulation Rw (Rw + Ctr)		
		No insulation	Pink® Partition 50mm 11kg/m³ R1.2	Report Day Design 3094-4
64 steel	116	47 (41)	55 (47)	
70 timber	124	46 (40)	49 (45)	

XRP7



- 1 layer of 13mm GIB **x-block**®
- Steel or timber stud framing at 600mm maximum centres
- 2 layers of 13mm GIB **x-block**®

Fire Resistance Level

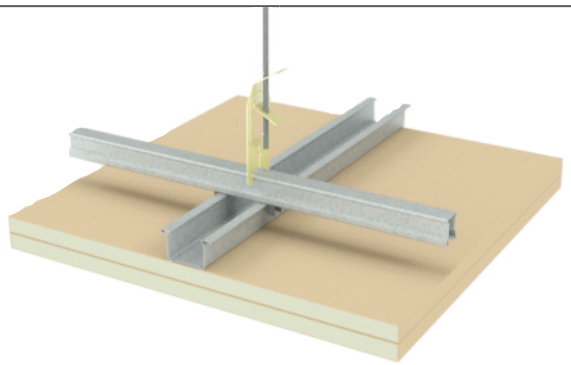
-/60/60
rated from both sides

Report
FAR 2320

Stud Depth (mm)	Width (mm)	Airborne Sound Insulation Rw (Rw + Ctr)		
		No insulation	Pink® Partition 50mm 11kg/m³ R1.2	Report Day Design 3094-4
64 steel	103	44 (39)	53 (46)	
70 timber	109	43 (38)	46 (42)	

XRP4

- [Option 1] Timber or steel ceiling joists
- [Option 2] Clips and Furring Channel
- [Option 3] Suspended Top Cross Rail and Furring Channel
- 2 layers of 13mm GIB **x-block**®



Maximum Framing Centres (mm)	Airborne Sound Insulation Rw (Rw + Ctr)	
600	35 (33)	Report Day Design 3094-4

Radiation Test Results

Table 1 Lead Equivalence in (mm)

13mm GIB x-block® Lead Equivalence measured in mm				
X-Ray Energy (kVp)	**1 layer**	**2 layers**	**3 layers**	**4 layers**
80	0.8	1.6	2.4	- *
100	0.75	1.5	2.25	2.9
125	0.5	1.0	1.4	1.9
150	0.4	0.7	1.0	1.3

1. Uncertainties ± 0.1mm
2. National Radiation Laboratory Reports 24062003/1, 24062008, 20022009.
3. *Quote from Report 20022009: 'Determination of lead equivalence for 4 layers of x-block Plasterboard at 80kVp was not feasible owing to the extremely low transmission of the X-rays through this sample thickness'.
4. kVp - kilovolts peak. Maximum voltage applied across the X-ray tube. The kVp controls the maximum energy of the emitted X-rays.

Table 2 Lead Equivalence in (kg/m²)

13mm GIB x-block® Lead Equivalence measured in kg/m²				
X-Ray Energy (kVp)	**1 layer**	**2 layers**	**3 layers**	**4 layers**
80	9.1	18.1	27.2	-
100	8.5	17.0	25.5	32.9
125	5.7	11.3	15.9	21.5
150	4.5	7.9	12.5	14.7

1. Calculated using the density of lead as 11340 kg/m³

X-Ray Resistance Energy Levels

X-Ray radiation is measured in kilovolts peak (kVp). Depending on the type of radiation equipment used in the room, diagnostic facilities will have different requirements for shielding:

- CT 120-140 kVp
- General radiographic rooms 60-90 kVp
- Dental 60-80 kVp
- Mammography 25-35 kVp

General Requirements

	Non-fire Rated	Fire Rated
Install control joints in plasterboard walls at: > 12m maximum intervals > At all control joints in the structure > At any change in the substrate	✓	✓
Use GIB **x-block**® jointing compound: > In the gap between the sheets > To fill the recessed joints on every layer > As the bedding coat with paper tape and as the second coat for the face layer. For the finish coat use masta**line** or masta**lite**. > To fill any other gaps and to cover all face layer fastener heads.	✓	✓
Treat all penetrations as shown in the construction details to maintain radiation protection or use lead of the appropriate thickness.	✓	✓
Use approved fire rated penetration details. Fire penetrations may require fire collars or other devices to maintain fire performance.		✓
Attach all fixtures to studs or purpose installed noggings. Wall anchors must not be fixed only to the plasterboard of fire rated walls.		✓

For acceptable modifications or variations to fire rated systems, refer to Section 2.3 Fire Resistance

Framing

	Non-fire Rated	Fire Rated
Use steel or timber framing.	✓	✓
Framing members as per framing table or structural design up to 600mm maximum.	✓	✓

> Noggings are permitted to assist the fixing of services.
> Plumbing and electrical services must not protrude beyond the face of the studs.

Plasterboard Layout

	Non-fire Rated	Fire Rated
Vertical Layout		
Sit GIB **x-block**® directly on the floor, leave no gap at the base of the sheet.	✓	✓
All recessed and butt joints must be backed by a framing member.	✓	✓
Leave a gap of 2mm between GIB **x-block**® sheets to allow GIB **x-block**® jointing compound to fill any gaps between and behind the sheets. [Figure 1]	✓	✓
Vertical joints must be 200mm minimum from the edge of any opening such as windows and doorways to minimise cracking at the joints.	✓	✓
Stagger recessed edges by 300mm minimum between layers and on opposite sides of the wall.	✓	✓
Stagger butt joints by 300mm minimum on adjoining sheets, between layers and on opposite sides of the wall.	✓	✓

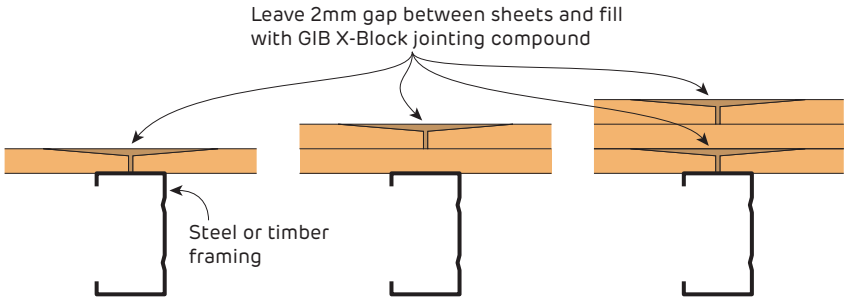


FIGURE 1 X-Block Jointing
Plan

Plasterboard Fixing

	Non-fire Rated	Fire Rated
Drive screws to just below the sheet surface, taking care not to break the paper linerboard. For over-driven screws, install another screw 20mm away. Leave or remove the over-driven screw and patch.	✓	✓
Use the 'Screw Only Method'.	✓	✓

