THE NATIONAL ASSOCIATION OF STEEL-FRAMED HOUSING INC.

GENERAL GUIDE TO STEEL-FRAMED BUILDING

NASH™

NASH is sponsored by BlueScope Steel,
Manufacturers of TrueCore® Steel

PO Box 1085 Hartwell VIC 3124
Phone (03) 9809 1333 Facsimile (03) 9809 1399 Freecall 1800 656 986
enquiries@nash.asn.au www.nash.asn.au

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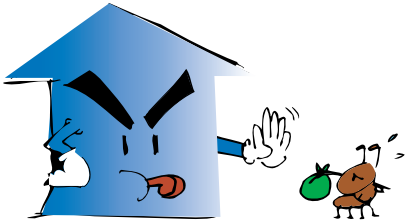
INTRODUCTION

This publication is provided as a guide only - it is not intended to be a training manual or to replace instructions issued by individual framing suppliers and/or building product suppliers.
Information designated “Following Trades” herein is designed to assist qualified tradespersons in the fixing of materials to steel-framed houses and is not intended for use by untrained persons. Do-it-yourself owner-builders should seek advice from qualified persons before installing any building product, and should preferably use qualified sub-contractors.



Termite, borer & rot proof

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THE BENEFITS OF STEEL HOUSE FRAMES

A house frame made of steel cannot be surpassed for quality. It represents value for money and brings peace of mind.

A steel frame has a very high strength to weight ratio, and will not burn, warp, or shrink.

Steel is termite, borer and dry rot proof, which means that these pests cannot attack and destroy the structure of your home.

A steel frame permits freedom in floor layout and architectural style. It facilitates construction of energy-efficient dwellings, and because steel framing is straight and true, it is easy to achieve a first class interior finish that will stay that way.

Because a steel frame's dimensions are stable, walls, ceilings and roofs are free from ripples or bumps, nail-pops do not occur in plasterboard walls, and there are no shrinkage problems with intermediate floor joists. Door and window frames do not distort, eliminating jamming.

For more information, refer to the section: "Frequently Asked Questions Answered".

THE NATIONAL ASSOCIATION OF STEEL-FRAMED HOUSING

The National Association of Steel-Framed Housing Inc. is a non-profit association whose charter is to represent the interests, and support the growth and development, of the steel-framed housing industry in Australia and New Zealand.

Steel house frames represent the future of home building. NASH endeavours to create wider public awareness of steel frames and to encourage their adoption by the building industry.

Utilising resources in the form of voluntary expertise and funding from the industry, NASH works in the fields of trades education, product innovation, market development, information exchange, specification and approval, and codes and standards, in order to hasten the inevitable changes.

NASH has Chapters in Queensland, New South Wales, Victoria/Tasmania, South Australia/Northern Territory and Western Australian, and is affiliated with kindred organisations in Australia and overseas. Membership is open to individuals and organisations engaged in all aspects of steel-framed housing, and comprises component manufacturers, fabricators, builders, erectors, specifiers, raw materials suppliers, engineering consultants, marketing consultants, suppliers of ancillary products, and education providers.

Nash National Office operates an information service. For technical enquires and information about the industry and suppliers, simply contact the NASH National Office on Freecall 1800 656 986, enquiries@nash.asn.au, or visit www.nash.asn.au

STEEL-FRAMED HOUSING

Introduction

Steel framed housing construction in Australia commenced in the 1940's when a shortage of building materials led to the development of steel framing systems using bitumen coated steel sections. During the 1960's galvanised steel frames made from 1.6mm base material were introduced and houses were built in Queensland, NSW, ACT and South Australia.

Over the following years steel-framed houses were constructed throughout Australia using a variety of material thicknesses and profiles.

The first "new era" 1.2 mm galvanised channel section frames were introduced in 1968 and fabricators have been developing individual steel framing systems since that time. Today thinner high tensile steel is generally used for the frames. The industry is highly innovative, due to its drive to become more material and cost efficient. In this it has the support of the Australian Standard for steel framing which is performance-based as opposed to prescriptive.

The idea behind steel framed housing is to use light, strong, cold-formed steel sections to make up the structural frame in a configuration similar to traditional timber construction. The frame is thus compatible with all of the popular cladding and lining materials such as plasterboard, interior feature panelling, particleboard and plywood flooring, brickwork, fibreboard planking, metal cladding, and tiling.

Steel framing systems have become popular with an increasing number of architects, project builders, contract builders, kit home suppliers, owner builders and consumers generally. Builders, engineers and architects specify steel-framed houses because of design versatility and consistency. Every piece of galvanised (hot dip zinc coated) or TrueCore® (45/55 Zinc/Aluminium alloy-coated) cold-formed steel framing is formed from consistent quality-assured material with controlled uniform dimensions, coatings and strength.

Benefits

Steel framing systems offer the benefits of:

- The strength, rigidity and reliability of steel – a versatile man-made material manufactured to high standards of quality control
- Close dimensional tolerances in the members themselves, including a high degree of straightness, resulting in a frame that is accurately square with dead-flat wall surfaces
- No shrinkage or warping, so that linings and cornices stay in place – no unsightly cracks or 'popping' of nails
- Freedom from attack by termites, dry rot, and borers
- Non-combustibility, which may attract a lower insurance premium
- A galvanised or aluminium/zinc coating which provides protection from any possible dampness under floors or in wall cavities
- Complete freedom in floor layout and architectural style
- Availability in a variety of fully engineered proprietary systems at economical and competitive cost.

Types of Systems

Because manufacturers and /or fabricators have developed a variety of different steel framing systems, with different sections, steel thickness, and joining methods, the following descriptions are generic. The consumer should discuss the merits of the individual systems on offer with the supplier.

There are two approaches to making up steel house frames. The most widely adopted method is that of factory prefabrication of floor frame units, wall frame units, and roof trusses of transportable size, which are then assembled and erected in place on site. The less popular approach is to deliver the pre-cut straight members to site and to carry out all fabrication and assembly on site.

Both methods have their benefits. Factory precision engineered pre-assembly is very practical for steel framing because the finished modules are straight and true, and light and easy to transport and handle. It also saves on costly site work, minimises possible weather delays and provides a guaranteed quality-assured framing system. Also owner-builders prefer a system which allows them to utilise simple, easy to erect framing procedures with minimum defects.

Fabrication

Initially most manufacturers welded their steel frames together, although a significant number of manufacturers are now using other connection methods as shown in Figure 1.

- **Tab and slot**
  Units have nesting members and are factory pre-assembled using tabs and slots. Final site erection is carried out using connector plates and self-tapping screws.

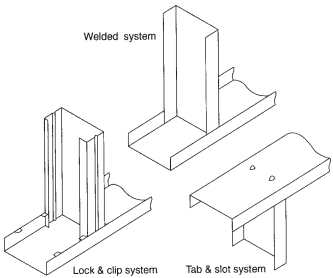
- **Lock and clip**
  Units are either assembled in the factory or on site by locking devices.

