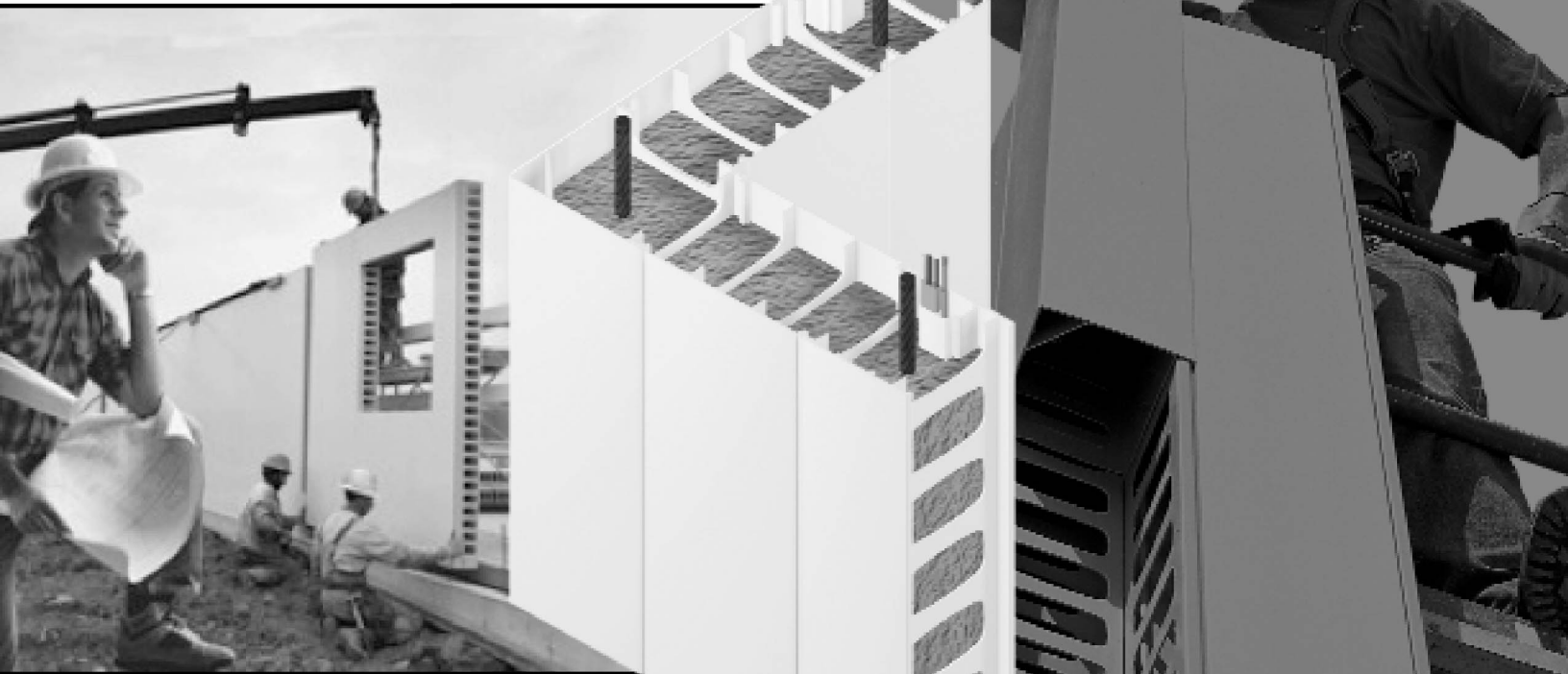




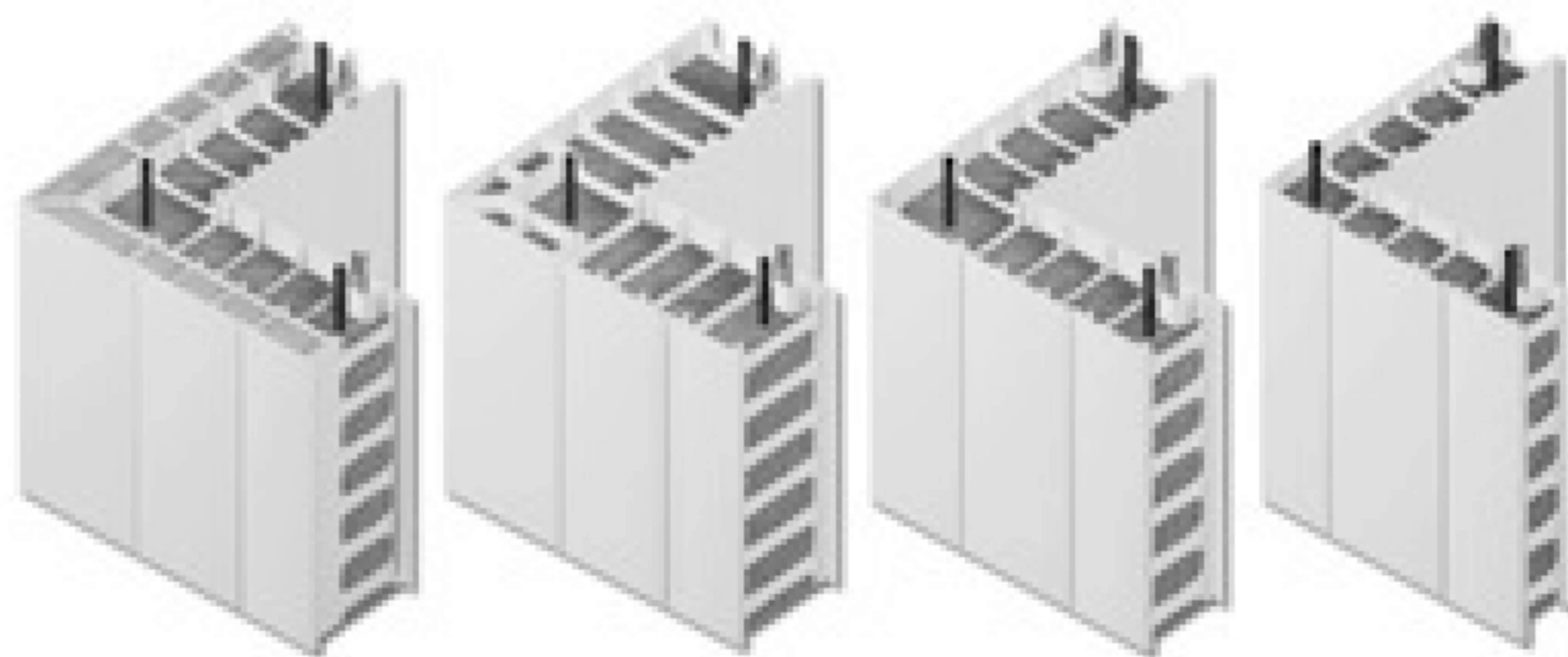
The Pre-Finished, Stay-in-Place
Concrete Wall Formwork

Construction Guide



Version 2.0





Building Solutions for a Better World...

Nuform Building Technologies Inc. is an innovative quality-driven building technologies company. Since the introduction of CONFORM® (formerly Royal Building Systems™) in 1992, the product has received global recognition for its approach in providing an innovative solution to the construction industry.

CONFORM is a patented polymer-based stay-in-place formwork for concrete walls. The extruded components slide and interconnect together to create a concrete formwork. The result is permanent, attractive, and pre-finished concrete walls that can be easily constructed in any climate.

CONFORM is composed of numerous modular components for 100mm, 150mm and 200mm (4", 6" and 8") concrete walls that can be assembled to suit any wall layout, whether you are building a vehicle wash, an agricultural facility or a large industrial building.

CONFORM requires no painting, and resists ultra-violet radiation. The polymer components will not decay or deteriorate over a lifespan that can be measured in decades. Furthermore, CONFORM is highly durable, virtually maintenance free, impervious to weather, and energy efficient.