Screw Type and Minimum Size for the Installation of Plasterboard to Steel

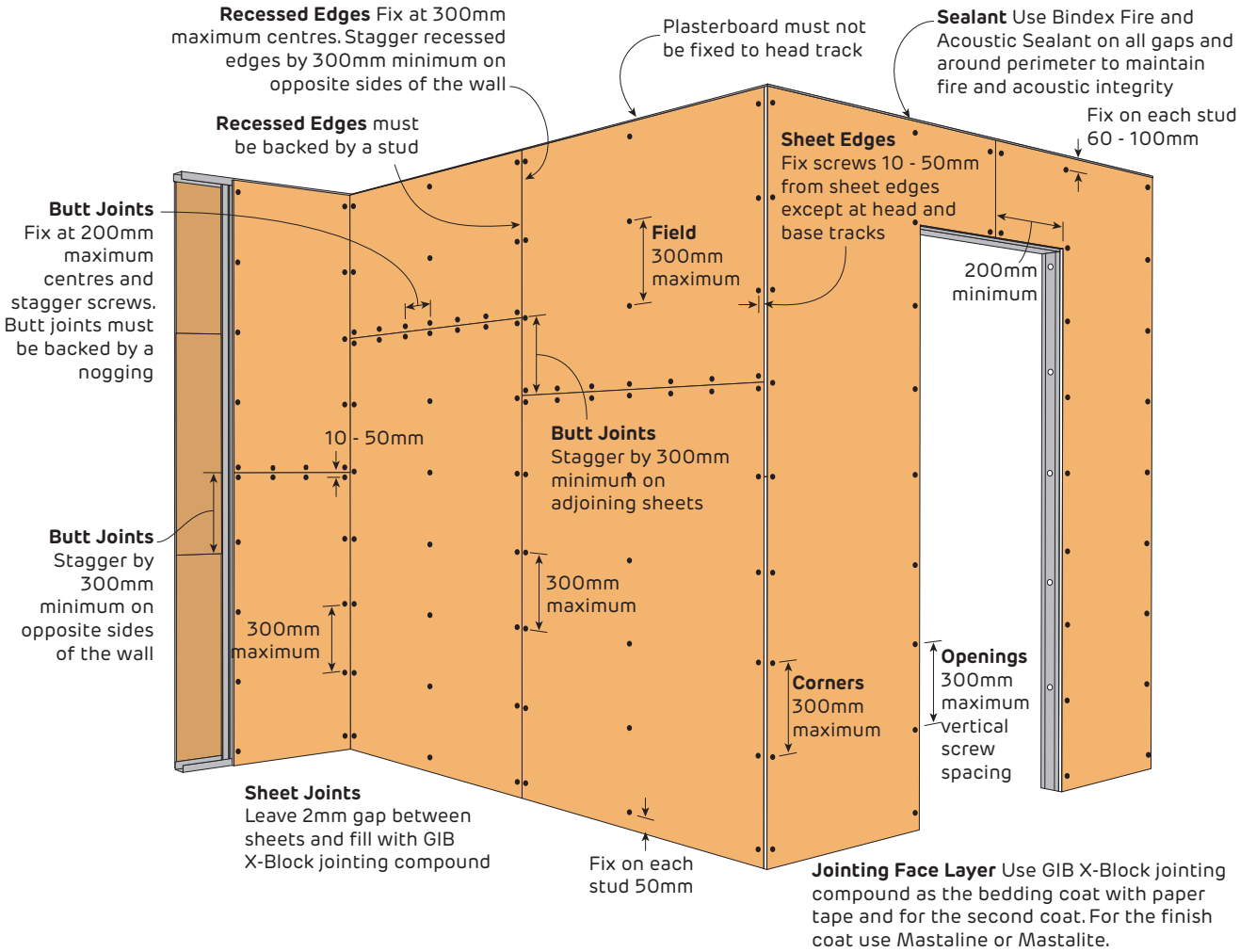
Plasterboard Thickness	1st Layer	2nd Layer	3rd Layer
13mm	6g x 25mm screw	6g x 41mm screw *	7g x 57mm screw *

For steel ≤ 0.75mm BMT, use fine thread needle point screws.
For steel ≥ 0.75mm BMT, use fine thread drill point screws.
*10g x 38mm Laminating screws may be used as detailed in installation diagrams.

Fastener Type and Minimum Size for the Installation of Plasterboard to Timber

Plasterboard Thickness	1st Layer	2nd Layer	3rd Layer
13mm	6g x 32mm screw	8g x 45mm screw	8g x 65mm screw

