MFS / YORK / STORMOR

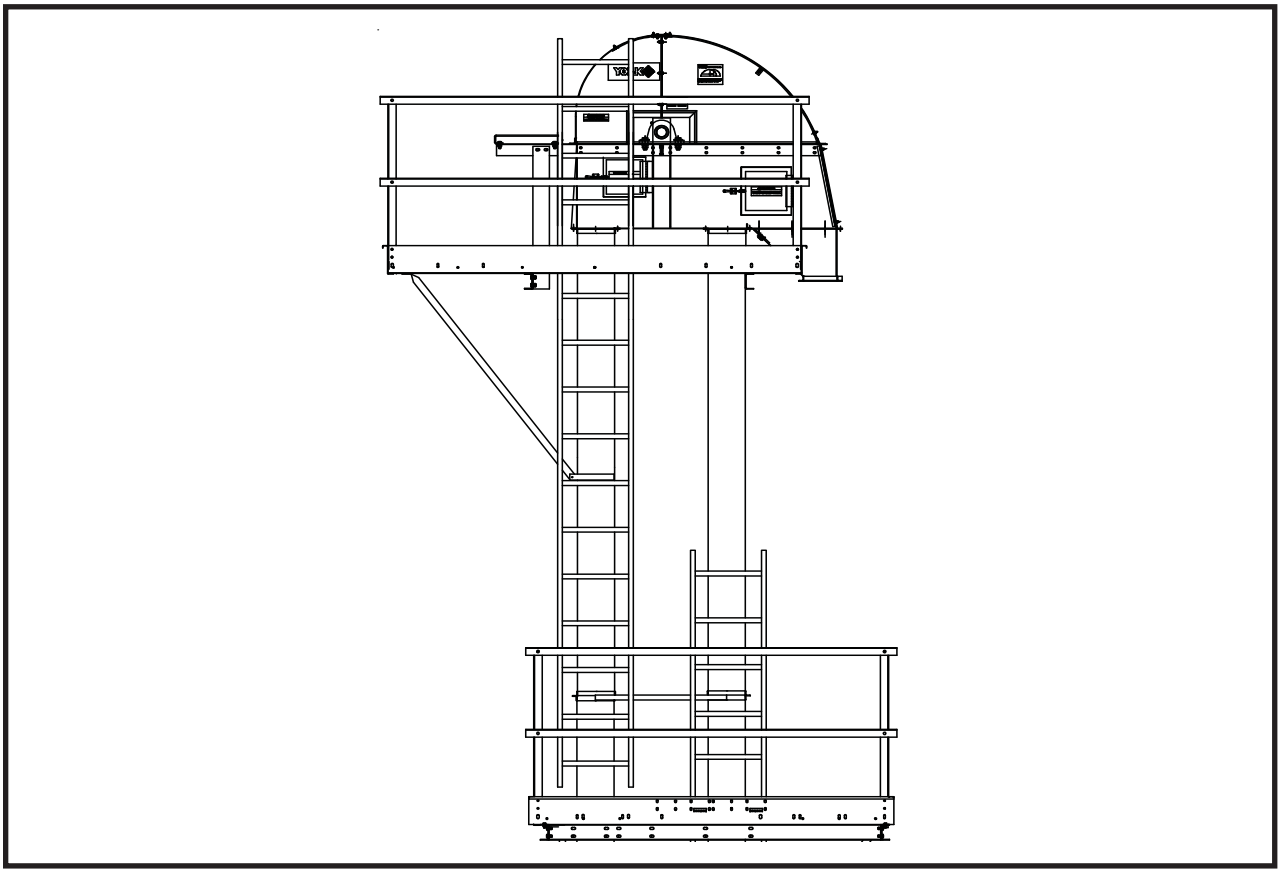
A Division of **GLOBAL** *Industries, Inc.*

YORK

Bucket Elevator

M16 - M24 13”[0.33 m] x 9”[0.23 m] LEGGING

CONSTRUCTION AND OWNER’S MANUAL



P/N 10230002

rev 6-09 [1]

The Symbol shown below is used to call your attention to instructions concerning your personal safety. Watch this symbol - it points out important safety precautions. It means **"ATTENTION"** - Become Alert! Your Personal Safety Is Involved! Read the message that follows and be alert to the possibility of personal injury or death.

Be Alert! Your Personal Safety Is Involved

The safety and performance of this elevator, constructed and readied for operation will be affected by the installation and construction personnel. Elevators generally involve extreme heights and high winds. Careful consideration must be given to the structural requirements. We therefore highly recommend the use of a skilled construction company with a qualified structural engineer. MFS/YORK/STORMOR cannot be responsible for the construction of the elevator. The information obtained in this manual is offered only as a convenience to the installer. No liability is expressed or implied toward the installation.

A copy of this manual should be available at all times to the owner/operator. Additional copies may be requested from the company at the address shown on the back cover. Please reference part number #10230002 when requesting additional copies.

Please Contact MFS/YORK/STORMOR or Your Dealer
If You Have Any Questions Concerning This Manual

Keep This Manual In A Safe Place Available For Future Reference

A GENUINE

GLOBAL INDUSTRIES, INC.

PRODUCT

PREFACE

You have purchased the finest bucket elevator manufactured today. The following information is intended as a guide for: bucket elevator pre-assembly, proper construction, and safe and proper use after construction.

General Safety Statement

Your safety and the safety of others associated with your grain system equipment is of prime concern to us at MFS/YORK/STORMOR. We wrote this manual to help you to better understand how to safely build and use this YORK bucket elevator.