CONFORM is manufactured using 'R3' extrusion technology as an environmentally friendly product. The polymer components contain over 55% recycled content and are recyclable, energy efficient, mold and mildew resistant and non-toxic.

CONFORM offers complete design flexibility and an innovative building product that is easy to maintain, friendly to the environment, and built to last. Whether you are a developer, contractor, architect, engineer, or designer you can find attractive and cost effective solutions for your next project with CONFORM.

Contents

1. Introduction	1
2. Project Organization	2
2.1 General	2
2.2 Planning	2
2.3 Individual Components	3
2.4 Pre-assembled Wall Sections	4
3. Wall Materials	5
3.1 CONFORM® Components	5
3.2 Concrete Mix	7
3.3 Steel Reinforcing Bars	8
3.4 Fasteners, Bracing, Others	9
4. Equipment	10
4.1 Hand Tools	10
4.2 Power Tools	10
4.3 Erection Equipment	10
4.4 Construction Equipment	10
5. Safety	11
5.1 Workmen	11
5.2 Weather Conditions	11
6. Site Preparations	12
6.1 Site Grading and Access	12
6.2 Storage of Material	12
6.3 Foundations	13
6.4 Wall Dowels	13
6.5 Underground Services	14
6.6 Electrical Power	14
6.7 Water Supply	14
7. Wall Erection - General	15
7.1 Orientation	15
7.2 Layout	15
7.3 Erection Procedure	16
7.4 Wall Length	17
7.5 Starters	17
7.6 Doors, Windows, Openings	18
7.7 Electrical	20
8. Wall Erection - Individual Components	21
8.1 Erection Procedure	21
8.2 Erection Sequence	21
9. Wall Erection - Pre-assembled Wall Sections	23
9.1 Erection Procedure	23
9.2 Individual Components	24
9.3 Erection Sequence	25
9.4 Doors, Windows, Openings	27
10. Placement of Steel Reinforcing Bars	28
10.1 General	28
10.2 Corner Reinforcing Bars	29
10.3 Placement Sequence	30
11. Bracing	32
11.1 General	32
11.2 Base of Wall	32
11.3 Mid-Height of Wall	33
11.4 Top of Wall	34
11.5 Ends, Corners, Intersections	34
11.6 Wall Openings	36
12. Concrete Placement	38
12.1 Concrete Pour	38
12.2 Inserts	40
12.3 Washing	40
12.4 Remedial Measures	40
12.5 Bracing	40
13. Finishing	41
13.1 Clean-Up	41
13.2 Multi-storey Band	41
13.3 Caulking	41
13.4 Maintenance	42
14. CONFORM® Repair	44
14.1 Patching	44
14.2 Materials and Tools Required	44
14.3 Repairing Surface Damage - Patching Holes	45
14.4 Repairing Surface Damage - Patching Cracks or Butt Joints	46
15. Alternate Wall Finishes	47
15.1 CONFORM®	47
15.2 Acrylic Stucco	47
15.3 Stucco - Direct Apply Method	47
15.4 Stucco - EIFS System Method	48
15.5 Vinyl Graphics	48
15.6 Paint	49
15.7 Insulation and Siding	50
15.8 Gypsum Board	53
Appendix A - Construction Bulletins	53
Appendix B - Bracing for CONFORM®	54
B.1 General	54
B.2 Bracing Design Guidelines	55
B.3 Single Bracing	56
B.4 Double Bracing	59
B.5 Vertical Bracing at Corners, I-Intersections and Ends	60
B.6 Bracing at Openings	65
B.7 Bracing at Piers, Columns and Double Walls	67
B.8 Bracing Example	68

1. Introduction

This Construction Guide has been prepared by Nuform Building Technologies Inc. (NUFORM®) to assist contractors, engineers and architects in the understanding of the construction procedures for bearing walls using CONFORM®. It is a part of our continuing effort to provide current and practical information to the users of CONFORM.