FIGURE 2 Fire Rated 1 Layer - Vertical
Screw Only Method

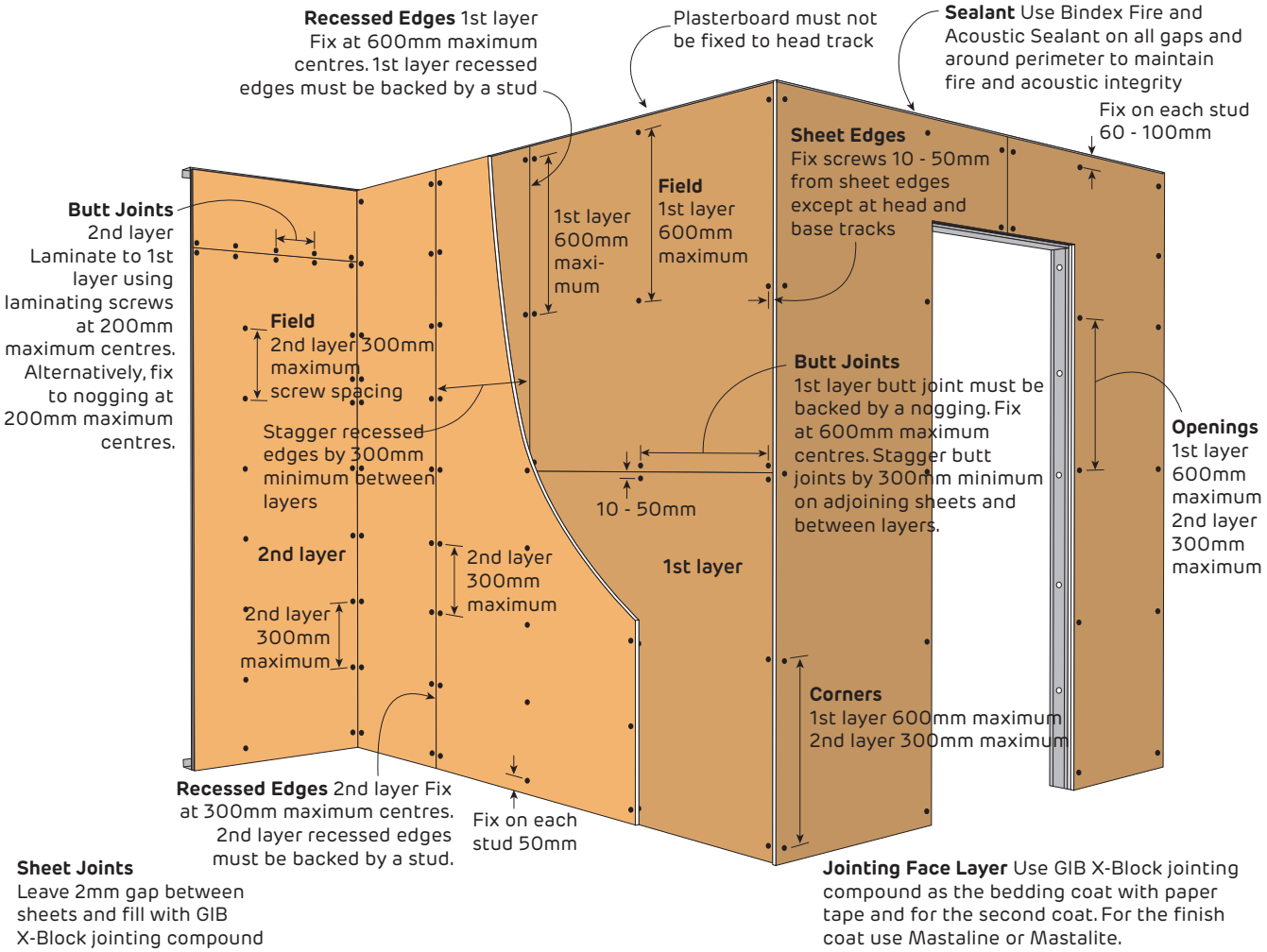


Maximum Ultimate Limit State Wind Load Table (kPa)

Plasterboard Thickness	Maximum Wall Stud Spacing			
	600mm	450mm	400mm	300mm
13mm	0.85	1.15	1.30	1.70

1. Calculations do not include the framing which must be independently designed to suit the desired loads.
2. If higher internal wind pressures are expected, please contact Siniat for specific design.

FIGURE 3 Fire Rated 2 Layers - Vertical + Vertical
Screw Only Method

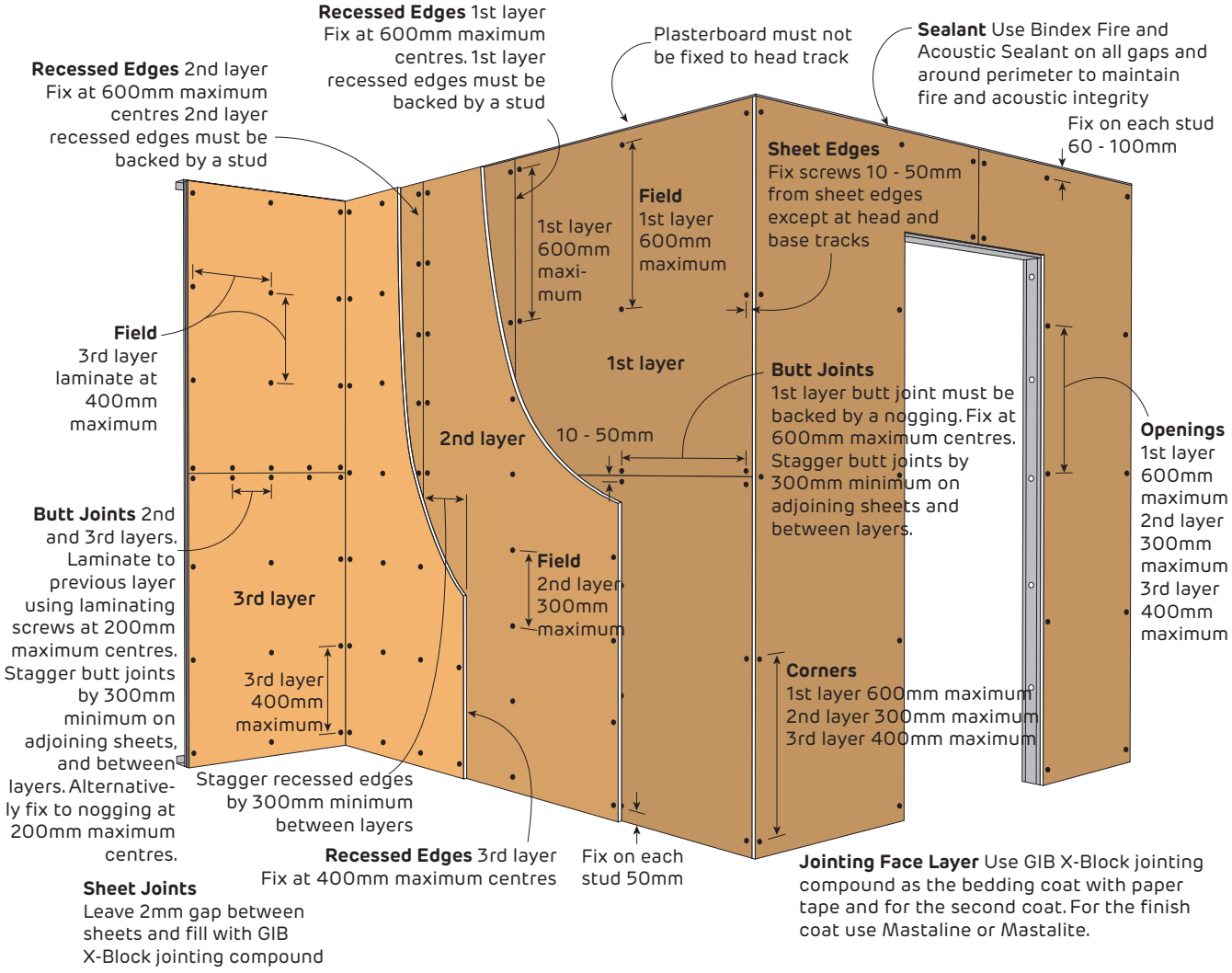


Maximum Ultimate Limit State Wind Load Table (kPa)

Plasterboard Thickness	Maximum Wall Stud Spacing			
	600mm	450mm	400mm	300mm
13mm	0.85	1.15	1.30	1.70

1. Calculations do not include the framing which must be independently designed to suit the desired loads.
2. If higher internal wind pressures are expected, please contact Siniat for specific design.