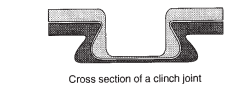
- **Factory clinched together systems**
  In a clinch joint two thicknesses of sheet steel are joined by extruding one sheet into the other using a punch and die to form a swaged joint, in such a way that the two pieces cannot be subsequently separated. With no introduced connection material, these joints are fast, simple, clean and economical

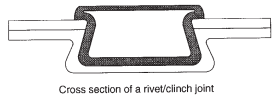
- **Riveted Systems**
  Units are either assembled in the factory or on site by conventional riveting.

- **Combination Rivet-Clinch System**
  This joint comprises a half rivet/half swage where one material layer is pierced by the rivet and the adjacent layer is swaged.

Figure 1
Connection methods







Erection

One of the major advantages of cold-formed steel framing is that the frames are pre-fabricated in the factory and delivered to site in bundles of floor frames, wall frames and trusses. The modules making up the frames are identified for easy assembly. Thus, erection of the home involves fixing together these components quickly on site. Self-drilling screws, powder-actuated fasteners and masonry anchors have played a major role in the erection of cold-formed steel framing. Cordless drills are widely used because of their convenience. The high strength clinch joint mentioned previously is also being developed as a connection method for on-site work.

Sub-Floor Systems

There are three types of conventional steel floor framing systems as shown in Figure 2 below.

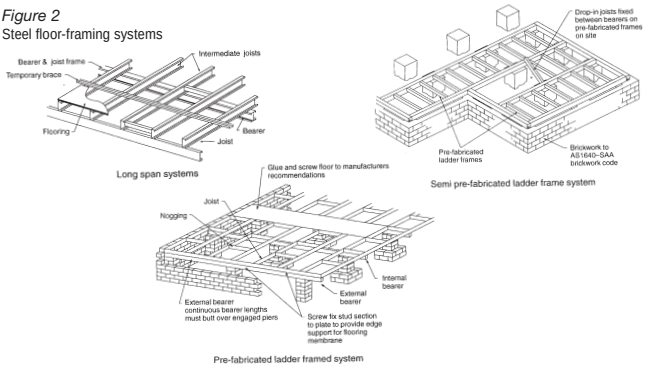
- **Prefabricated Ladder Floor Systems**
  These are completely factory manufactured into a ladder type configuration. The completed frame is delivered to site, set up, levelled and fixed into position with self-drilling screws or other approved fasteners. This system is typically used in lower floor applications.

- **Site Assembled Ladder Floor Systems**
  Special bearer sections are installed on piers with drop-in joists fixed between them using self-drilling screws. As above, these are also typically used in lower floor applications.

- **Other Site Assembled Systems (Long Span)**
  These are usually installed in a similar manner to timber systems. Rolled steel members (typically C-sections) are installed on bearers or on lower floor wall frames. Typical applications are upper or intermediate floors or longer span applications than are suitable for ladder floors.

There are also several proprietary sub-floor systems available that incorporate easily adjustable levelling mechanisms that make them very easy to install. Because of their longer spanning capability, it is generally possible to build using fewer piers. Steel eliminates shrinkage which is the most common reason for callbacks to completed projects. Shrinkage causes squeaky floors, cracks in cornices and tiles, and doors and windows that stick. Elevated steel sub-flooring facilitates under-floor inspection. Inspection is recognised by the Australian Standard series AS 3660 as the only truly safe termite prevention method.

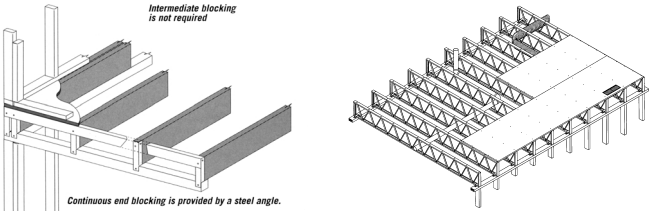
Figure 2
Steel floor-framing systems



Steel Upper-Level Floor Framing Systems

There are several systems available that are suitable for use as upper level flooring. These feature steel beams of different configurations designed to give high strength, light weight, long spans, no "bounce", and provision for services. They are precision made and will not shrink or twist, hence flooring sits uniformly flat on joists. Some of the proprietary sub-floor system beams are also suitable for use between upper floors. A couple of examples are shown in Figure 2a.

Figure 2a
Upper-Level Flooring



Walls

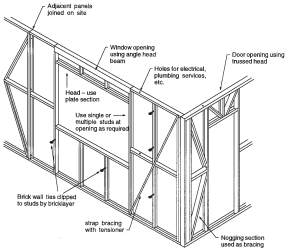
Wall frames are generally pre-fabricated in lengths up to 7.5 m maximum, for ease of transport and site handling. Methods of framing vary among manufacturers but the following members are generally present:

- Top and bottom plates
- Studs
- Noggings
- Bracing
- Lintels or beams

After delivery to site, the frames are erected in a manner similar to timber frames. They are placed in position, aligned, squared, levelled and fixed through the bottom plates and corner junctions. Typical fixings include bolts, self-drilling screws, rivets, expanding masonry anchors or power-driven nails. Choice of fixing is dependent upon the system used or requirements of local government authorities and engineers.

Most manufacturers provide factory-punched holes at convenient locations in the steel studs to allow for the installation of plumbing and electrical wiring. Plastic grommets or bushes are available to avoid metal-to-metal contact between copper piping and the studs, and to prevent damage to cable insulation. An example of wall framing is shown in Figure 3.

Figure 3
Steel wall framing



Roof and Fascia

Steel roof truss systems can be provided to suit all types of roof construction such as hips, gables, dutch gables, mansard etc. The strength and uniformity of the steel members enables standard design trusses to be used for spans up to 15 metres. Steel or timber battens can be fixed to the trusses to accommodate either metal roofing or roof tiles.

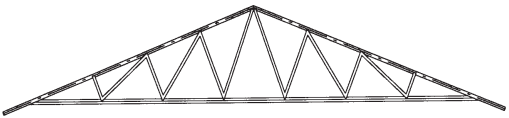
Lightweight steel roof battens provide substantial benefit over their timber equivalents. They are straight, and remain so, long after they are installed. This is particularly important when some of the newer, almost flat, shingle-type tiles are used, as these tend to highlight any change in alignment.

Due to their top-hat shape, steel battens nest together, simplifying transport and storage. They are also easy to install and can be lapped rather than butt-joined at a rafter.

A typical pre-fabricated roof truss is shown in Figure 4.

Provision can be made in the trusses for the easy attachment of fascia boards which can be either steel types or timber. Modern pre-painted steel fascia/gutter systems are particularly compatible with steel house frames, are easy to fix and will not warp or twist.