The Construction Guide provides information on the following aspects of construction using CONFORM:

- Project Organization
- Wall Materials
- Equipment
- Safety
- Site Preparation
- Wall Erection - General
- Wall Erection - Individual components
- Wall Erection - Pre-assembled Wall Sections
- Placement of Steel Reinforcing Bars
- Bracing
- Concrete Placement
- Finishing
- Repair
- Alternate Finishes

In addition to this Construction Guide, the following guides are also available to assist in designing and building your projects using CONFORM:

- Technical Guide
- Engineering Guide

Although every effort has been made to ensure that all the information provided in the Construction Guide is factual and consistent with good construction practice, NUFORM does not assume any liability for errors or oversights resulting from the use of information contained in this guide. Anyone making use of the information provided in these guides assumes all liability arising from such use.

The suggested suppliers for various products described in this guide are for information purposes, only. NUFORM does not warrant or guarantee the performance the performance of any of the products. Please consult each supplier for specific information regarding their products, and recommended application and warranty, if any.



1.0 Bearing Wall Project

2. Project Organization

2.1 General

1. CONFORM® consists of extruded rigid polymer components that serve as a stay-in-place formwork for concrete walls including bearing walls, non-bearing walls, shear walls, retaining walls and foundation walls. The extruded components slide and interconnect together to create a concrete formwork that remains in place after the concrete is poured and cured. Four different CONFORM types are available, as identified in the following Table 2.1:

Table 2.1: CONFORM

CONFORM	Wall Thickness		
	Overall (Nominal)	Concrete Core	Insulation ¹
CF4	100 mm (4")	95 mm (3.74")	0
CF6	150 mm (6")	145 mm (5.71")	0
CF8	200 mm (8")	195 mm (7.67")	0
CF8i	200 mm (8")	139 mm (5.47")	2.13" (54 mm)

2. The time to erect and brace CONFORM depends on the specific project. General guidelines are provided in sections 2.3 and 2.4.

3. The time to place the concrete in CONFORM depends on the placement method. With a concrete pump, an average of 225 m³ or (300 yd³) can be placed in a 10 hour day (22.5 m³ (30 yd³) per hour). However, this can vary significantly depending on the project.

2.2 Planning

1. The planning and preparation of the site, materials, equipment and related trades varies with each project and can greatly affect the erection and economy of CONFORM.

2. It cannot be overstated how important it is to have all activities prepared and coordinated prior to starting erection of CONFORM. CONFORM is based on a concept of sliding components together, which is so simple and easy that any difficulties with any other aspect of the work can greatly hamper and delay the CONFORM erection. Only if all activities are pre-planned and well organized can CONFORM be erected in an efficient and economical manner.

3. One of the major construction decisions regarding the planning and organization is whether to erect the CONFORM components individually or in pre-assembled wall sections. This affects all aspects of the project: the CONFORM drawings, shipping, off-loading, storage, bracing, erection methods, construction schedule and project costs.

4. The decision to ship and erect CONFORM using individual components or pre-assembled wall sections is based on the project size, the wall height and the availability of construction equipment. The following is a general guide in selecting the appropriate erection method:

Table 2.2: CONFORM Erection Methods

CF4	<ul style="list-style-type: none"> CF4 walls are erected individually and not pre-assembled, except for headers and sills and for walls of selected custom projects
CF6 & CF8	<ul style="list-style-type: none"> CF6 and CF8 walls less than 4300 mm (14') high are erected individually except for walls of unique projects and for headers and sills. Pre-assembled walls sections are used for walls over 4300 mm (14') high
CF8i	<ul style="list-style-type: none"> CF8i walls less than 3000 mm (10') high are erected individually and are not pre-assembled except for walls of unique projects and for headers and sills. Pre-assembled wall sections are used for walls over 3000 mm (10') high

(1) The CF8i components are pre-insulated with 54 mm (2.13") of polyurethane insulation. The insulation cavity is on the exterior side of the wall and protected from the interior with the non-combustible concrete core.