FIGURE 4 Fire Rated 3 Layers - Vertical + Vertical + Vertical
Screw Only Method

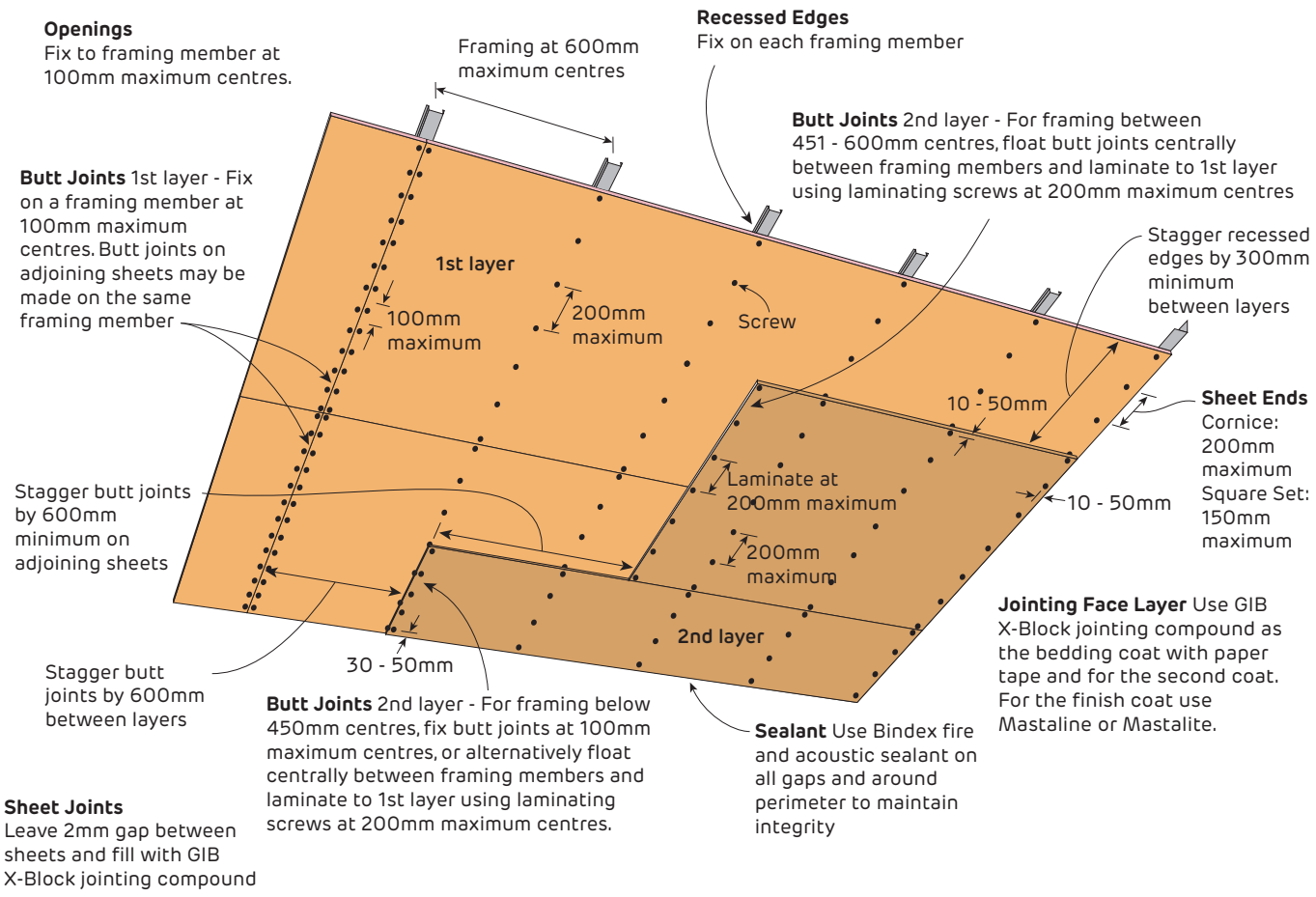


Maximum Ultimate Limit State Wind Load Table (kPa)

Plasterboard Thickness	Maximum Wall Stud Spacing			
	600mm	450mm	400mm	300mm
13mm	0.85	1.15	1.30	1.70

1. Calculations do not include the framing which must be independently designed to suit the desired loads.
2. If higher internal wind pressures are expected, please contact Siniat for specific design.

FIGURE 5 Fire Rated - 2 Layers
Screw Only Method



Fixing Pattern Table

Sheet Width	Screw Fixing Pattern
600mm	S S S S (4)
900mm	S S S S S S (6)
1200mm	S S S S S S S (7)
1350mm	S S S S S S S S (8)

S = One screw

Maximum Ultimate Limit State Wind Load Table (kPa)

Plasterboard Thickness	Maximum Ceiling Frame Spacing			
	600mm	450mm	400mm	300mm
13mm	1.15	1.60	1.80	2.45

1. Calculations do not include the framing which must be independently designed to suit the desired load.
2. Calculations include a ceiling insulation with maximum weight of 2.5 kg/m2 (equivalent to R5.0 Pink® Batts Ceiling insulation).
3. If higher internal wind pressures are expected, please contact Siniat for specific design.

