

# STEEL BUILDING Assembly Guide

DSKA SAMPLE

# XYZ Marina Storage

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# INTRODUCTION

This manual has been prepared to help guide the erection of steel buildings. It is a summary of the techniques in use in the building industry which are believed to be most representative of good erection practices. These procedures and methods are by necessity, general in nature. The erector should always, especially in special circumstances, use proven and safe erection methods.

This Assembly Guide is intended only as a supplement to the erection drawings that are furnished with each building. These drawings show the customer's building as engineered and fabricated according to his requirements. The building erection drawings will always govern with regard to construction details and specific building parts.

The information contained in this manual is believed to be reliable. However, [author] disclaims any responsibility from damages which may result from use of this manual since the actual erection operations and conditions are beyond [author]'s control. It is assumed that only experienced, knowledgeable erectors with trained crews and proper equipment will be engaged to do the erection.

# SAFETY COMMITMENT

[author] has a commitment to manufacture quality building components that can be safely erected. However, the safety commitment and job site practices of the erector are beyond the control of [author]

It is strongly recommended that safe working conditions and accident prevention practices be the top priority on any job site.

Local, state and federal safety and health standards should always be followed to help insure worker safety.

Make certain all employees know the safest and most predictive way of erecting a building. Emergency telephone numbers, location of first aid stations and emergency procedures should be known to all employees.

Daily meetings highlighting safety procedures, the use of hard hats, rubber sole shoes for roof work, proper equipment for handling material and safety nets where possible are recommended erection practices.

[author] intends that this guide be interpreted and administered with sound judgement consistent with good safety practices.

# Erection & Other Field Work

The Manufacturer of a Metal Building System is not responsible for the erection of the Metal Building System, the supply of any tools or equipment, or any other field work unless it has been specifically contracted for these responsibilities. The Manufacturer does not provide any field supervision for the erection of the structure, nor does the Manufacturer perform any intermediate or final inspections of the Metal Building System during or after erection. The term Erector in the following subpart refers to whichever firm or corporation has contracted to erect the Metal Building System.

## Metal Building Systems Erection & Other Field Work

All work included in the erection of the Metal Building System shall be in accordance with the erector's standard methods and procedures unless otherwise specified in the Erector's Contract.

When erection of the Metal Building System is included in the Contract Documents, only the erection work listed in the Contract Documents is included in the metal Building System erection.

### Work Furnished by the Erector and Usually Included in the Erection:

1. All field labor, tools, and equipment necessary to unload at the building site and to completely erect, safely and properly, the Metal Building System. Some standard and non-standard components and accessories of a Metal Building System including, but not limited to, field located openings, special framing, flashing, trim, etc., require minor field modification and fitting.
2. Insulation and insulation accessories, when included, assembled in conjunction with the exterior wall and roof of the Metal Building System.
3. Removal from the building and the job site of Erector's temporary buildings, rubbish resulting from the erection work, unused screws and bolts, and drill shavings.
4. Temporary guys and bracing where needed for squaring, plumbing and securing the structural framing against loads, such as wind loads acting on the exposed framing and seismic forces comparable in intensity to those for which the completed structure is designed, as well as loads due to erection equipment and erection operation, but not including loads resulting from the performance of work by others. Bracing furnished by the Manufacturer for the Metal Building System cannot be assumed to be adequate during erection. The temporary guys, braces, false work and cribbing are property of the Erector, and the Erector removes them immediately upon completion of erection.

## **Sequence of Erection**

The Erector, by entering into a contract to erect the Metal Building System, holds itself out as skilled in the erection of Metal Building Systems and is responsible for complying with all applicable local, federal and state construction and safety regulations including OSHA regulations as well as any applicable requirements of local, national or international union rules or practices.

The Manufacturer may supply erection drawings and instructions suggesting the sequence of erection and appropriate connection of the Metal Building System components. The erection drawings are not intended to specify any particular method of erection to be followed by the Erector. The Erector remains solely responsible for the safety and appropriateness of all techniques and methods utilized by its crews in the erection of the Metal Building System. The Erector is also responsible for supplying any safety devices, such as scaffolds, runways, nets, etc. which may be required to safely erect the Metal Building System.

The proper tightening and inspection of all fasteners is the sole responsibility of the Erector. All heavy structural (A325, A490) bolts and nuts must be tightened by the “turn-of-the-nut” method unless otherwise specified by the End Customer in the Contract Documents. Inspection of heavy structural bolt and nut installation by other than Erector must also be specified in the Contract Documents and Erector is responsible for ensuring that installation and inspection procedures are compatible prior to the start of erection.

## **Correction of Errors & Repairs**

The correction of minor misfits by the use of drift pins to draw the components into line, shimming, moderate amounts of reaming, chipping and cutting, and the replacement of minor shortages of material are a normal part of erection and are not subject to claim.

Except for friction type structural connections (not normally utilized in metal building system design), visible gaps between column and/or rafter connection plates can occur as a result of various causes without critical effect to the structural integrity. Minimal shimming at bolt locations is considered acceptable regardless of material yield and does not require full surface contact of the connection plates. The purpose of shimming, besides any aesthetic benefits, is to provide resistance to the tightening procedures of high-strength bolts for proper installation. The types of shims can be of a uniform thickness, full size, tapered or notched around bolts to permit installation without removal of bolts. Bolt holes oversized by 3/16" are permitted in full-size shims to facilitate alignment.