2. Project Organization

2.1 General

1. CONFORM® consists of extruded rigid polymer components that serve as a stay-in-place formwork for concrete walls including bearing walls, non-bearing walls, shear walls, retaining walls and foundation walls. The extruded components slide and interconnect together to create a concrete formwork that remains in place after the concrete is poured and cured. Four different CONFORM types are available, as identified in the following Table 2.1:

Table 2.1: CONFORM

CONFORM	Wall Thickness		
	Overall (Nominal)	Concrete Core	Insulation ¹
CF4	100 mm (4")	95 mm (3.74")	0
CF6	150 mm (6")	145 mm (5.71")	0
CF8	200 mm (8")	195 mm (7.67")	0
CF8i	200 mm (8")	139 mm (5.47")	2.13" (54 mm)

2. The time to erect and brace CONFORM depends on the specific project. General guidelines are provided in sections 2.3 and 2.4.

3. The time to place the concrete in CONFORM depends on the placement method. With a concrete pump, an average of 225 m³ or (300 yd³) can be placed in a 10 hour day (22.5 m³ (30 yd³) per hour). However, this can vary significantly depending on the project.

2.2 Planning

1. The planning and preparation of the site, materials, equipment and related trades varies with each project and can greatly affect the erection and economy of CONFORM.

2. It cannot be overstated how important it is to have all activities prepared and coordinated prior to starting erection of CONFORM. CONFORM is based on a concept of sliding components together, which is so simple and easy that any difficulties with any other aspect of the work can greatly hamper and delay the CONFORM erection. Only if all activities are pre-planned and well organized can CONFORM be erected in an efficient and economical manner.

3. One of the major construction decisions regarding the planning and organization is whether to erect the CONFORM components individually or in pre-assembled wall sections. This affects all aspects of the project: the CONFORM drawings, shipping, off-loading, storage, bracing, erection methods, construction schedule and project costs.

4. The decision to ship and erect CONFORM using individual components or pre-assembled wall sections is based on the project size, the wall height and the availability of construction equipment. The following is a general guide in selecting the appropriate erection method:

Table 2.2: CONFORM Erection Methods

CF4	<ul style="list-style-type: none"> • CF4 walls are erected individually and not pre-assembled, except for headers and sills and for walls of selected custom projects
CF6 & CF8	<ul style="list-style-type: none"> • CF6 and CF8 walls less than 4300 mm (14') high are erected individually except for walls of unique projects and for headers and sills. • Pre-assembled walls sections are used for walls over 4300 mm (14') high
CF8i	<ul style="list-style-type: none"> • CF8i walls less than 3000 mm (10') high are erected individually and are not pre-assembled except for walls of unique projects and for headers and sills. • Pre-assembled wall sections are used for walls over 3000 mm (10') high

(1) The CF8i components are pre-insulated with 54 mm (2.13") of polyurethane insulation. The insulation cavity is on the exterior side of the wall and protected from the interior with the non-combustible concrete core.

5. Also, the decision to ship and erect CONFORM using individual components or pre-assembled wall sections is based on the site storage, the amount of double handling, the erection sequence and the erection costs. For individual components, the labor costs for off-loading, sorting, handling and erection are increased. For pre-assembled wall sections, the cost for shipping and equipment rentals are increased.

6. Once the erection method is finalized, the erection sequence must be determined. The erection sequence affects the shipping, off-loading, material handling, construction methods and construction schedule. The erection sequence is selected, for each project, to minimize the construction time and material handling based on the site conditions, bracing requirements, reinforcing bar spacing and the available equipment.



2.2 Bearing Wall Project in Progress

2.3 Individual Components

1. Typically, individual components are used for small projects that are not more than 900 m² (10,000 sq. ft.), where wall heights are less than 4.3 m (14') or where the use of a boom truck, scissors lift and telescopic boom lift is not practical.

2. Components that are shipped individually require less trucking space since the components can be stacked tightly to completely fill a closed trailer or container. The individual CONFORM components are manually loaded and unloaded from the closed trailer. Generally, it takes approximately 4 hours for 6 men to unload a 48' trailer or a 40' container. The components are stored in neat piles as close as possible to the final wall locations.