Figure 4
Pre-fabricated roof truss



Fixing of Claddings, Linings etc

Because the steel studs are at the same spacing as in a timber frame, all of the normal cladding and lining materials are suitable for fixing to the steel frame. The use of gun nailing technologies to fix materials to steel frames has come about through the development of higher strength and thinner steel components and suitable nails. Fine head nails are now used to fix skirting boards and architraves, floor sheets are nailed down to steel floor joists and claddings can be nailed to the external faces of buildings. Development is continuing on steel-to-steel nailing and methods for fixing plasterboard to steel frames. For brick veneer, most systems provide a special wall tie to fix the brickwork to the frame.

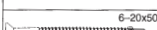
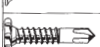
The spacing of roof trusses varies. Where the truss spacing is greater than the ceiling board can span, the ceiling board is fixed to steel battens which themselves attach to the underside of the trusses. Because of the precise nature of steel framing, no time-consuming packing of battens is necessary in order to obtain a flat ceiling.

Self-drilling screws are used extensively to fix claddings and linings to steel frames. The distinguishing feature of a self-drilling screw is its point, which is designed to drill through the steel member. A length of self-tapping thread then follows the point. These screws make very secure fixings as well as very neat ones. For example when the 'bugle head' screw, which is used for fixing plasterboard, is tightened, it finishes just below the surface of the board without damaging the paper facing.

These screws cannot be driven by hand, and require a power driver. Typical screw fixings used are shown in Figure 5.

More information is given in the "Following Trade Information" section of this booklet.

Figure 5
Typical Fixing Screws

Description	Uses
10–16x16mm Tek	Flush fixing screw where flush surface finish is required, e.g. Plasterboard corner angles.
10–16x18mm Tek	General non-structural fixing screw. Uses: wall connectors roof battens etc.
12–14x20mm Tek	Structural fixing screw, tiled roof truss fixing, girder/truss heel bracket fixing, roof battens.
14–10x20mm Tek	Structural fixing screw low wind area. Sheet roof truss fixing, rafter beam fixing and high load sheet connections.
12–14x45mm Tek	Fixing wall bottom plate to steel joists.
12–24x32mm Hex series 500	Used for fixing steel brackets or joists to heavy gauge beams up to 12mm thickness.
10–24x75mm CSK Wing Tek	For fixing timber batten or timber to steel. Timber thickness range 25–30mm.
10–16x45mm CSK Tek	Timber floor to steel joists fixing. General timber to steel. Timber thickness range 30mm.
8–18x35mm SEH Wing Tek	Used on Hardiplank. Weathertex and assorted timber claddings to steel stud work. (Use stainless steel for cedar.)
 6–20x50mm CSK wing Tek	Architraves, reveals and skirtings. General finishing and fixing timber screw.
6–20x65mm CSK Tek	Architraves, reveals and skirtings. General finishing and fixing timber screw.
6–18x30mm Bugle Needle Pt.	Plasterboard fixing to ceiling battens.
6–20x25mm Bugle Drill Pt.	Plasterboard fixing to wall frame studs.
 8–18x25 SEH Extended point Tek	Fibrous cement fixing screw (wet areas).

Plumbing

In-wall gas and water piping is simply passed through the service holes to reach the required outlet locations. Plastic grommets are snapped into the service holes before copper piping is installed to prevent frame contact and possible dissimilar-metal corrosion.

Extra service holes, if required, must always be located close to the centreline of each stud.

In brick veneer construction, piping may be run in the cavity and fixed to the studs with full saddles and self-drilling screws. Copper piping must be isolated from the steel frame.

Pipe sets for baths, basins, showers, cisterns, etc, are supported in the normal way on timber or steel nogging. Neoprene sheeting should be inserted under each pipe set to isolate it from steel nogging.

To provide support for the lip along the back of a bathtub, steel wall studs are notched, at the required height, and reinforced. This work is sometimes done during fabrication of the wall frame.

More information is given in the “Following Trade Information” section of this booklet.

Electrical Services

Steel house frames must be permanently earthed in accordance with the requirements of local electricity authorities. A temporary earth should be established until the permanent earthing is installed.

Installation of wiring for electrical services is made quick and easy by provision of pre-punched service holes, which may be plain or flared. Plain holes, either pre-punched, hand punched or cut out with a hole-saw, require a grommet fitted before wiring is pulled through.

More information is given in the “Following Trade Information” section of this booklet.

How to Purchase Light Structural Steel Framing for Dwellings and Other Buildings

The prospective buyer should contact one or more of the suppliers listed in this directory.

The industry in Australia has been highly innovative, making full use of computer technology, the properties of steel, and the structural engineering principles of cold-formed steel sections. Manufacturers have developed their own unique systems, and each system has its own particular features, which are described in the manufacturers' literature. Manufacturers will discuss these with you.

All that is necessary is for you or your builder to submit a normal (1:100 scale) plan of the house, or extension, or other building showing floor layout, elevations, room dimensions, etc., and each manufacturer will be able to quote you a price. The manufacturer you choose will also be able to supply all the necessary components from the same basic information should you decide to order.

Steel framing is supplied as a fully engineered system. If seeking supply of light steel framing for commercial or institutional premises, or for dwellings with unusual requirements, it is advisable to discuss the complete building specifications with the frame supplier so that all possible loads on the structure when in use can be allowed for.

Steel house framing is especially attractive if you are an owner/builder, as little trade skill is needed for erection. Instructional videos and literature which demonstrate the erection procedures and correct techniques are available from some manufacturers and NASH. Because steel framing is an engineered product, it is important to adhere strictly to the manufacturer's instructions on the number and positioning of fasteners, brackets, bracing etc.

Some Technical and Further Education (TAFE) Colleges conduct fast track Trade and Owner Builder courses on the construction of Steel Framed-Housing. Information on training materials and courses can be obtained by contacting (NASH) members in each state.

Codes and standards relating to steel-framed housing

Building Code of Australia (BCA) Class 1 and Class 10 Buildings, Housing Provisions:
Part 3.4.2 Steel Framing
Part 3.1.3 Termite risk management
Part 3.3.3.2 Masonry Accessories, Wall Ties

NASH Standard for Residential and Low-rise Steel Framing, Part 1: Design Criteria 2006

AS/NZS 4600:2006, Cold-formed steel structures

AS/NZS 1170 series, Minimum design loads on structures

AS 4055, Wind loadings for housing

AS 1397, Steel sheet and strip – Hot-dipped zinc-coated or aluminium/zinc coated

AS 3600 – 2000 series, Termite management

AS 3700, Masonry Code (wall ties)

Other references

Design of Cold-formed Steel Structures (to AS/NZS 4600:2005),4th Edition 2007 by G.J. Hancock.