Non-Fire Rated

X-Ray Protection Details - Systems XRP1 and XRP5 only

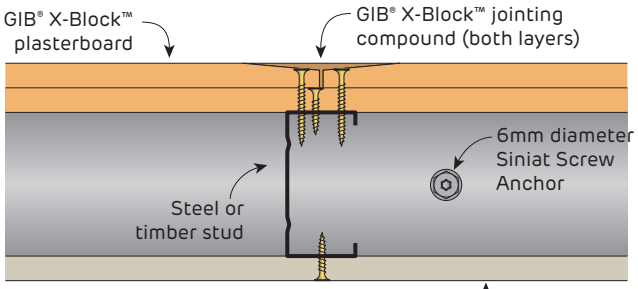


FIGURE 6 Jointing over Stud
Plan

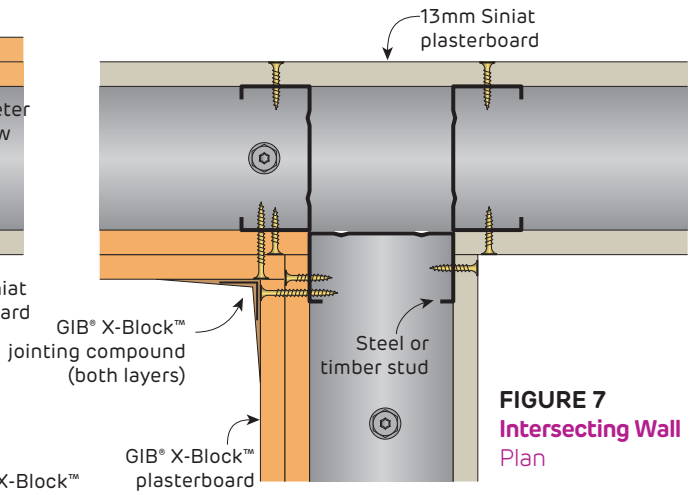


FIGURE 7 Intersecting Wall
Plan

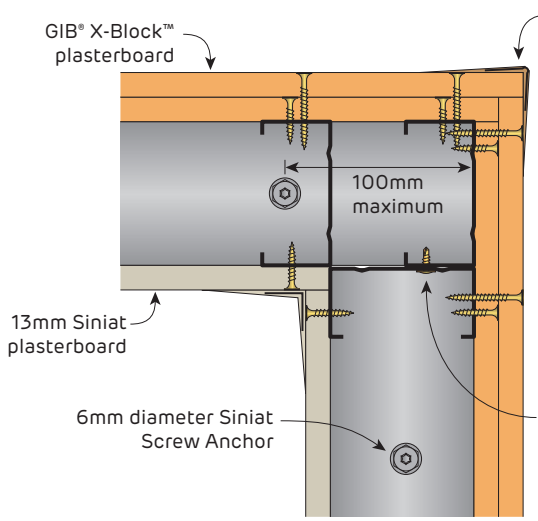


FIGURE 8 Wall Corner
Plan

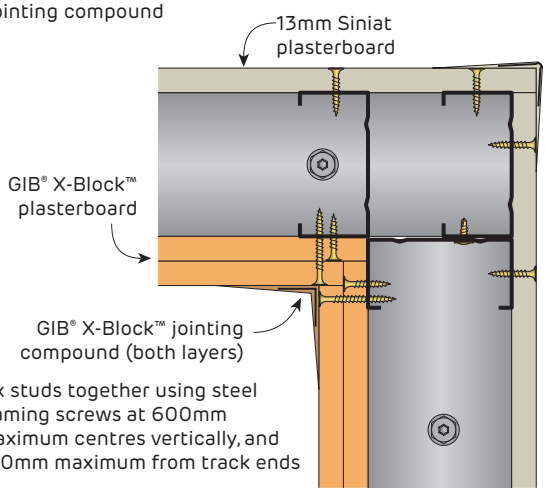


FIGURE 9 Wall Corner
Plan

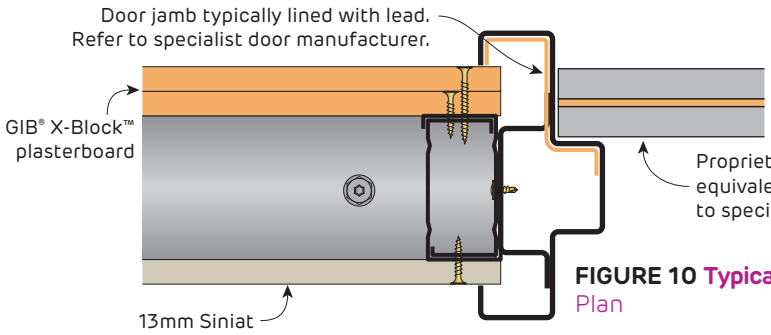


FIGURE 10 Typical Door Jamb
Plan

Fill any gaps with GIB® X-Block™ jointing compound