3. Alternately, the individual components can be packaged onto skids and loaded and unloaded from a closed trailer or an open flat-bed with a forklift. This is very helpful for multi-level construction since the skids of material can be placed directly on the upper floor slabs. The skids may contain up to 45 box connectors or 30 panels and may weigh 450 kg (1000 lb) per skid.

4. The components must be well organized at the site and are erected manually piece by piece as CONFORM is assembled.

5. The individual components are erected manually from ladders, rolling scaffolds or man-lifts. Approximately 40 lineal meters (120 lineal feet) of wall, 4.5 m (14') high, can be erected and braced in a day with a crew of 6 men working for 10 hours.

6. The bracing is erected as the CONFORM erection progresses and typically involves light framing using wood or cold formed steel members.



2.3 Construction using Individual Components

2.4 Pre-assembled Wall Sections

1. Typically, pre-assembled wall sections are used for large projects that are over 900 m² (10,000 sq. ft.), where wall heights are over 4.3 m (14') and where the use of a crane, scissors lift and telescopic-boom lift is practical due to the size and scope of the project.



2.4a Pre-assembled Wall Sections for Off-Loading with Crane

2. The components are pre-assembled at the manufacturing facility into large wall sections. Typically, the wall sections are full height and are 2233 mm (7'-4") wide, maximum. The wall sections have a panel component at each side. The box connectors that slide between the wall sections are shipped loose. In addition, some of the components near corners, intersections and openings are shipped loose.

3. The wall sections are shipped on open flat bed trailers. The trucks allow 2 hours for off-loading unless other arrangements are made. When possible, the wall sections are erected directly from the trailers. Alternately, the wall sections are off-loaded by boom truck or forklift and stored near their final wall locations.

4. The wall sections are shipped to suit the erection sequence, when erected directly from the trailers. Otherwise, they are shipped in reverse sequence when the material is off-loaded, prior to erection.

5. The wall sections are erected using a boom truck. Scissors lifts or telescopic-boom lifts are used for the workmen.

6. For some projects, it may be possible to provide pre-assembled wall sections that are small and lightweight so that they can be lifted by hand, using 2 workmen.

7. The bracing is pre-erected prior to the wall erection or is erected as the wall erection proceeds. The bracing of pre-assembled wall sections usually involves a significant amount of material and labour, due to the height of the wall. The choice of bracing methods is selected to suit the availability of material and the project requirements.



2.4b Erection of Pre-assembled Wall Section

8. Approximately 90 lineal meters (300 lineal feet) of non-bearing wall, 9 m (30') high, can be erected and connected to steel framing or pre-erected bracing, with a crew of 6 men working for ten hours.

3. Wall Materials

3.1 CONFORM[®] Components

1. All of the CONFORM[®] components that are required for each project are indicated on the Shipping List and on the Erection Drawings. The various CONFORM components are identified in Figures 3.1 to 3.4.

2. The CONFORM components are pre-cut to the required lengths, fabricated to suit the specific project requirements and labeled to match the erection drawings.

3. For walls that are over 6500 mm (21') high, the individual CONFORM boxes and panels are split into two or more lengths. The joints in the boxes and panels are staggered near mid height. For pre-assembled wall sections, the staggered joint is typically 1500 mm (5') high and is not less than 900 mm (3'-0"). The panels with the longest length and the boxes with the shortest length are placed at the bottom of the walls. The horizontal joints in the CONFORM components do not affect the concrete pour and concrete remains monolithic. The joints are concealed with an architectural, 'multi-storey', band.

4. For large projects, CONFORM wall sections are pre-assembled at the manufacturing facility. The maximum width of pre-assembled sections is 2233 mm (7'- 4") to suit shipping and handling. The CONFORM components of a wall section are screwed together at the webs. For wall sections with staggered joints, the members are screwed together on the exterior face, at the staggered joints.

5. To avoid delays during erection, spare CONFORM components are ordered based on the project size, the project schedule, the site proximity to the manufacturing facility, the potential for damage on site and the potential for site modifications. The spare pieces include box connectors, panels (P232, P182, P093), spacers (S068 and S049) and box joiners. The quantity and type of spare pieces are discussed with a NUFORM[®] representative to suit each specific project.