For further information regarding shimming, refer to AISC publication, “Engineering for Steel Construction”. In the event of connection gaps, the manufacturer must be consulted for approval and specific recommendations for proper shimming.

The Manufacturer does not pay claims for error correction unless the following claim and

authorization procedure is strictly complied with by the Builder, or if the correction work is begun prior to receipt by Builder of Manufacturer's written "Authorization for Corrective Work". If erection is not by Builder, Erector is responsible for providing Builder the information necessary to make claim to the Manufacturer as provided below.

The Manufacturer is not liable for any claim resulting from use of any drawings or literature not specifically released for construction for the project.

The Manufacturer is not liable for any claim resulting from use by the Erector of any improper material or material containing defects which can be detected by visual inspection. Costs of disassembling such improper or defective material and costs of erecting replacement material are not subject to claim.

### **Field Welding**

Welding shall conform to the A.W.S. (American Welding Society) Specifications, latest edition with revisions. Welding rods shall be E70XX series unless noted on plans or on approved shop drawings. All shop and field welds shall be chipped and painted with a rust inhibiting primer. All structural steel shall conform to the A.I.S.C. specifications, latest edition with revisions.

# General Erection Information

## Tools

When buying tools for building erection, it is recommended that only industrial rated, top quality tools are purchased. Experience shows that lighter duty tools, although cheaper initially, will hold up satisfactory, and in the long run, will cost more, not only in repairs, but also in lost time. High speed drill bits are always recommended since carbon steel bits will not give satisfactory service. Most builders find that short jobbers length bits are more economical and rugged than standard length bits.

The smaller hand tools are particularly difficult to maintain because of breakage, losses, pilferage, etc. Some erectors require men on the crew to furnish their own tools in this category. Others issue the tools to individuals or foremen who are held responsible and liable for them. Since work rules and customs differ according to localities, each erector should establish a definite policy which is acceptable to his workers while protecting his property.

Maintaining equipment and tools in clean first class condition reduces replacement expense and stimulates workers to take better care of equipment and greater pride in their work.

### **SAFETY PRECAUTION:**

Make certain that the correct tool is available and used for each phase of building erection. Improper tool usage results in employee injury.

<b>HAND TOOLS</b>	<b>QNT</b>
<b>Wrenches</b>	
12" Adjustable	5 - 10
15" Adjustable	2 - 5
<b>Open end structural w/drift handle:</b>	
(3/4", 7/8", 1-1/8", 1-1/4", 1-7/16", 1-1/2", 1-5/8", 1-7/8", 2-1/4")	2 - 10
<b>Box end structural</b>	
(3/4", 7/8", 1-1/8", 1-1/4", 1-7/16", 1-1/2", 1-5/8", 1-7/8", 2-1/4")	2 - 7
1/2" <b>drive ratchet</b> w/ 3/4", 7/8", 1-1/8", and 1-1/4" six point sockets, extensions	2 - 7
3/4" or 1" <b>drive ratchet</b> w/20" or 24" handle; sockets maximum size 1-5/8"	2 - 7

<b>POWER TOOLS</b>	<b>QNT</b>
Cutting torch w/ 100' hose, bottle cart, w/ fire extinguishers	1
Drill, 1/4" drive	2 - 3
Drill, 1/2" drive	1
Drill bits (1/8")	2 - 6 dozen
Generator-2 to 5 KW, with 110V D.C. w/ 50' ground and 75' lead and access	1
Hammer drill w/ 6 bits	1
Impact tool 1/2"	1 - 2
Impact wrench and sockets	1
Power nibbler	1
Power shears	1
7-1/2" heavy duty saw	1
Screw guns	
1900 RPM electric screw gun for self drill screws	3 - 15
500 RPM electric screw gun for self drill screws	3 - 15
5/16", 3/8", and 7/16" hexhead sockets	3 - 15
Welding hood with spare lens	1
Welding unit	1

# Erection Drawings & Tally Sheets

## Erection Drawings

The set of Erection Drawings that is furnished with every [author] building contains the plans necessary for its erection. Each plan is specifically prepared for the individual building and illustrates and locates the components furnished by [author]. The tally is a complete listing of the materials that go into the building.

Multiple sets of the Erection Drawings are sent to the dealer in advance of the building shipment. A set of these drawings should be obtained by the Erector and used to plan the erection. It is important that reference to the plans be made throughout construction.

## Tally Sheets

The tally sheets furnished for each job are a bill of material which lists every piece that is included in the shipment. These sheets are broken down into sections, such as main structural frames, secondary framing, trim, accessories, etc. A full understanding of the tally sheet is extremely important and can save the erector considerable time in locating material. A good practice is to always check the packing list attached to the building parts with the tally.

## Shortages/ Damages

Any shortages and damages must be noted on packing slip and reported to the driver; manufacturer must be notified within 72 hours. All concealed damages must be reported within (7) seven working days.

# Pre- Erection

## Access to Site

The vehicle transporting tons of building parts must gain access to the building site from the adjacent highway or road. Such access should be visualized and prepared in advance of arrival. All obstructions, overhead and otherwise, must be removed and the access route graveled or planked if the soil will not sustain the heavy wheel loads.

Permission should be obtained by owner to trespass over other owner's property in gaining access to the building. Even though such permission is thought unnecessary, the good will of the other owner should be solicited and is generally assured when such permission is requested.

The building site should be carefully pre-inspected to insure that there is enough room to physically perform the tasks required to erect the building. Application of sheeting and trim can be expensive when there is not sufficient working space because of the nearness of adjacent buildings or other obstructions.