It is your responsibility as the owner, builder, operator, or supervisor, to know what specific requirements, precautions, and hazards exist and to make these known to all personnel working with the equipment or in the area, so that they too may take any necessary safety precautions that may be required!

Failure to read this Manual and its Safety Instructions by all personnel is a misuse of the equipment. We want you as our partner in safety!

All personnel, including construction personnel, must read and understand all equipment Operator's Manuals before starting bucket elevator construction!

Contents

Warranty

MFS/YORK/STORMOR DIVISION (the **Company**) makes the following warranty to the initial retail purchaser of its products (the **Customer**).

MATERIALS and WORKMANSHIP:

The Company warrants products manufactured by it to be free from defects in materials and workmanship in normal use and service for a period of one (1) year after date of delivery to the Customer.

COMPANY'S OBLIGATION and CUSTOMER'S EXCLUSIVE REMEDY:

The Company's sole obligation and the Customer's exclusive remedy under this warranty is as follows:

If within one (1) year after delivery to the customer the product fails to function properly due to a defect in either materials or workmanship, the Company will at its option, either repair the defective part or replace the defective part with a new or reconditioned part. Labor charges for removing defective parts and installing replacement parts, shipping charges with respect to such parts, and applicable sales and other taxes, if any, shall not be covered by this warranty.

CONDITIONS, LIMITATIONS, AND EXCLUSIONS:

There are no warranties or merchantability or fitness for a particular purpose with respect to any product manufactured or sold by the Company. Motors provided by the Company are in most instances warranted by the manufacturer thereof and are not warranted by the Company. The Company shall not be responsible under this warranty or otherwise for personal injury or for **Incidental or Consequential Damages,** including, without limitation, loss of use and lost profits. This warranty does not apply to defects or damages caused by misuse, improper maintenance, or improper installation of the Company's product or any equipment attached to or used in connection with the Company's product. The Company reserves the right to make changes or improvements to its products without incurring any obligation with respect to previously manufactured products. Field modification of this product without the expressed written permission of the Company constitutes a misuse of the product. The Company shall have no liability under this warranty until payment in full for the product in question has been made by the customer. The foregoing is the sole warranty made by the Company. No one is authorized to make other warranties on behalf of the Company.

1 Maintenance

WARNING! NEVER REMOVE OR LOOSEN (1) OR MORE GUY CABLES WITHOUT PROVIDING OTHER MEANS OF SUPPORT TO THE ELEVATOR LEG!

Regularly scheduled maintenance can greatly increase the life of your equipment and reduce downtime. A good maintenance program includes general housekeeping, adequate regular lubrication, and periodic inspection. Remember to check the bucket elevator immediately if any unusual noise or vibration is observed.

Following is a list of some things you should check regularly at the given specified intervals.

1. Check the belt frequently to make certain it is running in the center of the leg. Check the belt alignment every hour for the first 10 hours and daily thereafter. A rubbing belt could quickly cut a hole in the side of the leg or cause sparks.
2. Check the bucket bolts for tightness after 10, 30, and 100 hours of operation and every 200 hours thereafter.
3. Bearings are greased at the factory and do not need to be greased prior to start-up. Grease all bearings every 800 - 1000 hours after start up. When the unit is running use only enough grease until you can see the fresh grease at the seals. If you cannot lubricate the bearings when the unit is running, do it immediately after shut down when the bearing is still warm. Do not grease a cold bearing.
4. Be certain to maintain the reducer as specified by the manufacturer. Follow the manufacturer's instructions for periodic oil level inspection and oil changes.
5. Check the head pulley and drive belt after 10, 30, 100 and every 300 hours, or twice yearly thereafter. **See page 73 for correct belt tension!** The best belt tension for a V-belt drive is the lowest tension at which the belts will not slip under the highest load condition.
6. Oil motor every 1000 hours or once yearly if equipped with oil holes or grease unit if zerks are available.
7. Check guy cables, turnbuckles, and cable clips every 3 months for damage or loosening. If any cable needs to be tightened, use the procedure given on pages 69 - 71 in this manual. Note: Any change in the cable tension may cause the leg to go out of plumb, resulting in the belt not running straight or even in structural damage to the leg.
8. Check for deterioration or looseness of any bolts or fasteners and check to make certain all ladder connections continue to be secure.
9. Check for damaged or missing cups.
10. Check the pulley hub bolts and set screws after the first 8 - 10 hours of operation.
11. Check for worn holes in the spouting.

2 Safety

This MFS/YORK/STORMOR Construction/Safety Manual is written to assist and instruct those who are responsible for the complete elevator assembly, and for those who operate it after assembly.

MFS/YORK/STORMOR assumes no liability with respect to proper construction, assembly, inspection, or use of its products established under applicable laws, all of which is the sole responsibility of the purchaser and those doing the assembly work.

Appurtenances and the accessories manufactured by us for use with our products conform only to applicable Federal or Safety Standards in effect at such time.

GENERAL SAFETY STATEMENT

Occupational Safety is of prime concern to us at MFS/YORK/STORMOR. This manual was written with the safety of the operator and others who come in contact with the equipment as our prime concern. The manual presents day to day work problems encountered by the operator and other personnel. We wrote this manual to help you understand safe operating procedures for bucket elevators with accessory equipment.

It is your responsibility as an owner or operator or supervisor, to know what specific requirements, precautions, and work hazards exist and to make these known to all other personnel working with the equipment or in the area, so that they too may take any necessary safety precautions that may be required.

Failure to read this Manual and its Safety Instructions by all personnel is a misuse of the equipment.