Fig 3.1 CF4 Components

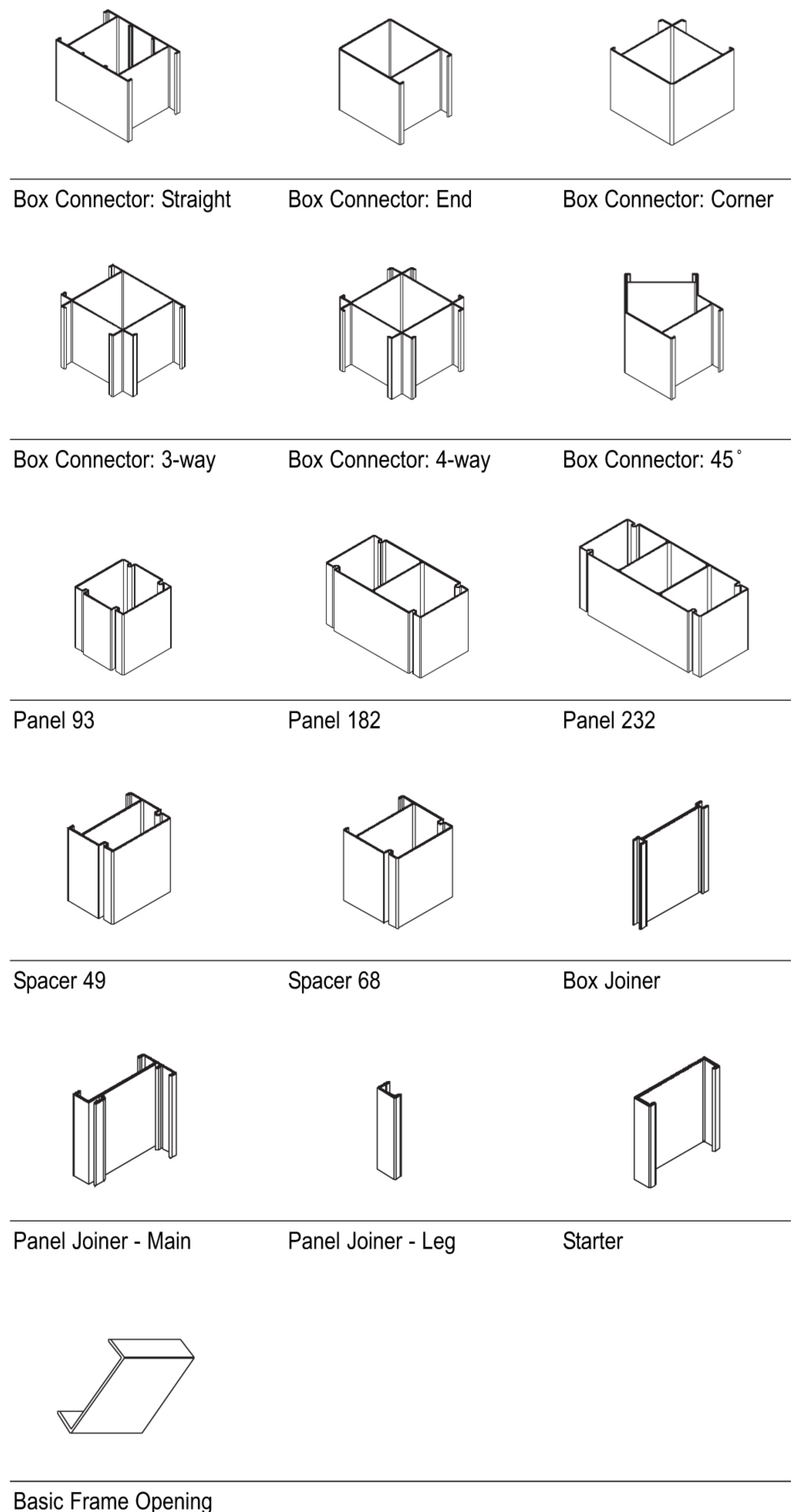


Fig 3.2 CF6 