NASH POSITION ON STEEL FRAMES IN TERMITE MANAGEMENT

Termites cannot eat steel.

To take the first and most basic step towards minimising the risk you face from the termite menace, for the lifetime of your home, you must impose an absolute limit on the amount of damage they can inflict. Achieve this by making sure your home has a steel frame. Don't accept alternatives.

All households are exposed to a risk posed by termites. Just two things determine how great that level of risk is. The first is the likelihood that termites will enter your home; the second is the amount of damage they can wreak before detection and eradication.

The likelihood that termites will enter your home varies with region, construction type, materials used, and expertise of the builder, but is higher than you might think! The incidence of termite attack appears to be increasing everywhere and has reached disturbing levels. Conventional termite barriers fail for a variety of reasons, and there is convincing evidence that these failures are on the increase. Often it's only a matter of time.

If you choose to build or buy a house with an untreated termite-susceptible timber frame, automatically your level of risk will be high, because the damage that termites cause can be so extensive. Usually the first sign of termite attack is damage inside the home to items such as doorframes or skirting boards. With a non-resistant frame, by then it is too late. It has already been attacked, and if, as often happens, they have destroyed most of the frame, they have for practical purposes destroyed your house, because the frame supports the house. Often the result is a condemned building, or expensive, time-consuming, and disruptive repair work at least. Do not accept this risk. The cost of rebuilding or restoration could be a financial disaster. Also, bear in mind that termites are not the only organisms that attack timber. Borers and fungal rot cause far more damage than is generally realised, and barriers cannot keep them out.

The Building Code of Australia allows a steel-framed house to be built without any extra defence against termites. Depending on factors such as the local environment, style of building, and personal circumstances, you may decide you don't need a barrier, because your frame will be safe and potential damage will be moderate. You may judge this to be an "acceptable risk" option.

Owners however have two very low-risk options available to them. Choose either:

1. A steel-framed house, with non-structural components of termite-resistant materials. In this case no barrier is necessary.
2. A steel-framed house, plus a termite management system that conforms at least to the minimum requirements of the relevant Australian Standards (AS 3660 series).

Builders are traditionalists. Most have been trained as carpenters, and prefer working with timber because of their long-standing familiarity with it. Under the so-called "whole of house protection" policy espoused by some state government agencies many will not build a steel-framed house without a termite barrier, because there is a chance that termites might damage non-structural parts of the building. Builders are told they will then be held responsible for fixing such damage. Because of this, many builders take the view that if they have to install a barrier with a steel frame anyway, why bother building in steel. Some will even try to dissuade you from building with a steel frame but don't be talked out of it.

NASH, in line with the Australian Standard, strongly recommends regular competent inspections of buildings for any signs of termites. Termite barriers don't stop termites. They force their earthen leads into the open where they can be seen. Steel frames don't attract termites, but they will not stop some species. There is no substitute for vigilance, and being informed.

NASH believes that the cost of inspection for termites should be lower for steel-framed dwellings than for timber framed dwellings. This is because the frame is generally inaccessible, but being inaccessible doesn't matter if the frame is built of steel. Bear in mind also that pest inspectors do not accept liability for the condition of concealed members, simply because they are so difficult to inspect properly.

For more information about termites visit www.nash.asn.au, contact NASH on (03) 9809 1333, or enquiries@nash.asn.au.

FREQUENTLY ASKED QUESTIONS

Q. Why steel framing?

A. Very simply, a frame made of steel is a high quality product. It represents value for money and brings peace of mind. A steel frame is light and strong, it will not burn, it is termite, borer, and fungus-proof, and it will not shrink or warp.

Q. I have heard of homes that have been almost completely destroyed by subterranean termites, and it is hard to imagine anything worse. Is a steel frame really the answer?

A. Yes. For ongoing peace of mind the best solution to the termite menace is a steel frame. Termites cannot eat steel. Most timbers needs to be defended against termites. Organchlorine chemical treatments, which were effective for protecting timber, were banned some years ago because of health concerns. The treatments that have taken their place are probably less toxic but are also less effective. The alternative physical barriers are not foolproof. Because it is unseen, most people rarely think about the frame of their house, but without it there can be no house. Any damage to the frame is clearly very serious, is often dangerous, and for most people, a financial disaster. The consumer's lowest-risk option is a steel frame in combination with either a termite barrier, or termite-resistant fittings in the house. For information visit www.nash.asn.au

Q. Is steel framing expensive?

A. No. Steel framing is very competitive on price, particularly when you consider its quality! A steel frame gives value for money. It is a premium quality product that sets the benchmark. It has many advantages over timber, including the best quality timber. Timber comes in many types and grades, and its price can fluctuate widely. Compared with top quality timber, and counting all the benefits of steel frames, they are a bargain. The fact is that discerning buyers are increasingly demanding steel frames. The proof is that steel framing suppliers continue in business.

Q. Where can I get quotes on steel frames?

A. For the names of local suppliers consult this directory, contact NASH on 1800 656 986, or visit www.nash.asn.au

Q. Are there any long-term cost advantages?

A. Yes. There are ongoing savings for the householder. Because steel will not burn and is termite-proof, some insurers offer attractive discounts on their premiums for steel framed homes. Also, the expense of ongoing anti-termite chemical treatments is avoided, and you will never have to replace your frame due to termite damage.

Q. Will my builder charge more for building a steel frame?

A. Competitive pricing is generally available from progressive builders for standard house designs. Progressive builders are aware that steel frames are the way of the future, and are generally prepared to quote competitively. Steel frame suppliers can advise you of a suitable builder. Bear in mind that quality and peace of mind are worth a premium. For the name of a builder in your area contact NASH on 1800 656 986 or enquiries@nash.asn.au.

Q. Have steel framed buildings been proven over time?

A. Yes. In Australia steel framing has been used successfully in housing since the early 1950's. The Australian steel framing industry has a well-earned reputation for being highly innovative. Today's framing represents the results of years of research, testing and product improvement. It is a thoroughly engineered product. In responding to the needs of the Australian customer, the steel framing industry in Australia leads the World with its technology. Don't forget that steel frames have been used in commercial buildings for many years because of their superior attributes.

Q. What underlies the quality of a steel frame?

A. The steel in the frames is produced by quality-accredited producers to appropriate National Standard Specifications. The components are precision manufactured and assembled to very tight tolerances using advanced techniques. Computer-aided design, computer-controlled manufacture, and advanced engineering, ensure the home buyer gets the design he or she wants, and that installation is quick and easy. Strength and performance are engineered into the frame.

Q. Can a house frame be erected by the customer?

A. Almost all systems on the market can be installed by the customer. Some producers supply houses based on steel frames in kit form specifically for the do-it-yourself owner-builder. Panels are easily handled and are clearly identified for assembly, generally with pre-punched electrical and plumbing service holes. Roof trusses are identified and easily secured to support the walls. Ceiling and roof battens are easily fixed to the trusses. NASH and the suppliers provide instructional material to assist the owner-builder or do-it-yourself installer.