WARNING! Watch For This Symbol: !

It Points Out Important Safety Precautions. It Means "**ATTENTION**" - Become Alert! Your Safety Is Involved.

WORK AREA SAFETY STATEMENT

Under no circumstances should persons not involved in the operation be allowed to **tresspass** into or be present in the work area.

It shall be the duty of all operators to see that children and/or other persons stay out of the work area! Trespassing into the work area by anyone not involved in the actual operations, or trespasssing into a hazard area by anyone, shall result in an immediate shut down by the operator.

It shall be the duty of all operators to see that the work area has a secure footing and is clean and free of all debris and tools which might cause accidental tripping and/or falling. It shall also be their responsibility to keep the work area clean and orderly during operation.

OPERATOR QUALIFICATIONS

Operation of this elevator and your grain systems equipment shall be limited to competent and experienced persons. In order to be qualified, they must know and meet all other requirements, such as, but not limited to, the following:

1. Some laws and regulations specify that no one under the age of 16 years may operate power machinery. It is your responsibility to know what these requirements are in your own area or situation.
2. Current OSHA regulations state in part: “At the time of initial assignment and at least annually thereafter, the employer shall instruct **every** employee in the safe operation and servicing of all equipment with which the employee is, or will be involved” *
3. Unqualified persons are to **stay out** of the work area.
4. A person who has not read and understood all operating and safety instructions is not qualified to operate the machine.

* Federal Occupational Safety and Health Standards for Agriculture
Subpart D. Section 9128.57 (a) (6).

OSHA
OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

Certain purchasers of our products may be subject to the requirements and standards of the William-Steiger Occupational Safety and Health Act of 1970, which prescribes standards for use of appurtenances of our manufacture, such as handrails, platforms, stairways, fixed ladders, ladder cages, and guard rails. (Occupational Safety and Health Standards Section 1910.21 through 1910.32). Before installing these devices, familiarize yourself with the above Federal Standards.

At the time of manufacture, these **optional** items conform to applicable standards. MFS/YORK/STORMOR assumes no liability with respect to proper construction, assembly, inspection, or use of its products under applicable laws, all of which is the sole responsibility of the purchaser and those doing the assembly work.

PROPER PERSONNEL

To insure the safe use of all your material handling equipment be certain that only trained personnel install, maintain, and operate your bucket elevator!

Grain Dust Explosions

Any facility that stores and handles any type of grain is susceptible to a grain dust explosion. Grain dust is not dirt. It is not inert, but highly flammable and can be very explosive in a confined area. Seven elements must work together to produce a potentially deadly explosion.

ALL INFORMATION ON THIS PAGE IS WARNING INFORMATION!

1. **Air** - Air must be present to provide the oxygen necessary for combustion.
2. **Fuel** - In this case the fuel is the grain dust. The finer the dust, the easier it is to ignite.
3. **Suspension** - A pile of grain dust will not explode, it must be suspended in air.
4. **Minimum Concentration** - There must be a minimum concentration of grain dust in suspension in the air. Current tests seem to indicate the minimum concentration is about 0.4 oz/ft^2.
5. **Low Moisture** - The grain dust must be of a relatively low moisture content. Ambient air moisture or relative humidity, has no bearing on the potentiality of an explosion.
6. **Ignition Source** - The ignition source could come from a fire, an overheated bearing, a spark, welding or cutting sparks or debris, hot metal electric failure or other similar sources.
7. **Confined Area** - An explosive action must take place within a confined area.

Recognizing this hazard, MFS/YORK/STORMOR believes that we all need to work together to prevent grain dust explosions in order to protect lives, jobs, property, and profits. A number of preventive measures can be taken to lesson the likelihood of an explosion. Following are some suggested measures.

CONTROL THE DUST

- **a** Employ methods to clean the grain to reduce the fines.
- **b** Use equipment to minimize the breakage, such as decelerators. Corn that is broken exposes the starch, the most explosive element of the grain.
- **c** Use an outside bag filter to capture the dust.
- **d** Use an air system on the bucket elevator to reduce the dust inside grain elevators and conveyors.
- **e** Spraying edible mineral oil on the grain significantly reduces the airborn dust when handling grain.
- **f** Paint equipment that is in the interior of a facility with a coating that is slick, not allowing the dust to accumulate.
- **g** Enclose all conveyors to keep the dust from escaping.

CONTROL THE IGNITION SOURCE

- **a** Apply a “no smoking” policy in all potentially hazardous areas.
- **b** Use only explosion proof lights.
- **c** All welding and cutting is to take place on the outside of the facility.
- **d** Properly lubricate bearings on all equipment at the required intervals.
- **e** Use magnets to trap metal that might be mixed in with the grain.
- **f** Check the lagging on the bucket elevator head pulley and replace it if it is worn or smooth.
- **g** Use recommended safety devices such as heat detectors on bearings, motion sensors on the boot shaft, belt alignment sensors, or limit switches to shut down the system if the leg is choked. Make certain all electrical wiring, lights and outlets meet local codes. (**DANGER! Do not “jog” a choked leg.**)

GRAIN DUST EXPLOSION MYTHS

Throughout the years several myths have surrounded grain dust explosions. These are some of the most common:

- **a** Grain dust explosions do not occur in times of high humidity
  False: Dust explosions have occurred during rain storms.
- **b** Grain dust explosions do not occur in wooden elevators. **False**
- **c** Grain dust explosions do not occur in small country elevators.
  False: 70% - 80% of grain elevator explosions occur in small country terminals.
- **d** There are only (2) explosions that occur, a primary and a secondary
  False: Up to (13) explosions have been documented during (1) incident.