The availability of any required utilities should also be considered at this time. Take careful note of any overhead electrical lines or other utilities to avoid hazards and damage.

**THINK SAFETY!**

# Unloading Operations

Pre-planning of the unloading operations is a most important part of the erection procedure. This involves careful and orderly storage of all materials. Detailed planning is required at the job site where storage space is restricted. Here, a planned separation of materials in the order of the erection process is necessary to minimize the costly double handling of materials. While set procedures are not possible in all cases, special attention should be given to the following items.

## 1) Location of Carrier Vehicle During Unloading

Trucks should be located where the different building parts can be unloaded near their usage points to minimize lifting, travel and re-handling during building assembly.

## 2) Ramp for Truck or Lifting Equipment to Get On & Off Slab

An access ramp usually made of stone or wood, when necessary, should be constructed ahead of time to avoid delays. The edges of the concrete slab should be protected with heavy planking or timbers in the ramp area to minimize the danger of chipping or cracking.

## 3) Lifting Equipment

The type and size of lifting equipment is determined by the size of the building and site conditions. Length of boom, capacity and maneuverability of lifting equipment will determine its location both for unloading and erection.

## 4) Use Same Lifting Equipment to Unload & Erect Structural Parts

Lifting equipment costs are usually minimized by combining the unloading process with the building erection.

## 5) Consideration of Overhead Electrical Wires

Overhead power lines are a continuing source of danger. Extreme care must be used in locating and using lifting equipment to avoid contact with power lines.

## 6) Split of Crew During Unloading

Generally time will be gained if the supervisor plans and watches ahead

instead of getting tied up with a particular unloading chore.

Two workers on the truck can set chokers and slings while two workers on the slab can spot blocking and unhook and remove slings and chokers. Valuable time will be gained by having two sets of unloading slings, cables, and chokers.

One worker should open the hardware boxes containing the nuts and bolts used to splice connections and purlins connections and start assembling as many splices on the ground as feasible.

The worker assembling the splices usually fastens down the columns by tightening the anchor bolt nuts when positioned.

#### 7) Check Shipment

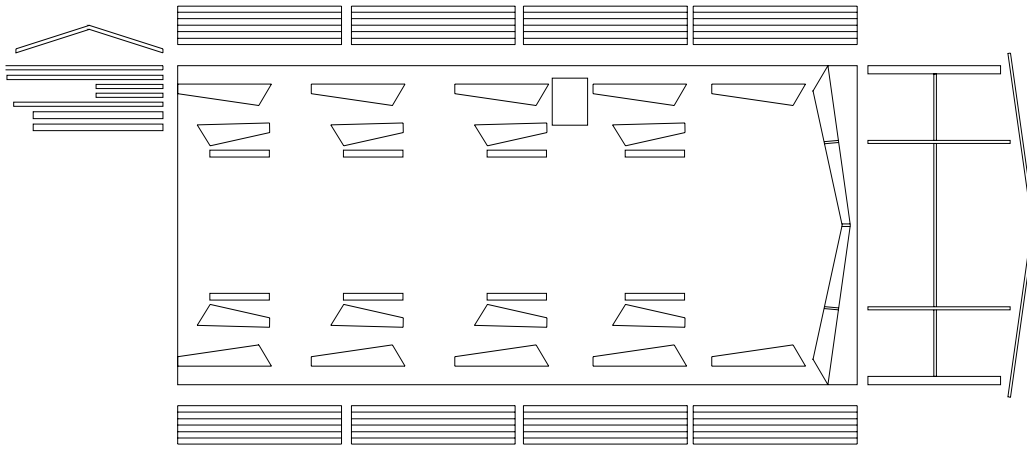
When the shipment is received, it should be checked against the bill of lading and tally sheets. If the damage or a shortage is found, have the truck driver note the damage or shortage on the tally sheet and bill of lading. The truck driver should sign both documents.

**THINK SAFETY!**

# Location of Building Parts

Hardware packages should be, but not mandatory to be located centrally, usually along one side-wall near the center of the building. This will minimize walking distances to other parts of the slab area.

Purlins and girts, depending on the number of bundles, are usually unloaded near the sidewalls clear of the other packages or parts.



Sheet packages are usually along one or both sidewalls off the ground and sloping to one end to encourage drainage in case of rain.

Accessories are usually in a corner of the slab or off the slab near one end of the building to keep them as much out of the way as possible from the active area during steel erection.

**THINK SAFETY!**

# Handling & Storing Materials

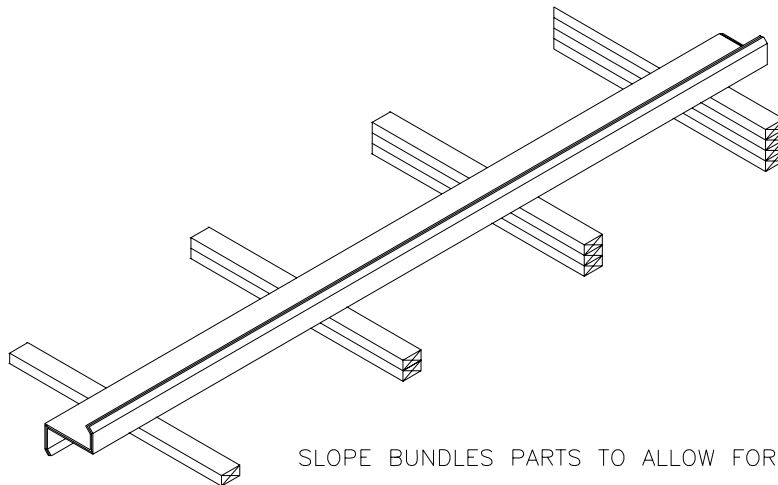
## Structural

As previously emphasized, a great amount of time and trouble can be saved if the building parts are unloading at the building site according to a pre-arranged plan. Proper location and handling of components will eliminate unnecessary handling.