Q. Can I add to a home at a later date?

A. Yes. Additions are relatively simple and pose no problems. Furthermore the existing steel structure will remain straight and true regardless of its age, making the job of lining up the extension easier than for conventional timber framing.

Q. How much flexibility do I have with design?

A. Freedom of floor plan and architectural style is practically unlimited. Steel frame manufacturers and fabricators can produce almost any one or two storey home design seen in the Australian market today. Furthermore, it is possible to produce designs in steel that are difficult with other materials. By taking advantage of this feature the owner can often build with less expense than by using more conventional materials.

Q. Will the house framing system I choose be approved by councils and lending authorities?

A. Yes. Engineers' details to satisfy council requirements are provided as a matter of routine, and lending authorities see steel framing as an excellent long-term investment.

Q. Can I have my home designed by a steel frame supplier?

A. Yes. Not all steel frame suppliers provide this service, but there are many who do. There are some that have their own designs and nearly all will supply to fit the customer's design.

Q. Can I build on piers or a concrete slab?

A. Either! There are several steel floor systems available for pier-design. Direct fixing to concrete slabs is also very widely used. On sloping sites where limits have been imposed on the maximum depth of cut and fill, it can be far more economical and environmentally friendly to use raised steel flooring than a concrete slab. Also, an elevated steel flooring system performs as an excellent first line of defence against sub-terranean termites because any termite workings are forced into the open where they are easily seen.

Q. Do homes with steel look different?

A. To the discerning eye, yes, they look better. Walls, ceilings and roofs do not have ripples or bumps in them, there are no "nail pops" in the plasterboard walls, and there are no shrinkage problems in intermediate floor joists. Roofs of steel-framed homes do not sag over time, even under concrete tiles, so the finished job keeps looking good.

Q. I have heard that steel frames are made of thin steel. How do I know they will be strong enough?

A. The properties of steel are known and consistent, and conform to Australian standards or their equivalent. Steel-framing components are designed around those properties with an extra allowance included for safety. Most modern systems use high tensile steel components with appropriate jointing methods, and are engineered to pass strict performance tests.

Q. Is steel framing suitable for cyclonic areas?

A. Yes. Steel is used extensively in cyclone prone areas because of its inherent strength. Many suppliers can adapt their framing systems for cyclonic conditions if required. It is recommended that you consult with your local fabricators for details.

Q. Will a steel frame perform in any climate?

A. Yes. Not surprisingly steel is the preferred framing material in the extreme climate of North West Western Australia, for example, where temperatures can vary more than 40 degrees Celsius in a single day.

Q. Steel expands or contracts as the temperature changes. Is this a problem?

A. Whether a steel frame is mechanically jointed or welded, in a properly constructed and insulated home thermally induced movement is not an issue. Steel framing expands and contracts at rates not too dissimilar from the other materials used in building, which means it is unlikely that there will be noise or cornice cracking problems. It is important that steel roof sheeting is not fixed too tightly to the roof battens, otherwise sound from expanding and/or contracting sheeting may be transmitted through the frame.

Q. Why won't a steel frame rust?

A. Steel frames are made of steel protected against corrosion by a hot-dipped metallic coating of either a zinc-aluminium alloy, or almost pure zinc (galvanised). These coatings conform to the appropriate Australian standards or their equivalent. In external applications such as roofing these products are exposed to the elements and have excellent durability, so in less exposed applications such as inside the building envelope they weather more slowly. Where there are drill holes and cut edges the galvanic action, or sacrificial protection, of the coatings protects the exposed steel edge against corrosion. For more detailed information on this topic, please contact NASH.

Q. Does lightening-strike affect a steel-framed home more than a timber one?

A. No. Because steel creates a positive earth, the lightning has less effect. The energy is conducted straight to the ground, and is not released destructively within the frame as in conventional framing or cladding.

Q. Is a steel frame safe when exposed to a live electric wire?

A. Yes. Steel frames are safe because they are earthed. It is a requirement that all new housing be fitted with circuit breaking safety devices, so there is little chance of you touching anything live. A broken or pierced wire in a timber frame can remain live and leaking current can cause troublesome faults and fire risk. For further information on this topic, please contact NASH.

Q. How does a steel frame perform in a fire?

A. When a fire breaks out in a building the safety of individuals is paramount, and in this respect frame performance is of secondary importance. Unless quickly brought under control, a fire can intensify and spread at frightening speed and therefore it is most important to have warning devices installed and for people to be able to get out of the building as quickly as possible. Smoke and heated air and/or asphyxiating gases are responsible for about 75% of fatalities in house fires. A steel frame will not burn. It will not therefore contribute to the fire or its spreading, and will not release smoke and carbon dioxide. Electrical faults cause many fires in wall cavities. An electrical fault cannot ignite a steel frame. If fire gets into the ceiling and ignites timber trusses it can spread very rapidly to the rest of the house. In a bushfire the point of ignition is often the roof cavity when burning embers are blown in under the eaves or tiles. House fires have been known to break through ceilings into the roof cavity. A steel roof truss cannot be ignited in either of these ways.

Q. I am a builder. Why should I build in steel?

A. Steel frames represent the future of house framing. Continual product improvements and consumer awareness means that demand for steel-framed homes will keep increasing. People are more conscious than ever of the ever-increasing threat from termites. You can build the major termite management into the building, rather than add it on. A steel-framed house is a quality product that delivers to the customer long-term peace of mind and cost savings. Callbacks are reduced and your reputation can be enhanced. Although steel frames require different techniques they are quick and easy to erect. Because steel has consistent strength and complies with strict standards and tight tolerances, every stud is a good stud. Steel frames are lightweight and easy to handle, time is not lost sorting to select suitable pieces, there is no need to straighten framework on site, and wastage of material is reduced.

Q. As a consumer I am very conscious of the environment. Will I be doing the right thing if I use a steel frame?

A. Yes. All industries have some impact on the environment but most are making concerted efforts to reduce those impacts. The steel industry, the timber industry, and other building materials industries are required to work within government guidelines, which are influenced by international agreements. Attention is often drawn to the carbon dioxide produced when new steel is produced, overlooking the fact that steel is 100% recyclable, and that about 60% of all steel in use in Australia has been produced from recycled scrap. Little is also said about the negative impact on the environment of large plantations of introduced species of timber, and the attendant loss of habitat for native species. For more information on this topic, please contact NASH

Q. What about the energy consumed to make steel compared with say timber?

A. A steel house frame is only one part of all the materials used in the construction of the house. Further, the total energy used to produce all of the materials in a house has been calculated in some studies at less than 6% of the total energy consumed in the running of the house over its lifetime. Householders can make a much more substantial contribution to the environment through selecting good design, the thoughtful orientation of the building, and the use of building materials and insulation to conserve energy consumed by air conditioning or heating over the life cycle of the home. They can install solar power, and engage in waste recycling. They can minimise the impact of the building on a fragile hillside. On such sites the use of raised steel floors can minimise disturbance to the natural contours of the land and enable better management of stormwater run off. Storage of rainwater in tanks can contribute. Also, by using a steel frame and termite-resistant fittings the owner can do away with the ongoing use of chemicals for controlling termites. For more information on this topic please contact NASH.