EXPLOSION VENTING

Explosion vents for the trunking can be supplied as optional equipment for all models of bucket elevators. Explosion vents for heads are standard on all SC models and optional on smaller units. These vents, should an explosion occur within a leg, may possibly minimize damage to the leg and prevent a secondary explosion.

Note: Remember: Good housekeeping and safety procedures will help protect lives, jobs, property and profits.

ALL INFORMATION ON THIS PAGE IS WARNING INFORMATION!

Operating Safety

Follow these **4 BASIC SAFETY RULES** for your bucket elevator to make certain that accidents do not occur! Make certain that everyone working with or around your bucket elevator follows these rules!

1. **Be certain that all covers, grates, and guards are in place and securely fastened before operating!**
2. **Never step or walk on conveyor covers, grates or guards!**
3. **Lock out all power before removing covers, grates or guards! Secure all chains and belts so that they can't move before working on any part of your bucket elevator or conveyor.**
4. **Don't modify or redesign your bucket elevator without first obtaining written approval from MFS/YORK/STORMOR.**

Following these 4 basic safety rules is a proven way to reduce accidents! Be certain to provide all employees working on or near your bucket elevator with effective safety training, including management.

It is ok to add extra safety rules for your job site but DO NOT SUBSTITUTE other safety procedures for the 4 safety rules! Following the safety rules given for the safe use of your bucket elevator requires a commitment at all levels within your company.

SECONDARY SAFETY DEVICES

Devices such as interlock switches, may be helpful but are not fail safe and should not be substituted for a proper lock-out procedure. Do not rely on a switch that can fail, can lose adjustment or can be bypassed. A proper lock-out procedure will prevent accidents.

REMEMBER! There is no substitute for a commitment to safety!

ALL INFORMATION ON THIS PAGE IS WARNING INFORMATION!

Lock-Out

FOLLOW A PROPER LOCKOUT PROCEDURE

This suggested procedure must be performed **EVERY TIME** your bucket elevator is to be worked on. Stick with these steps and they will assist in preventing accidents.

1. **Shut down the bucket elevator in a normal manner.**
2. **Shut off energy to the bucket elevator at the main power source.**
3. **Turn the power switch back on to confirm that power has been deactivated.**
4. **Attempt to restart the elevator to guarantee the power is shut off and then return the switch to the off position.**
5. **Using your own lock, lock-out all (other) energy sources which could provide any power to the bucket elevator.**
6. **With your lock in place test the disconnect to make certain the power cannot be restored.**
7. **Make absolutely certain that the power can't be supplied by any means to the bucket elevator.**
8. **All authorized personnel must put his/her own personal lock on the switch to lock it in the off position. Everyone must use only his or her own personal key.**
9. **Nobody is to return power to the bucket elevator until all work on the elevator has been completed and, all locks have been removed.**

Company management needs to look for maintenance or other employees working on the bucket elevator without following the proper lock out procedure. Management also needs to look for any cover or guard not in its proper place. It is the responsibility of everyone to report any missing grates, guards, equipment failures, or failures to lock out. Make certain that no cover is removed unless power is locked out.

SAFETY QUESTIONS OR CONCERNS

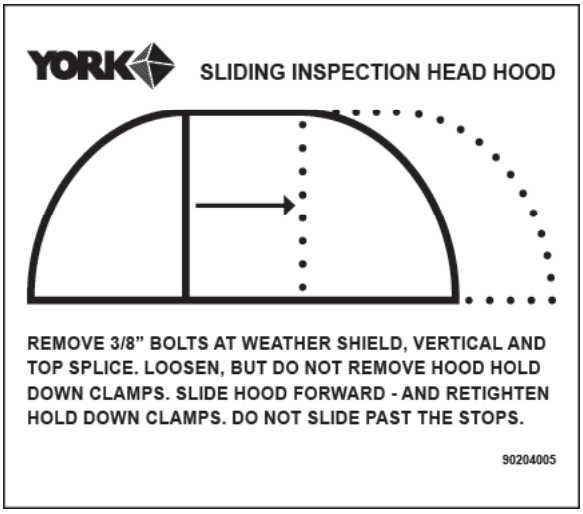
Please be free to contact MFS/YORK/STORMOR with any specific safety needs surrounding your bucket elevator or its use!

ALL INFORMATION ON THIS PAGE IS WARNING INFORMATION!

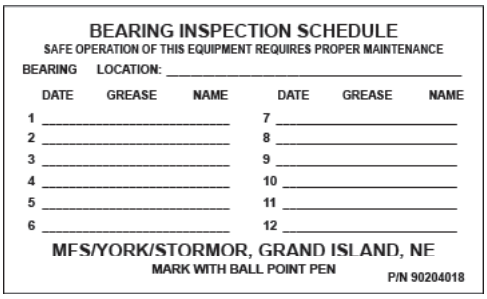
Warning Decals

ALL INFORMATION ON THIS PAGE IS WARNING INFORMATION!