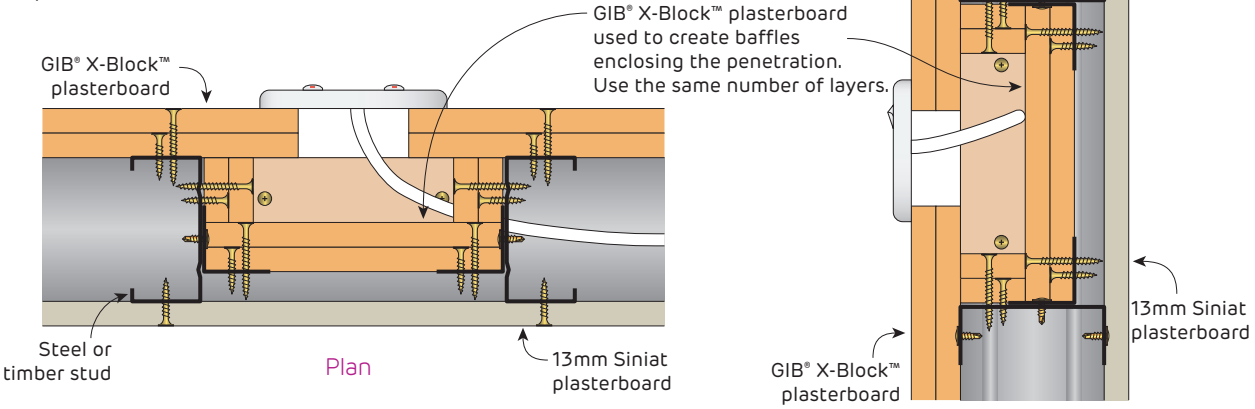


FIGURE 11 GPO Penetration

Non-Fire Rated
X-Ray Protection Details - Systems XRP2 only

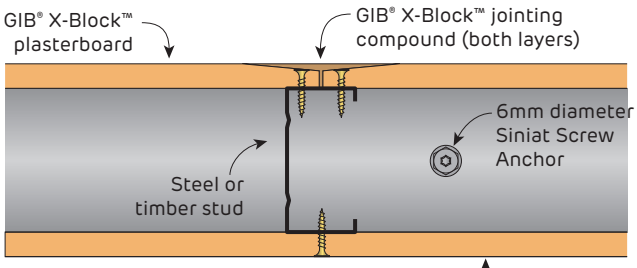


FIGURE 12 Jointing over Stud
Plan

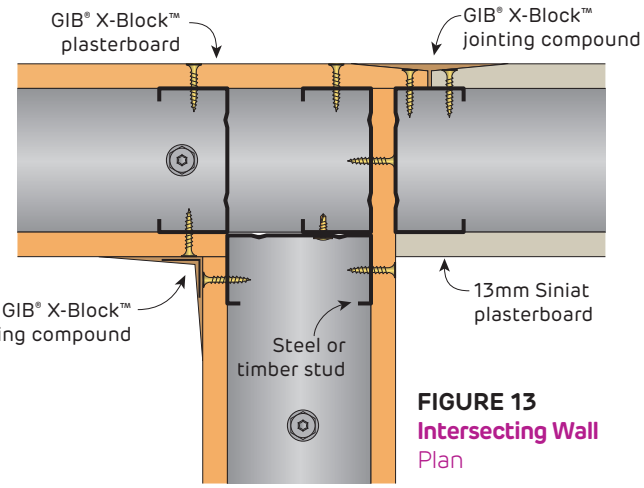


FIGURE 13
Intersecting Wall
Plan

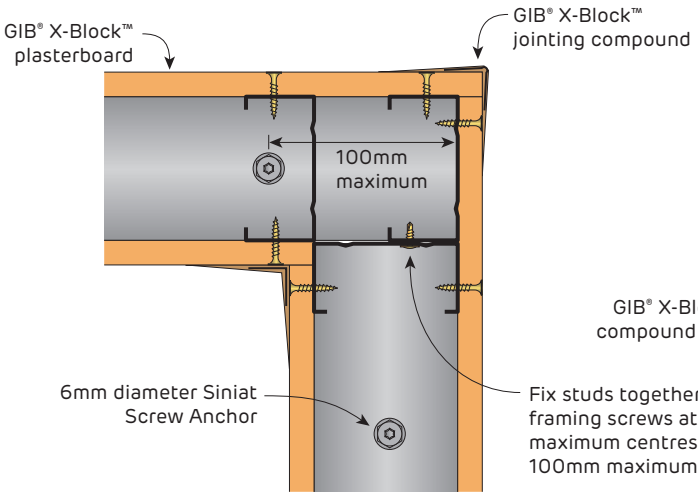


FIGURE 14 Wall Corner
Plan

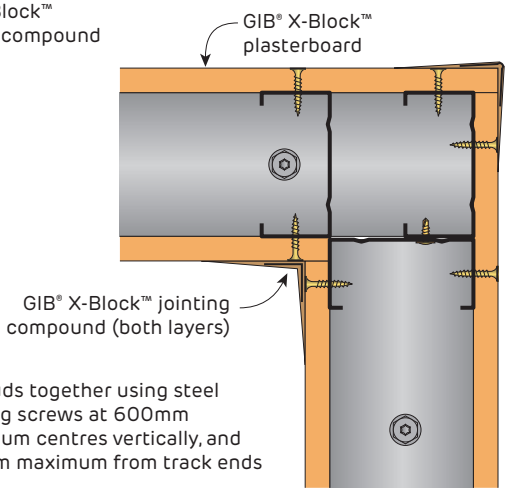


FIGURE 15 Wall Corner
Plan

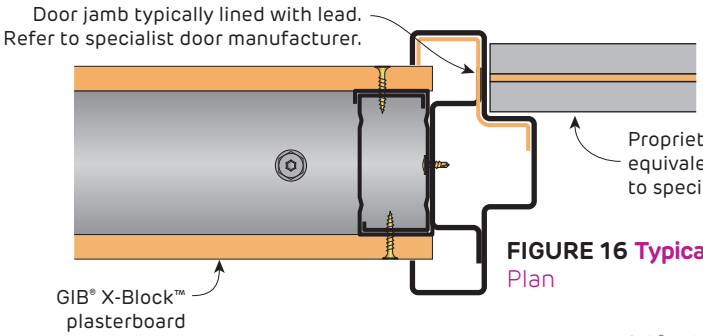
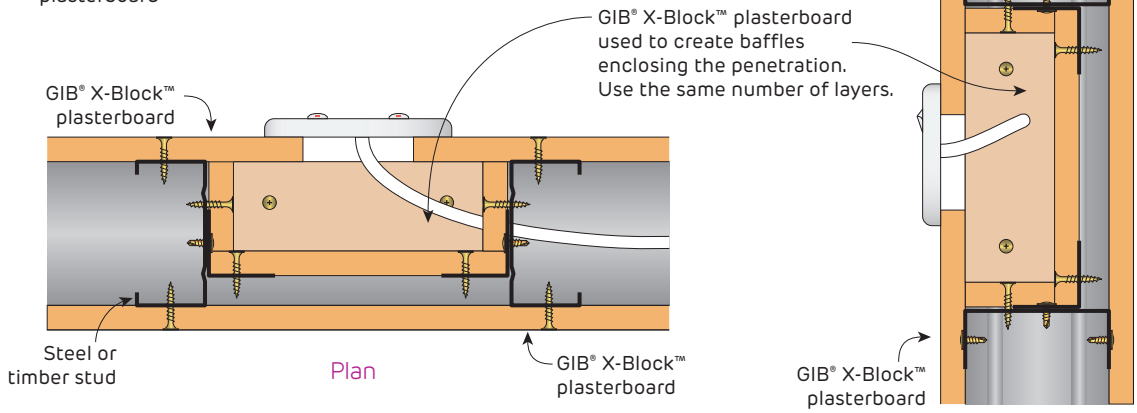