Q. Does a steel frame interfere with radio or television reception?

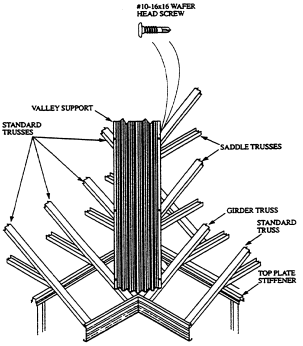
A, No. Waves pass through the spaces between the studs, allowing the use of all household appliances without any interference.

ROOF DRAINAGE

VALLEY SUPPORT

The generic, readily available, valley support provides a quick, reliable method of constructing a valley on steel framed roofs. It provides a safe, secure platform for fixing battens during roof construction.

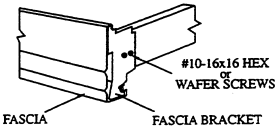
Fix valley support to roof trusses using #10-16x16 wafer screws.



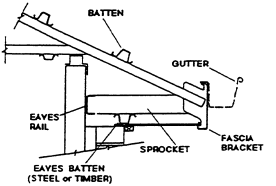
Internal Corner Showing Valley Support

FASCIA

Fascia brackets are usually pre-attached to the sprocket. Fascia is fitted to the brackets according to the manufacturers specifications. If brackets are not pre-fixed, install two (2) # 10-16x16 hex screws through the bracket, to the truss end or sprocket.



Typical Fascia Fixing Details



Typical Boxed Eave Components

To ensure a straight gutter line, install the two end fascia brackets first, then extend a string line between the two end brackets and fix intermediate brackets or sprockets to the string line. On long runs, install a central bracket to prevent the string from sagging.

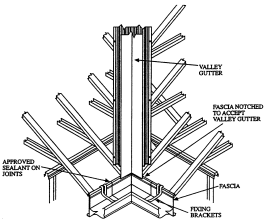
Install the fascia to the brackets, with the corners and joint as required.

VALLEY GUTTER

Valley gutter is placed over the valley support and fixed in the usual way. Trim the valley at the fascia and ensure that the valley gutter laps over the fascia to deposit water in the eaves gutter. Seal all joints with an approved sealant.

GUTTERING & DOWNPIPES

Install guttering & downpipes using manufacturers recommended fixing procedure.

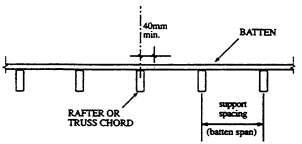


Typical Gutter Fixing, Valley Gutter in Place

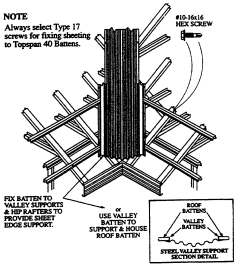
SHEET ROOF INSTALLATION

ROOF BATTENS

1. To minimise cutting, lay all battens in one direction, starting from one end of roof. Lap ends of battens at least 40mm from the truss centre line as shown.
2. Cut battens to length using a saw or angle grinder with metal cutting disc.
3. Roof batten spacing is calculated on the sheet profile and length. The number of supports per sheet is usually defined in sheet manufacturers tables.
4. Fix battens to trusses using #10-16x16 Hex screws, to both batten flanges at each truss.
5. Valley and Hip Ends will require a batten to be fixed to the valley support or hip rafters to provide sheet edge support.



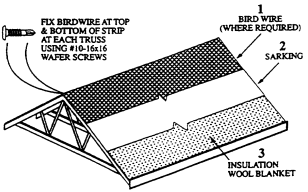
Lapping Battens



Fixing Battens

BIRD WIRE & SARKING

Where insulation materials are used, they should be laid over the battens as shown in the diagram.



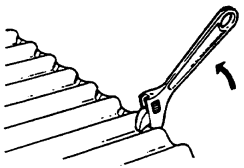
Fixing Insulation Materials

Note

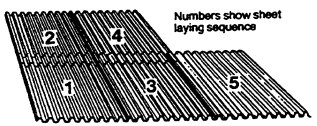
The following instructions are typical of the operations used to install a sheet roof to a steel framed home. Due to the various profiles and fixing systems available, the installer should obtain detailed instructions from the material supplier.

SHEET INSTALLATION

1. On roofs with a slope below 25°, the trays between the ribs require turning up to prevent wind driven water from entering the building. Before sheet installation, ribbed sheets are gripped with an adjustable spanner and turned up as far as possible. Special tools are available for other sheet profiles.
2. Sheet lengths normally cover the roof run. If more than one sheet is used, sheeting should be lapped according to manufacturers recommendations.
3. Fix the first sheet to the roof using the sheet manufacturers recommended screws and fixing intervals. Do not fix in valleys of the sheet. When fixing to light gauge battens, ensure that a coarse threaded screw is used, as recommended by sheet manufacturer.
4. When the following sheets are fixed, it is important that the profiles are lapped correctly according to manufacturers recommendations.
5. Fix Flashings and capping according to manufacturers recommendations.

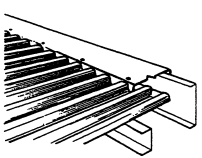


Turn Up High End of Sheet

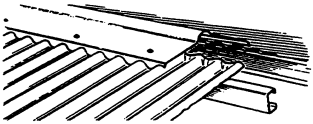


Overlapping of Sheets (where required)

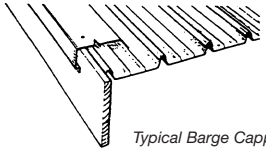
Typical Fixing Of Roof Sheeting



Typical Fascia Capping.



Typical Ridge Capping



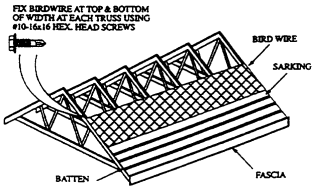
Typical Barge Capping

ROOF TILING

SARKING AND SUPPORT MESH

If sarking (reflective foil) is required it should be installed under (ie. before) battens in the following manner, using planks positioned across trusses for access if required. Support mesh is generally required only where truss centres exceed 900mm.