1 on each inspection section opening



1 on each side of the sliding hood



1 on each side of the sliding hood

1 per each inspection door

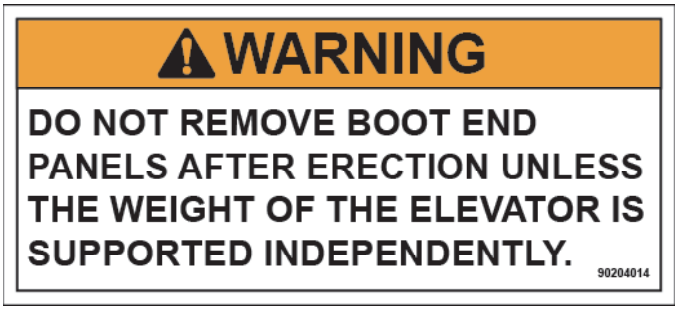
1 on the drive side of the head hood, 1 on the drive guard

1 per boot

1 at the boot end

1 at the boot end

1 on both sides of each boot intake



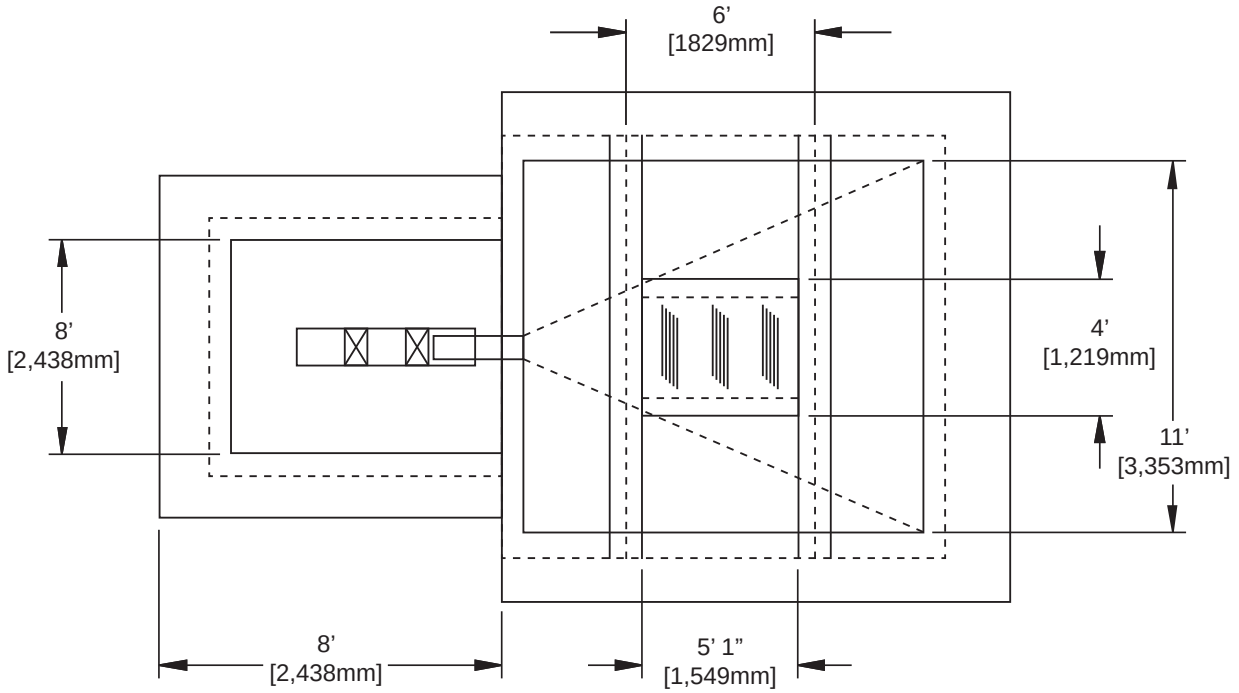
1 at each end panel

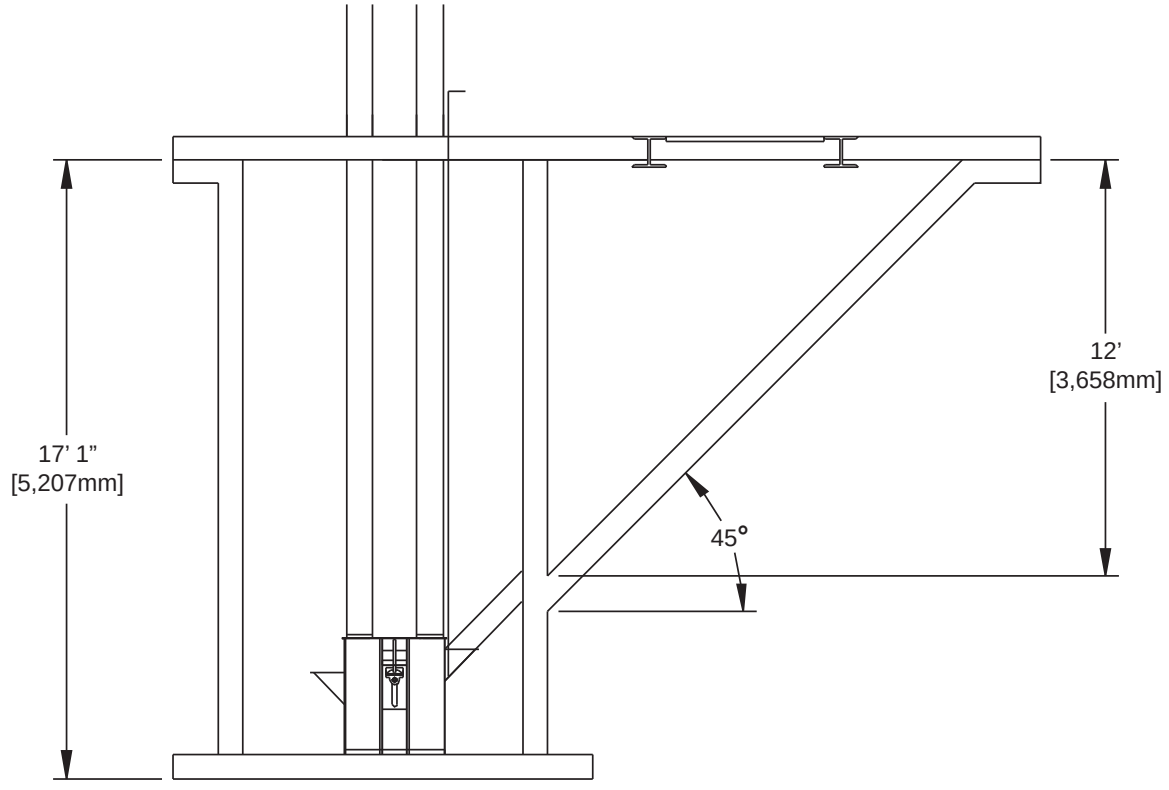
1 for each explosion panel on head and legs