Blocking under the columns and rafters protects the splice plates and slab from damage during the unloading process. It also facilitates the placing of slings or cables around the members for later lifting and allows members to be bolted together into sub-assemblies while on the ground. Extra care should always be exercised in the unloading operation to prevent damage to materials and the concrete slab.

If water is allowed to remain for extended periods in bundles of primed parts such as girts, purlins, etc., the pigment will fade and the paint will gradually soften reducing its bond to the steel. Therefore, upon receipt of a job, all bundles of primed parts should be stored at an angle to allow any trapped water to drain away and permit air circulation for drying. Puddles of water should not be allowed to collect and remain on columns or rafters for a long period of time or after installation.

All primer should be touched up as required before erection. Any finish interior painting where required by the customer should be applied over the primer after the erection.



# Wall & Roof Panels

[author]'s wall and roof panels including color coated, aluminum coated and galvanized, provide excellent service under widely varied conditions. All unloading and erection personnel should fully understand that these panels are quality merchandise which merit cautious care in handling.

Under no circumstances should panels be handled roughly. Packages of sheets should be lifted off the truck with extreme care taken to insure that no damage occurs to ends of the sheets or to side ribs. The packages should be stored off the ground sufficiently high to allow air circulation beneath the packages. This avoids ground moisture and deters people from walking on the packages. One end of the packages should always be elevated above the lower end to encourage drainage in case of rain.

All metal panels are subject to some degree to localized discoloration or stain when water is trapped between their closely fitted surfaces. However, due to climatic conditions, water formed by condensation of humid air can become trapped between stacked sheets. Water can also be trapped between the stacked sheets when exposed to rain. This discoloration caused by trapped moisture is often called wet storage stain.

The stain is usually superficial and has little effect on the appearance or service life of the panels as long it is not permitted to remain on the panels. However, moisture in contact with the surface of the panels over an extended period can severely reduce their effective service life. Therefore, it is imperative that all panels be inspected for moisture upon receipt of the order. If moisture is present, dry the panels at once and store in a dry, warm place, if possible.

## **CAUTION:**

Panels are slippery. Oil or wax that has been used on the roof and wall panels for protection against weather damage will make them a very slippery walking surface. Wipe dry any oil that has puddled from bundles stored on slope. Dew, frost or other forms of moisture greatly increase the slipperiness of the panels.

Use blocking to elevate and slope the panels in a manner that will allow moisture to drain. Wood blocking placed between panel bundles will provide additional air circulation. Cover the stacked bundles with a large tarp or plastic cover leaving enough opening at the bottom for air to circulate.

**NOTE:** See Cladding Manual for assembly instructions.

When handling or un-crating panels, lift, rather than slide, them apart. Burring edges may scratch the coated surfaces when sheets are slid over one another. Never allow panels to be walked on while on the ground.

**ROUGH AND IMPROPER HANDLING OF PANELS IS INEXCUSABLE AND A PRIME EXAMPLE OF POOR JOB SUPERVISION.**

# Clothing Recommendation for Workers

As a general rule, the erector may not be able to specify just what clothing the workers shall wear, unless furnished by the erector. However, some types of clothing are more suitable than others and should be recommended. Soft soled shoes are a necessity for working on the roof, both from a standpoint of SAFETY and to protect the roof sheets from damage. Some builders provide gloves for their workers and some do not. A leather palm, canvas back, short cuff type is preferred.

Providing uniforms and other clothing for the crews may be prohibitively expensive.

## **Job Transportation**

Obviously, some form of transportation must be provided for tools and equipment, and sometimes for workers. While the type of vehicles may vary, the general rule should be that the vehicle be in good working order.

## **Safety Precaution**

[author] recommends that all workers wear steel toed shoes with metatarsal guard, eye protection and hard hats. Personal protection equipment should always meet OSHA standards. Keep soles of shoes clean. Oil or wax from walking on roof panels can cause slipping even when no longer on the roof.

**ROUGH AND IMPROPER HANDLING OF PANELS IS INEXCUSABLE AND IS A PRIME EXAMPLE OF POOR JOB SUPERVISION.**

# Wire Rope (cable) Information

The capacity of wire rope to withstand bending becomes greater as the number of wires or strands in the rope increases. In other words, the rope is more flexible. The increase in the number of strands decreases the average wire size, and the finer the wires in a rope the greater its flexibility becomes.

Rope classes as 6 x 37 (6 referring to the number of strands and 37 referring to the number of wires in each strand) contains the finest wires and is therefore most flexible. The 8 x 19, 6 x 19 and 6 x 7 groups are less flexible in the order listed.