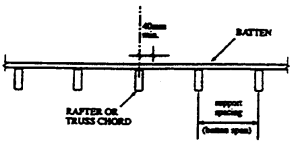
1. Fix a run of mesh to an end truss using #10-16-16 hex head screws and stretch to the other end along the fascia line. Place a run of sarking over the mesh and temporarily place weights on the sarking to hold in position.
2. Fix first batten back from the fascia in position according to the roof batten fixing procedure, fix batten screws through the sarking mesh. Fix battens over the sarking until it is covered.
3. Position the next run of mesh on the roof, above the first run. Twist the wire together between trusses and place the next width of sarking over the mesh.
4. Fix the remaining battens, mesh and sarking in the same manner until the roof is covered.



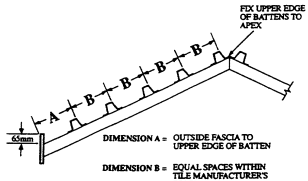
Fixing Bird Wire & Sarking

ROOF BATTENS

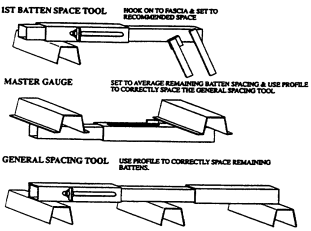
1. To minimise cutting, place all battens in one direction, starting from one end of roof. Lap ends of battens at least 40mm from each side of the truss centre as shown.
2. Cut battens to length using a saw or angle grinder with metal cutting disc.
3. Position the first batten at the tile manufacturers recommended spacing from the outer edge of the fascia and the top batten to the roof apex. The remaining batten spaces are divided evenly to fall within allowable tolerances. The first batten spacing tool, shown over, can be used to position the first batten.



Lapping Battens

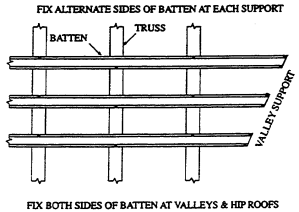


Spacing Battens

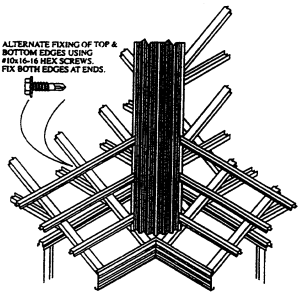


Batten Spacing Tool Set

4. Measure the distance between the top batten and the first batten. Divide the figure to result in equal batten spaces with correct lap, as in normal batten fixing procedure.
5. Set the master gauge to this measured spacing (if the tools used have this feature).
6. Set "General Spacing" gauge to the "Master Gauge" setting. Space Battens using the General Spacing" gauge by progressively moving up the roof, positioning the bottom part of the gauge over the fixed batten and fixing the next battens to the positions of the gauge locations.
7. Fix battens to trusses using #10-16x16 hex screws, alternating fixing the top and bottom edges of battens at each truss. Fix both edges at ends and joints.



Alternating Fixing of Batten Edges to Truss



PLACING TILES

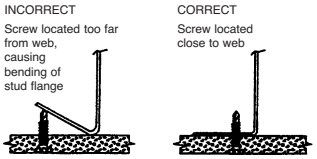
Position the first tile of the bottom row over the batten. Position the end of the tile clip over the bottom edge of the batten and lift the hooked end of the tile clip over the top edge of the tile, in the tile valley adjacent to the overlapping edge.

Position the next tile and fix in the same manner and continue with the remaining tiles of the first rows until the roof is covered.

EXTERNAL CLADDING

GENERAL INFORMATION

When fixing external cladding to "C" section, stud screws should be fixed as close as possible to the web side of studs to ensure the screws will engage correctly.



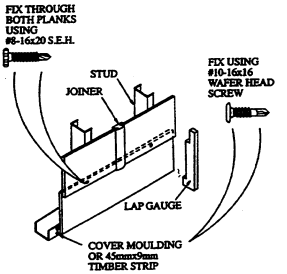
Fixing Cladding to "C" Sections.

CAUTION

CCA treated timbers are corrosive to steel. Do not fix in direct contact with steel frames.

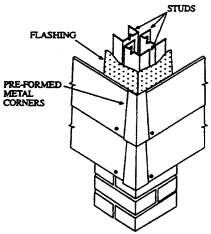
FIBRE CEMENT & HARDBOARD PLANKS

1. Fix flashing at external & internal corners, head, sill and side openings as required. Fix a strip of cover moulding or 45mm x 9mm timber around the bottom edge of the building, to pack out the first plank.
2. Fix a string line around the building to establish the top of the first plank. Starting from an external corner, fix the first plank at each stud, flush to the corner and the string line.
3. Fix a joiner to the free end of the plank and continue to fix the bottom row of planks fitting joiners as required.



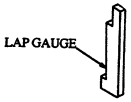
Fibre Cement Fixing Details

4. Internal corners of planks are normally butted to a timber stop. Preformed metal external corners are normally filled with a recommended adhesive and pushed in position.

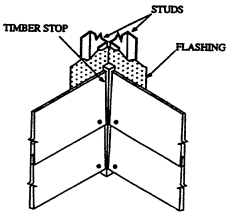


Fixing External Corners

5. Measure the wall height, then calculate the board overlap and the number of sheets to cover the wall. Taking into account the lap required, fabricate two lap gauges from timber as shown and tack to the first plank, to enable the second plank to be accurately aligned.
6. Starting from an external corner, start off with an offcut plank to stagger the joints and fix in position. Fix joiner in position, move lap gauges to the second plank position and fit the following plank. Finish the course in the same manner, fixing corners as required. Follow this method for remaining courses.



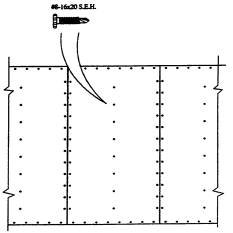
Timber Lap Gauge



Fixing Internal Corners

FIBRE CEMENT SHEET

1. Fix flashing at external & internal corners, head, sill and side openings as required. Set a string line along the bottom edge to ensure correct alignment of sheets. Starting from a corner, position the first sheet, align correctly and fix in position using #8-16x20 S.E.H. (self embedding head) screws.
2. Screws should finish 0.25mm below the sheet surface, so that holes may be filled and sanded flush if required. They should not be overtightened, as damage to sheet may occur.
3. Fix vertical and horizontal joints and all corners to manufacturers specifications.



Typical Fibre Cement Sheet Fixing Details

STEEL WALL PANELS

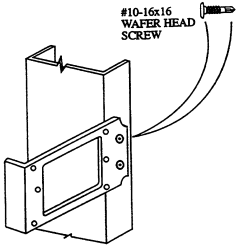
Wall Cladding profiles should be fixed in accordance with manufacturers specifications.

Brackets and clips where required, should be fixed using #10-16x16 hex screws generally, or wafer head screws if the head will foul the panels.