FIGURE 16 Typical Door Jamb
Plan

Fill any gaps with GIB® X-Block™ jointing compound



Plan
Section

FIGURE 17 GPO Penetration

Non-Fire Rated

X-Ray Protection Details - Systems XRP3 and XRP6 only

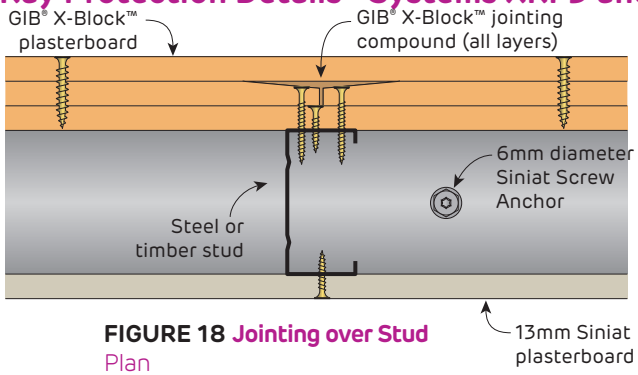


FIGURE 18 Jointing over Stud
Plan

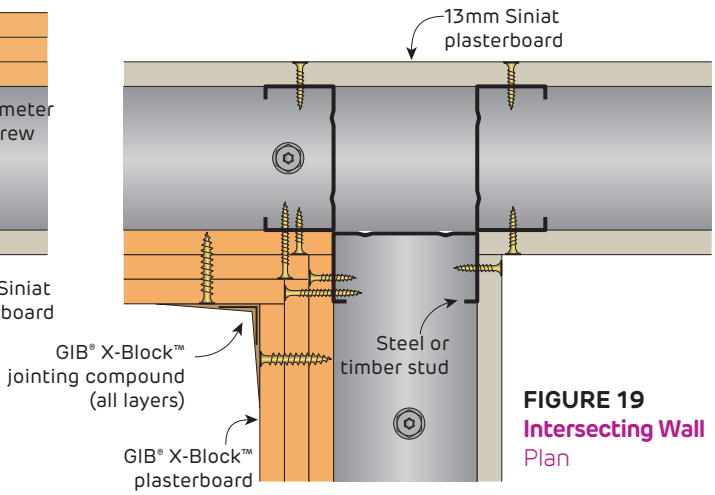


FIGURE 19 Intersecting Wall
Plan

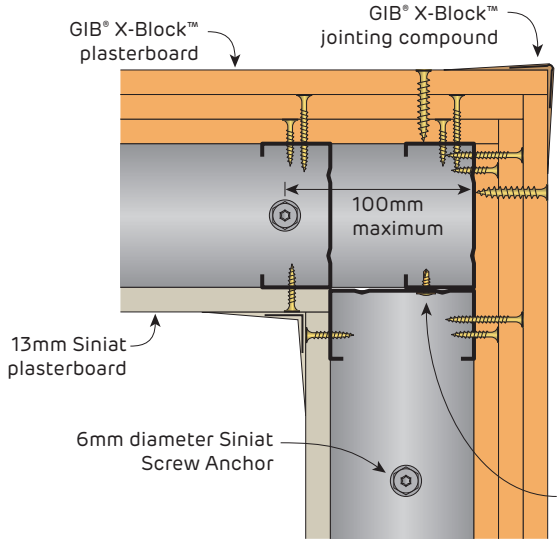


FIGURE 20 Wall Corner
Plan

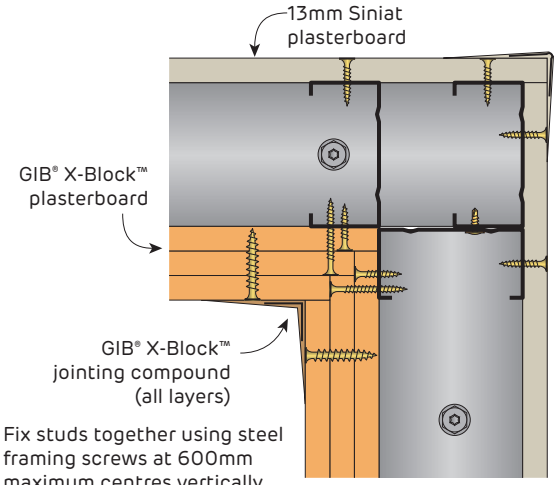


FIGURE 21 Wall Corner
Plan

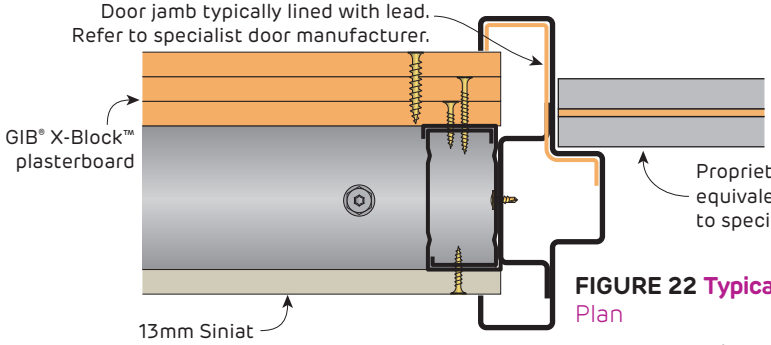


FIGURE 22 Typical Door Jamb
Plan

Fill any gaps with GIB® X-Block™ jointing compound