Diameter	Strands & Wires	Improved Plow Steel Fiber Core	Improved Plow Steel IWRC	Extra Improved Plow Steel IWRC
1/2"	6x7	10.3	11.1	tons
	6x19	10.7	11.5	13.3
	6x37	10.7	11.5	13.3
	8x19	9.2	10.1	
3/4"	6x7	22.7	24.4	
	6x19	23.8	25.6	29.4
	6x37	23.8	25.6	29.4
	6x19	20.5	22.5	

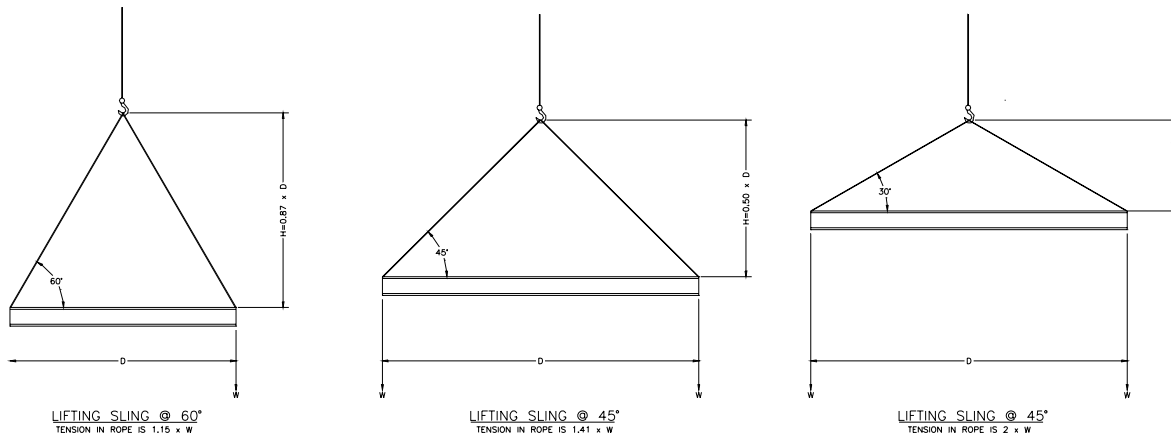
**NOTES:**

- 1) The above breaking strengths are for non-galvanized regular lay.
- 2) For galvanized ropes deduct 10% from the strengths.
- 3) IWRC- Independent wire rope core.

**SAFETY PRECAUTION:**

Check wire rope for broken strands, broken wire and kinking. Replace damaged, unsafe rope immediately.

Tension and hook heights for lifting weights at various angles are shown by diagrams below.



Notice how the cable tension increases as the lifting angle is decreased. It is of interest to note that if this angle is reduced to 15 degrees, the cable tension is 3.9 times the vertical lift; at 10 degrees, it is 5.7 and at 5 degrees it is 11.5. When tension in the cable increases, the compressive or buckling load on the peak rafter section also increases. Slings with low lifting angles should therefore be avoided both to protect the cable and to prevent buckling the rafter.

Great care is exercised by the manufacturer of wire rope to lay each wire in each strand and each strand in the rope with uniform tension. To prevent the loss of tension and uniformity the cut ends of the rope should be protected with 8 closely wound tight wraps of seizing wire (.35 inches in diameter for 1/2" cables and .063 inches in diameter for 3/4" cable).

Most common damage to wire rope is development of a kink through mishandling. Tight loops can be avoided before kinking develops by turning rope at either end in proper direction to restore normal lay.

# Lifting Cables

Notice how the cable tension increases as the lifting angle is decreased. It is of interest to note that if this angle is reduced to 15 degrees, the cable tension is 3.9 times the vertical lift; at 10 degrees, it is 5.7 and at 5 degrees it is 11.5. When tension in the cable increases, the compressive or buckling load on the peak rafter section also increases. Slings with low lifting angles should therefore be avoided both to protect the cable and to prevent buckling the rafter.

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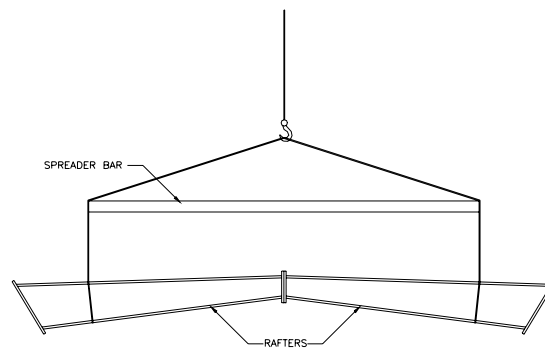
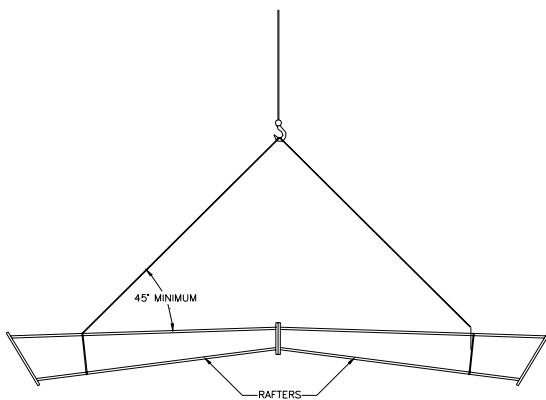
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# Lifting Cables & Spreader Bars

In all instances the length of the lifting cables should be such that the angle between the rafter and the lifting cables is no less than 45 degrees. To reduce the severe compressive stresses at the ridge of the rafters which are created by the angle of lifting cables, a spreader bar is recommended, which allows the lifting cables to be more parallel to each other.