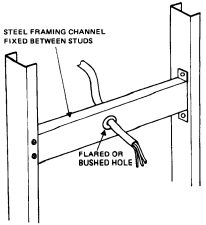
ELECTRICAL WIRING

SWITCH & POWER POINT SUPPORT.

Fixing backing plates for switches & powerpoints using #10x 16-16 Wafer Screws. Do not fix switches or other control devices directly to architraves or skirting boards, due to the close proximity of metal framework.

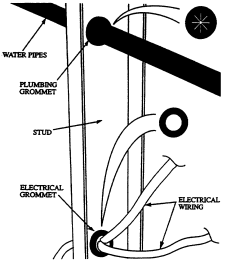


Switch & Power Point Backing Plate



Wiring and Backing Plate

ELECTRICAL WIRING.



Installed Position of Electrical Grommets

Electrical wiring is installed through service holes provided in studs and wall plates. Grommets must be used in all non-flanged holes through which wiring is installed, to protect insulation. Wiring may be secured to frames using cable clips.

Cable Clip

FRAME MODIFICATIONS.

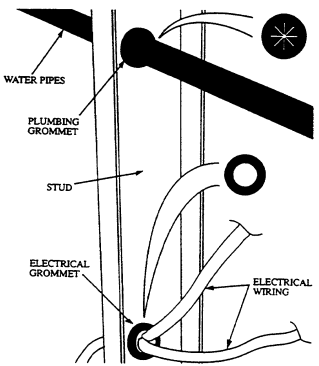
If components require modification for electrical services, consult with the framing system fabricator.

WATER PIPES

Piping is installed through service holes provided in studs and wall plates. Grommets must be used in all holes through which pipes are installed. The grommets minimise water hammer and isolate the piping from the frame.

IMPORTANT

Where Copper Piping is fixed directly to steel frames, it must be insulated from the coated steel members.

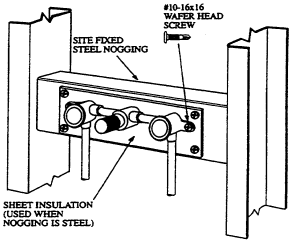


Installed Position of Plumbing Grommets

SADDLES

Nylon or nylon coated saddles are recommended for fixing copper or PVC piping.

PLUMBING FITTINGS



Shower Set Fixed to Site Fixed Nogging.

Plumbing fittings and associated components are fitted to steel noggings. These are fixed on site at the locations of the plumbing fixtures. Sheet insulation should be used to isolate the tap set fixed to the nogging. Fix using #10-16x16 Wafer screws.

FRAME MODIFICATIONS.

Information relating to framing modifications for plumbing services must be obtained from the framing system fabricator.

SURFACE INSPECTION

All surfaces to be lined must be free of protrusions such as hex head screws, plumbing or electrical components. Wafer head screws are acceptable.

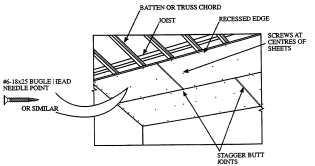
CEILING FIXING DETAILS

Apply walnuts of recommended adhesive as specified by the lining manufacturer. Do not place adhesive where screws will be driven. Walnuts should be located at least 200mm from screw points.

Apply sheets with recessed edges at right angles to battens. Screw fix one recessed edge of the sheet to batten, then along the centre of the sheet, fixing one screw at each batten.

Butt join sheets to manufacturers specifications.

Screw fix the ends of each sheet around openings as required.



Ceiling Lining Fixing

WALL FIXING DETAILS

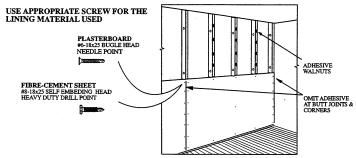
Apply lining material manufacturer's recommended adhesive to studs with a broad knife, using enough material to form walnuts of adhesive, as recommended by the manufacturer.

Do not place adhesive where screws will be driven. Walnuts should be located at least 200mm from screw points.

Allow a gap of approximately 5mm between the bottom of the sheet and the floor. Apply the lining sheets horizontally, fixing the bottom sheet first. Press the sheet firmly against the studs, then screw along one recessed edge of each stud.

Hold the sheet firmly against the studs, then screw fix along the second recessed edge. Finally, screw fix along the centre line of the sheet at every second stud.

Screw fix the ends of the sheet at butt joints, internal or external angles at recommended centres. Screw fix around all openings as recommended.



Wall Lining Fixing

TOOLS REQUIRED

Screw gun and drive bits (Phillips or square drive depending on screws) or air driven nail gun using 16 gauge F 35 ST hard steel brads with mildly deformed shank..

DOOR JAMBS

Use 6g x 50 Wing Tek screws or F35 ST brads to fix door Jambs to steel jamb studs where the web faces the jamb.

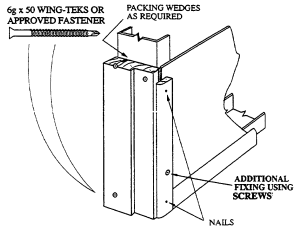
Note.

Ensure jambs are installed with packing to allow the jamb to be plumbed correctly in position.

ARCHITRAVES

Nail architraves to door jambs and window reveals (conventional “C” 38 brads can be used in F35 ST bradders)

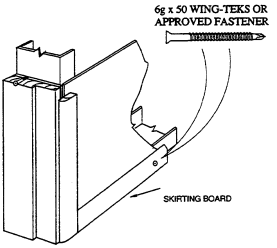
Fix to steel stud using threaded and drill point screws or F35 ST or F45 ST hard steel brads



Fixing Door Jambs & Architraves.

SKIRTING BOARDS

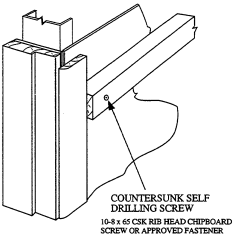
Screw skirting to steel framing. If a pilot hole is drilled through skirting boards before installing screws, it will help prevent a thread being formed in the skirting and pulling away from the wall during fixing.



Fixing Skirting Boards

CUPBOARD FIXING RAIL

Use countersunk self drilling screws of appropriate length to fix cupboard rail to steel frame.



Fixing Cupboard Rail

SUPPLIERS OF STEEL FRAMING AND ANCILLARY PRODUCTS

Nash has members who supply some or all of the items below.

- Steel wall framing, roof trusses and sub-flooring
- Roof sheeting and accessories such as ridge and barge cappings, valleys, fascias, guttering and downpipes
- Roof batters
- Purlins and structural sections
- External cladding - steel, fibre cement, hardboard
- Electrical and Plumbing grommets
- Wall and ceiling linings and accessories
- Tools and fasteners
- Engineering

Contact NASH for details on:

Tel: (03) 9809 1333
Fax: (03) 9809 1399
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