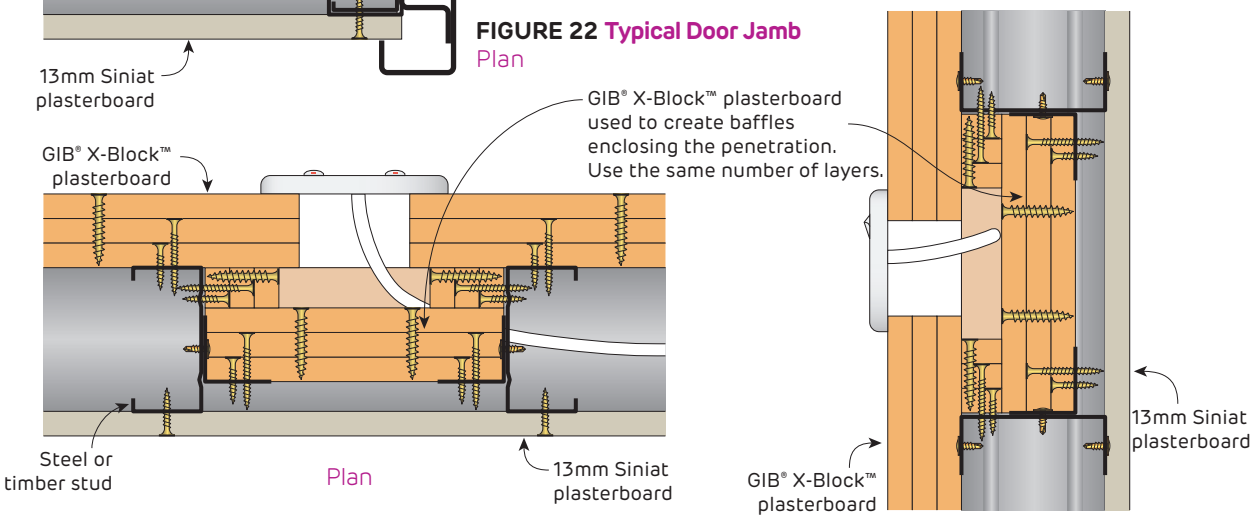


FIGURE 23 GPO Penetration

Fire Rated

X-Ray Protection Details - Systems XRP7 only

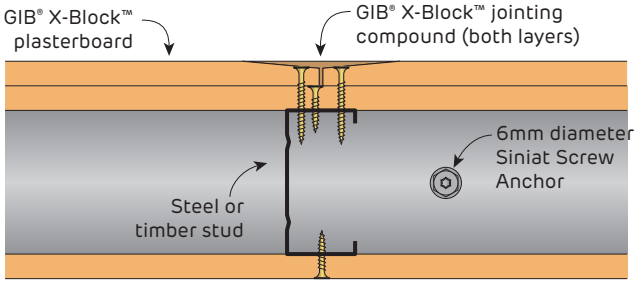


FIGURE 24 Jointing over Stud
Plan

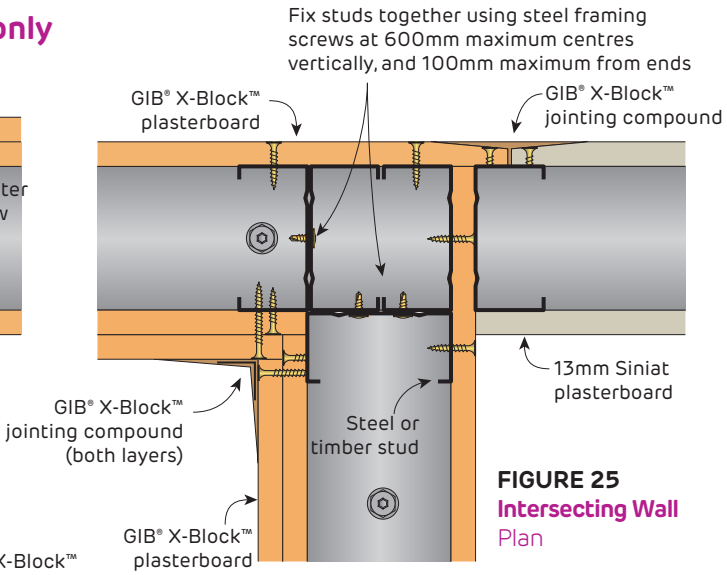


FIGURE 25 Intersecting Wall
Plan

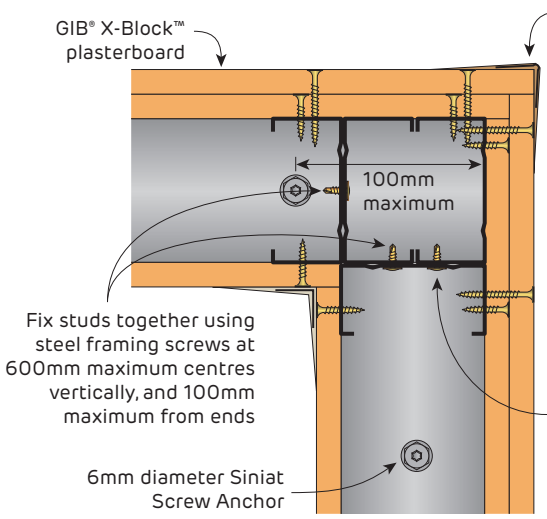


FIGURE 26 Wall Corner
Plan

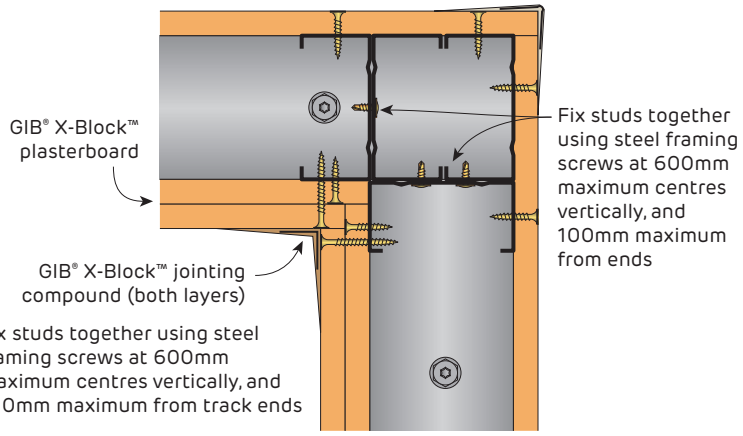


FIGURE 27 Wall Corner
Plan

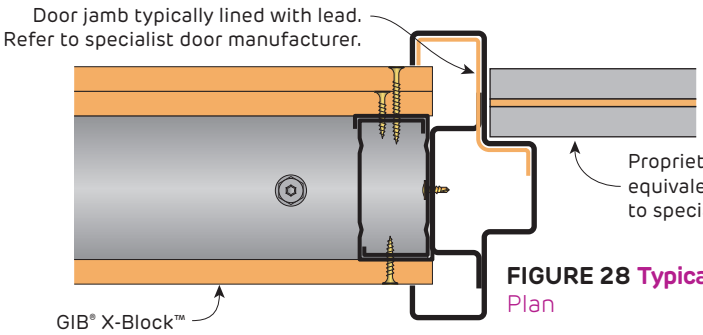


FIGURE 28 Typical Door Jamb
Plan

Fill any gaps with GIB® X-Block™ jointing compound

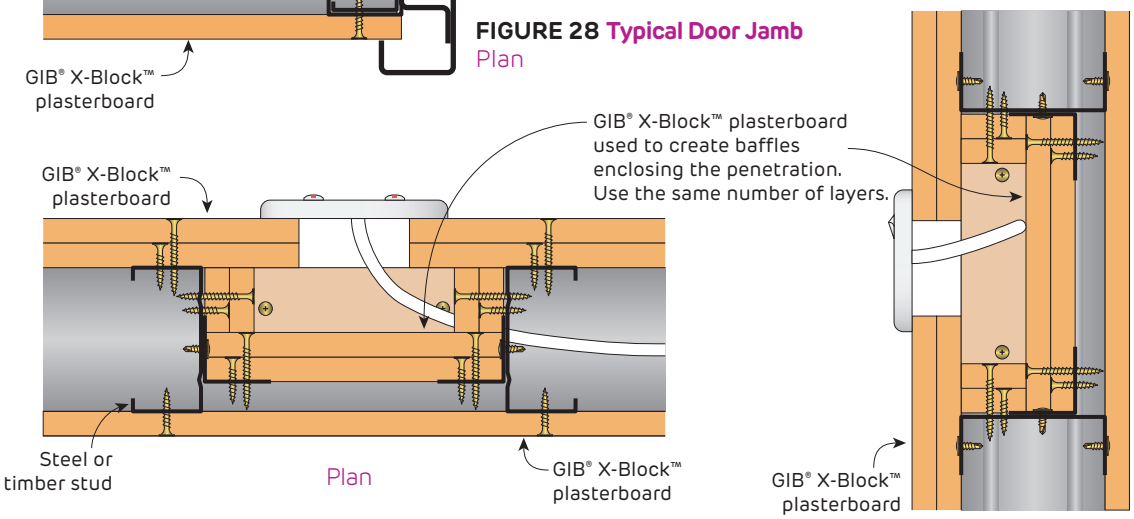


FIGURE 29 GPO Penetration