## **SAFETY PRECAUTION:**

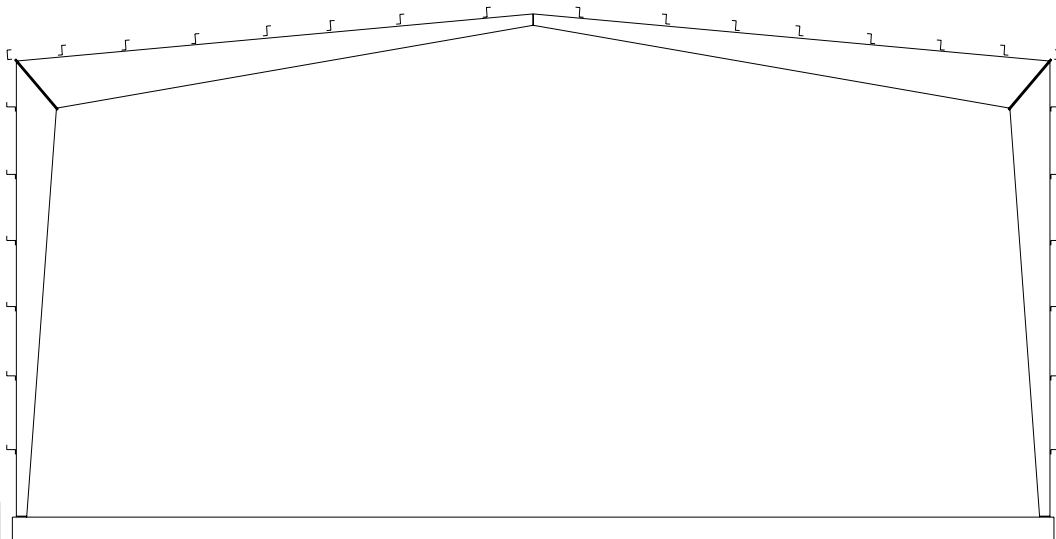
Stay well clear of the loads being moved by any lifting device. Hands and feet should be kept clear of moving loads. Never stand under a load being lifted.

# Erection of Primary & Secondary Structural

## General Information

Many methods and procedures are in use for erecting the structural portion of metal buildings. For example, the techniques of raising frames may vary all the way from erecting small clear span and end-wall frames in units, to erecting the larger clear spans and modular frames in sections. The erection methods used depends strictly on the type of building, the available equipment, the experience level of the crews an the individual job conditions.

The variation in these factors preclude the establishment of a firm or specific set of erection rules and procedures. Consequently, the erection operation must be tailored by the Erector, himself, to fit individual conditions and requirements. However, there are certain erection practices, pertaining to structural members, which are in general use and have proven sound over the years. Descriptions of these follow.



**THINK SAFETY!**

# Raising Rigid Frames

## General Information

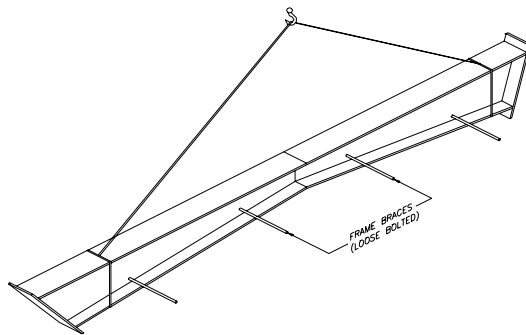
The intermediate or interior frames nearest the bearing end-wall are usually erected first. This bay usually contains the diagonal bracing. The proper completion and plumbing of this first bay, as will be discussed later, is extremely important to the successful completion of the building.

Although several methods are used to erect rigid frames, it has been found most satisfactory to erect the columns first, tie them together with the girts and tighten the anchor bolts. On small spans and short eave heights, columns can often be set in place by hand without the use of hoisting equipment.

### **SAFETY PRECAUTION:**

Each worker should be trained to use the safest and most productive erection techniques.

After the columns have been erected, the ground assembled rafter is hoisted into place and connected to the columns. The size of the rafter which can be safely handled depends on the equipment available and the experience of the erection foreman. Generally as many connections as possible are made on the ground.



The flange brace should be loose bolted to the rafter prior to raising in order to save time. The hoisting equipment should never be released from the rafter until the frame is adequately braced, so it cannot buckle or tip in the longitudinal direction of the building.

### **SAFETY PRECAUTION:**

Stay well in the clear of loads being moved by any type of lifting equipment.

When the rafters consist of several roof beams, as in the case of wide buildings, a safe procedure of raising by sections and supporting the free end must be followed, regardless of the type of equipment available. In all instances work proceeds from the outside columns inward toward the peak until the entire frame is bolted into place.

The same general procedures of erection apply to either clear span or LRFM (interior column) frames. In the case of the latter, the support for rafter sections during erection is generally supplied by the interior columns, themselves, making temporary supports unnecessary.