ALL INFORMATION ON THIS PAGE IS WARNING INFORMATION!

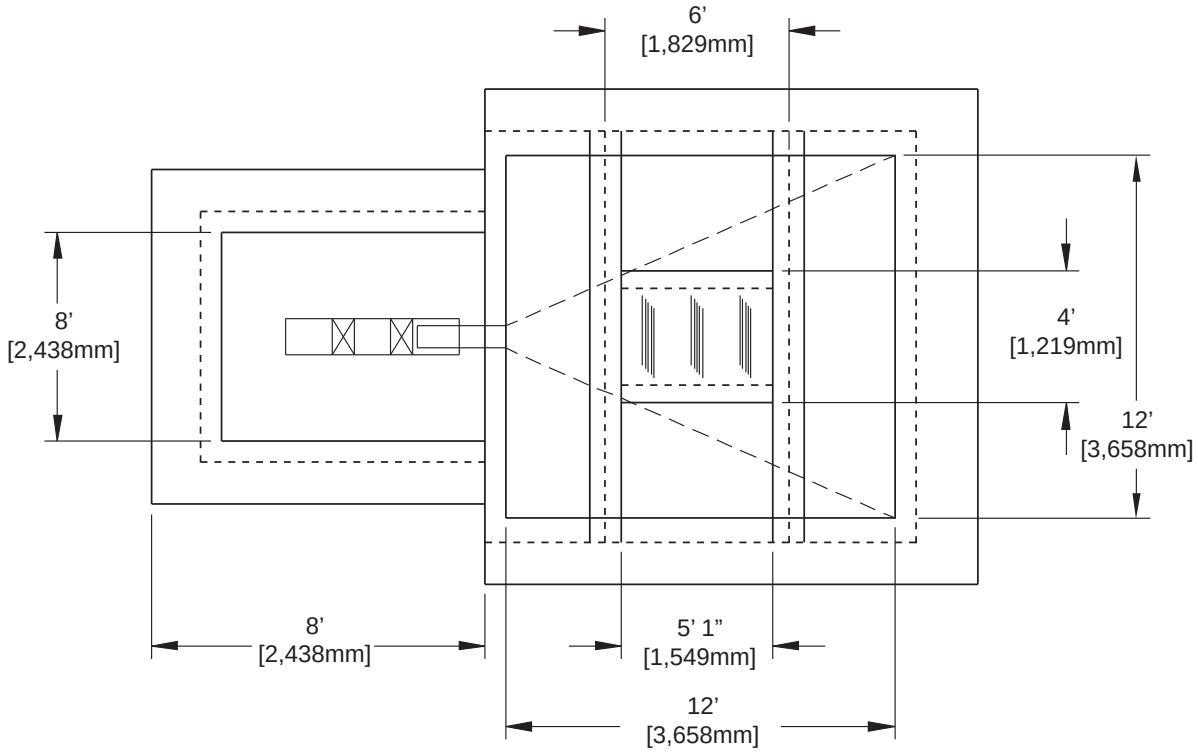
3 Pit Drawings

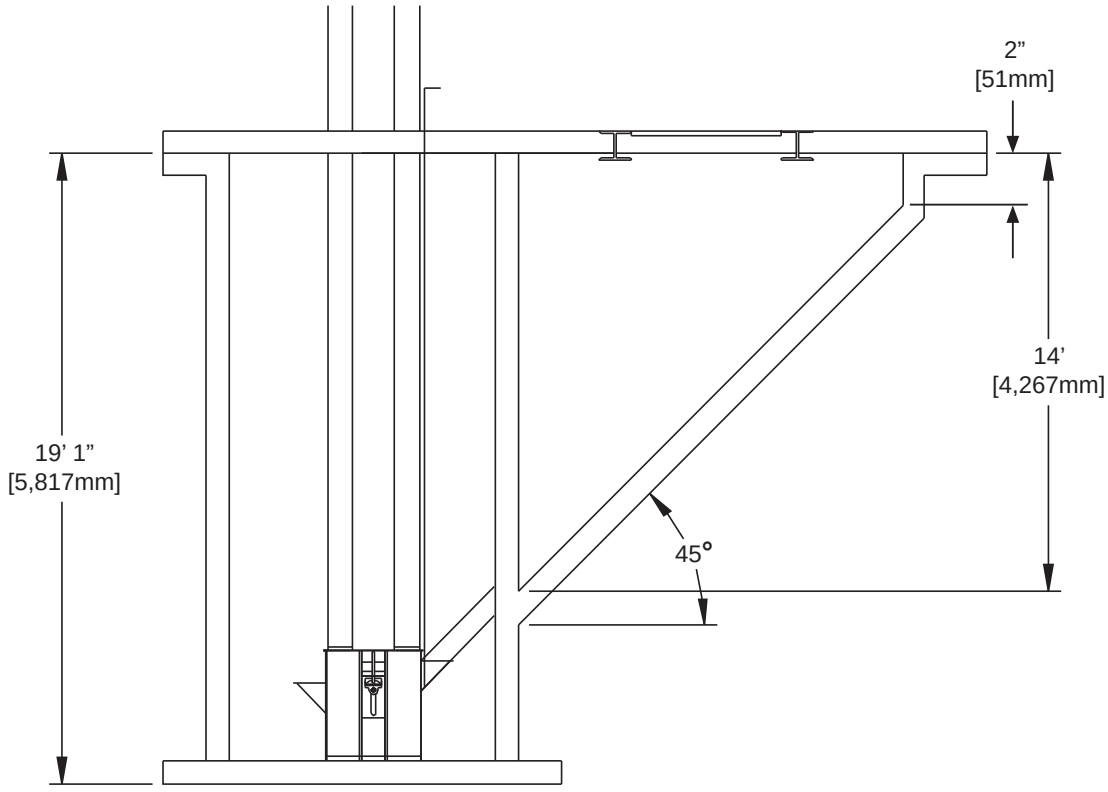
300 Bushel Pit





500 Bushel Pit

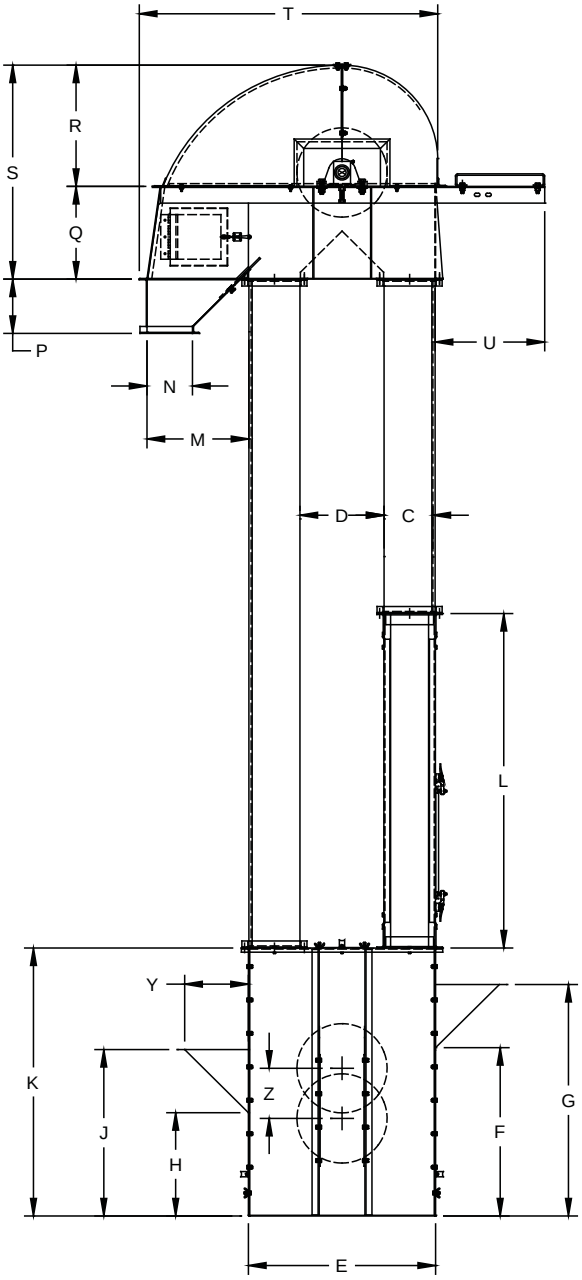




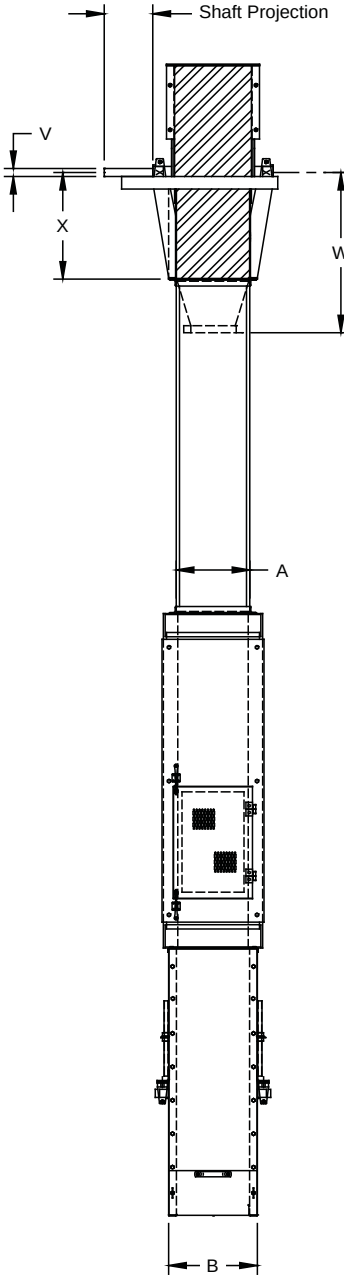
4 Specifications

M16 Dimensions

DENOTES OPTIONAL
1/4" EXPANDED METAL
URETHANE LINED AREAS

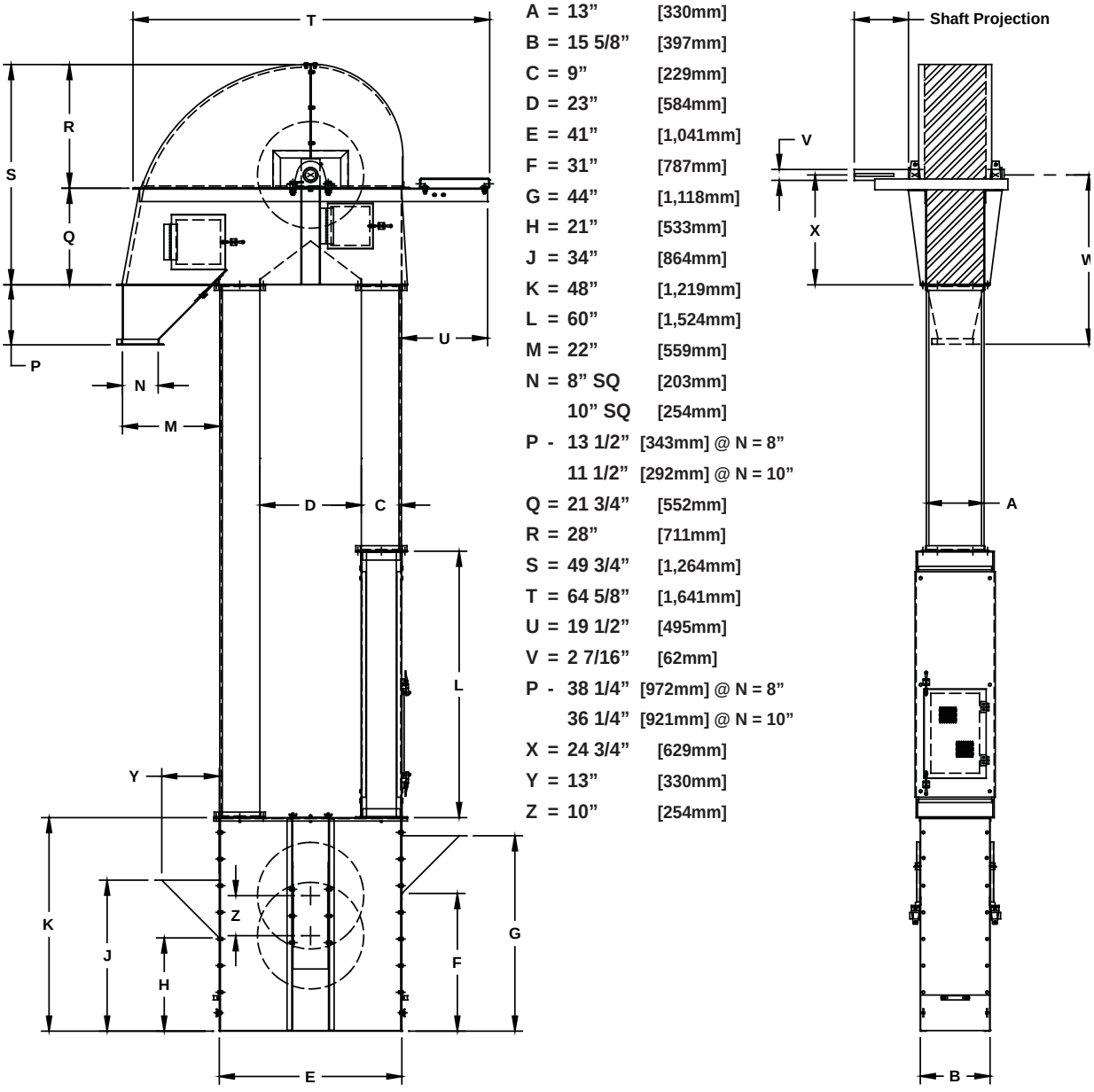


A	= 13"	[330mm]