Components

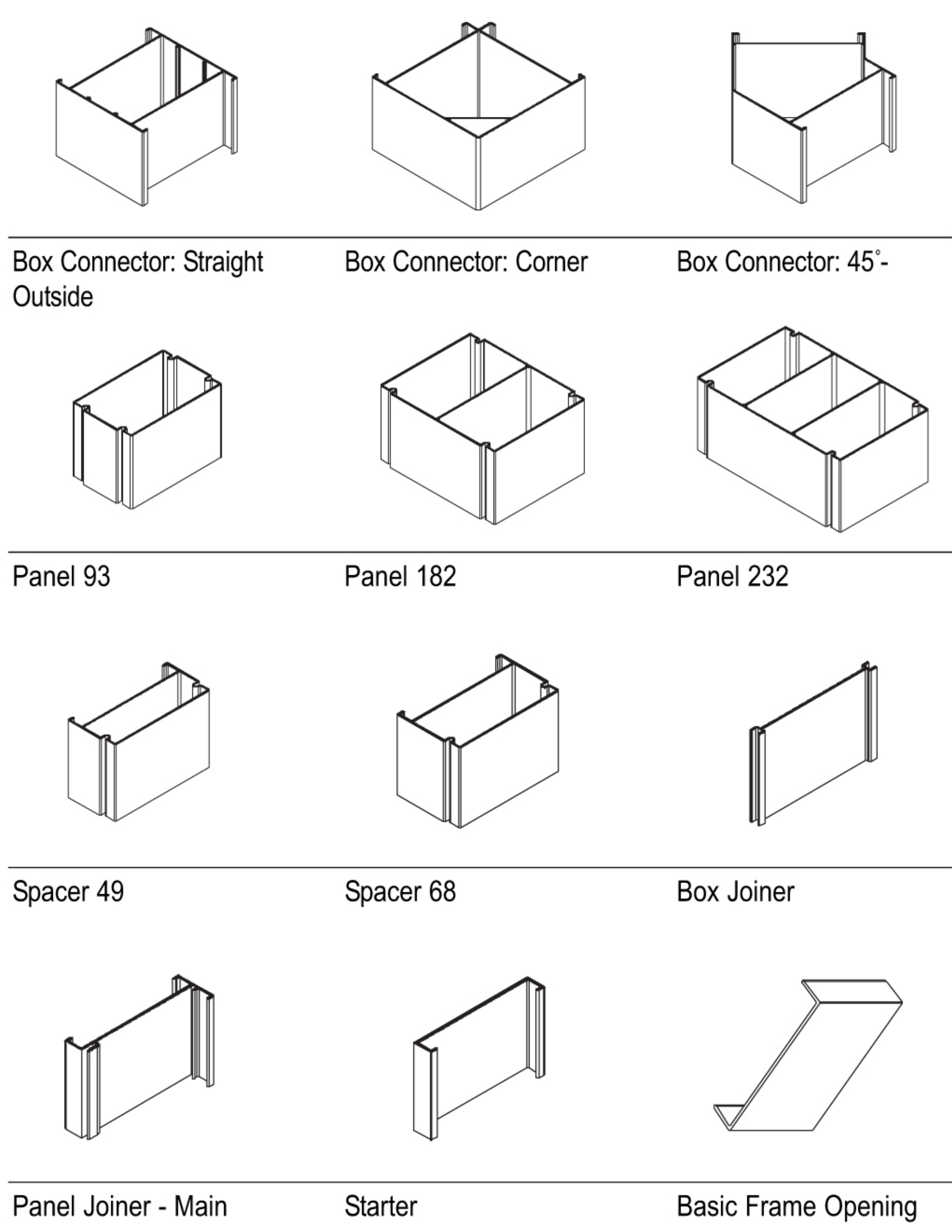


Fig 3.3 CF8 Components