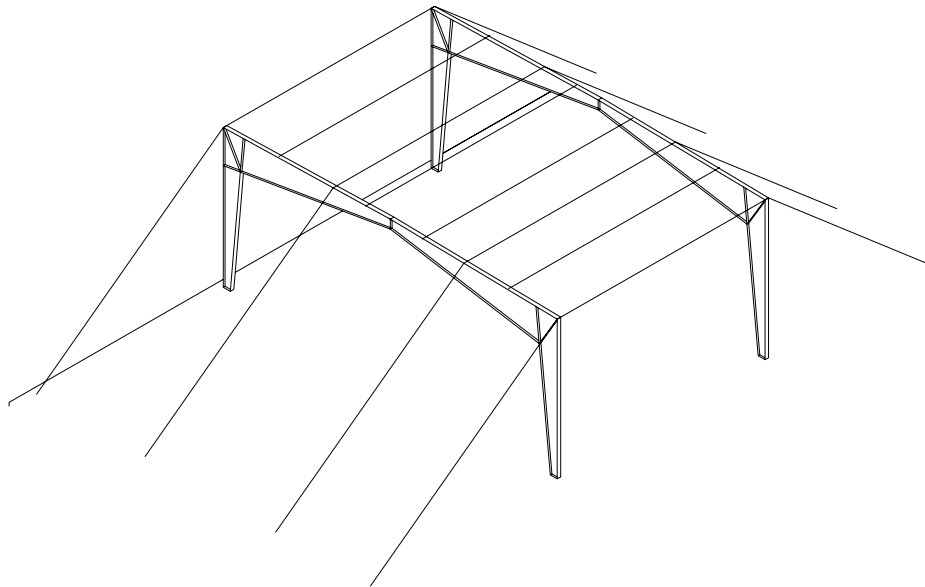
Two words of caution concerning the erection of rigid frames is in order. The first is that the free ends or cantilevered sections, such as one-half of an M-2 frame, should never be left “for the day” in an unsupported, unbraced or unguyed condition. Such practice has resulted in the total loss of considerable amounts of erected steel because of wind. The second word of caution pertains to the additional care required in the erection of LRFM frames compared to clear span frames. Frames with interior columns, because of closer supports, have much lighter sections. They are much more apt to buckle during erection than clear span frames, and consequently require greater care in rigging and handling.

**SAFETY PRECAUTION:**

Each worker should be trained to use the safest and most productive erection techniques.

# Temporary Bracing During Erections

The framework must be sufficiently braced or guyed to prevent wind damage. To be effective, either leaning equipment against the framing and/or adding guy wires that attach to objects such as anchor bolts or poles properly buried in the ground.



At the end of the day, be sure the building is left properly braced. Many erectors have returned to the job in the morning following a storm during the night and found a mass of twisted steel on the ground.

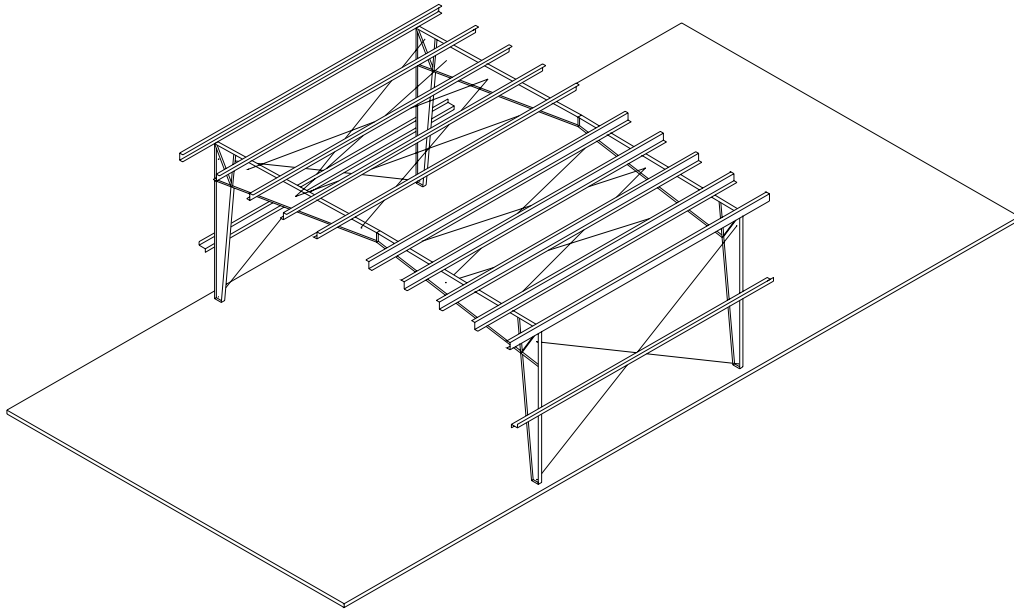
**THINK SAFETY!**

## Completing & Plumbing the First Bay

After the first intermediate or interior frames have been set, [author] recommends that all purlins, girts and eave struts be installed in the braced bay and the entire bay plumbed, aligned and braced before proceeding any further.

When this bay is properly and accurately plumbed and braced, the remaining members will automatically plumb and align themselves, when installed, to a large degree. Only a final check of the building plumb remains, and few adjustments, if any, will be necessary.

To plumb building lengthwise using transit, sight it parallel by a few inches, to the frame line. Make sure transit is level. Check frame by reading tape through transit. First bring columns into plumb, then rafters, by adjusting diagonal bracing. Take all measurements from centerline of flange.



**THINK SAFETY**

# Installation of Wind Bracing

Diagonal bracing in metal building serves two purposes. It is useful in plumbing and aligning the framework and it provides support for wind loads, such as those created by a crane.

Cable bracing should be installed as early as possible.

The diagonal bracing is usually cable or round rod. It should always be installed as shown on the erection drawings and should have the same tension so that the building will not sway or rock when the wind blows. Care should be taken, however, not to over tighten and bend the structural members. The workman should watch the structural members carefully as he tightens the bracing.

Occasionally the bracing in the wall of a building cannot be installed in the specified bay because of doors or other complications. Usually these can be moved to other bays without affecting structural integrity of the building. However, before moving, check with the Engineering Department of [author] to make sure that the structure is not weakened. If bracing must be eliminated, alternate bracing arrangements must be made available, but these are generally more costly and time consuming. Never move or eliminate bracing without checking with [author]'s Engineering Department. To do so could result in an unsafe structure, and you, as the erector would be held responsible.

When the building has all its framing in place, all bracing should be tightened and upon completion, all bracing should be checked and tightened for final inspection.

**THINK SAFETY!**

# A325 Bolts

Bolts used to make connections in secondary framing members such as the purlins and girts are usually ½" diameter, ASTM designation A307 or A325. These bolts are usually subject only to shear loads.

All primary framing connections are made with ASTM A325 bolts; ¾" (usually), 7/8" and 1" diameter. The primary framing moment connection bolts are usually subject to shear and tension loads.

The high strength ASTM A325 bolts are identified by the three slash marks and A325 on the head and the three circular marks on the nut. The size and grade of the bolts are marked on the building erection drawings.

Two tightening procedures are specified for A325 bolts in joints subject to tension loads, turn-of-the-nut method and direct tension indicator. Bolts in connection not subject to tension need only be tightened to the snug tight condition, defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench.

## **TURN-OF-NUT TIGHTENING**

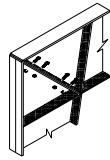
When the turn-of-nut method is used to provide the bolt tension specified, there shall first be enough bolts brought to a 'snug tight' condition to insure that the parts of the joint are brought into good contact with each other. Following this initial operation, bolts shall be placed in any remaining holes in the connection and brought to snug tightness. All bolts in the connection shall then be tightened additionally by the applicable amount of nut rotation specified with tightening progressing systematically from the most rigid part of the joint to its free edges. During this operation there shall be no rotation of the part not turned by the wrench.

## **TIGHTENING BY USE OF A DIRECT TENSION INDICATOR**

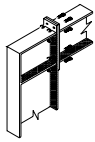
Tightening by this means is permitted provided it can be demonstrated by an accurate direct measurement procedure that the bolt has been tightened to specified fastener tension.

**THINK SAFETY!**

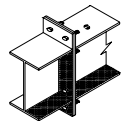
# Primary Framing Connection Details



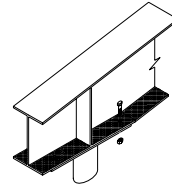
COLUMN TO RAFTER @ KNEE  
LRF, LRF-M, LSSS BUILDINGS



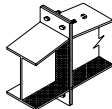
COLUMN TO RAFTER @ KNEE  
GC, LP-2, LP-4, SS BUILDINGS



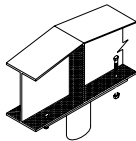
RAFTER @ INTERMEDIATE  
(FIELD) SPLICE



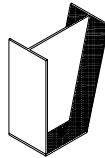
INTERIOR COLUMN TO RAFTER



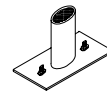
RAFTER @ RIDGE W/O COLUMN



RAFTER @ RIDGE W/ COLUMNS



EXTERIOR COLUMN TO FOUNDATION



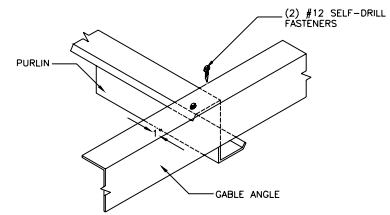
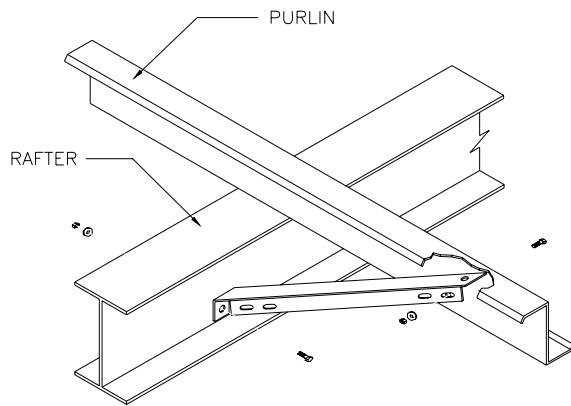
INTERIOR COLUMN TO FOUNDATION

Note: Check erection drawings. Details may change with building code.

**NOTE:** HIGH STRENGTH BOLTS SHOWN REQUIRED TO BE TIGHTENED TO SNUG-TIGHT CONDITION ONLY.

# Secondary Framing Connections

Washer may not be required. Check erection drawings.



DSKA

# Sheeting

All the primary and secondary framing should be erected, plumbed and the bolts properly tightened before the sheeting of the building is started. Framed openings should also be installed, plumbed, squared and tightened before sheeting begins.

Wall and roof panels are quality merchandise and should be handled and cared for as such. When unpacking panels, pick them up and apart; never slide one panel over another. When lifting panels, support long panels to prevent buckling.

## **SAFETY PRECAUTION:**

Workers should always use gloves when lifting sheets

## **NOTES**

All loads are photo inventoried for completeness and your protection by [author] and its suppliers. Check all drawings which pertain to your order for details or requirements.

# Finalize & Cleanup

Foreman and crew will finalize the erection with a completion sign-off sheet signed by the responsible party. Included in the sign-off sheet are attachments which list the following:

1. All remaining materials and equipment are itemized for return
2. The site is safe and secure.
3. All warranty and maintenance conditions are described.
4. All applicable Inspections forms.