B	= 15 5/8"	[397mm]
C	= 9"	[229mm]
D	= 15"	[381mm]
E	= 33"	[838mm]
F	= 26"	[660mm]
G	= 39"	[991mm]
H	= 16"	[406mm]
J	= 29"	[737mm]
K	= 48"	[1,219mm]
L	= 60"	[1,524mm]
M	= 18 1/8"	[460mm]
N	= 8" SQ	[203mm]
P	= 9 3/4"	[248mm]
Q	= 16 5/8"	[422mm]
R	= 21 3/4"	[552mm]
S	= 38 3/8"	[975mm]
T	= 53"	[1,346mm]
U	= 19 1/2"	[495mm]
V	= 2 3/16"	[56mm]
W	= 28 7/8"	[733mm]
X	= 19 1/8"	[486mm]
Y	= 13"	[330mm]
Z	= 10"	[254mm]



M24 Dimensions

DENOTES OPTIONAL
1/4" EXPANDED METAL
URETHANE LINED AREAS



A =	13"	[330mm]
B =	15 5/8"	[397mm]
C =	9"	[229mm]
D =	23"	[584mm]
E =	41"	[1,041mm]
F =	31"	[787mm]
G =	44"	[1,118mm]
H =	21"	[533mm]
J =	34"	[864mm]
K =	48"	[1,219mm]
L =	60"	[1,524mm]
M =	22"	[559mm]
N =	8" SQ	[203mm]
	10" SQ	[254mm]
P -	13 1/2"	[343mm] @ N = 8"
	11 1/2"	[292mm] @ N = 10"
Q =	21 3/4"	[552mm]
R =	28"	[711mm]
S =	49 3/4"	[1,264mm]
T =	64 5/8"	[1,641mm]
U =	19 1/2"	[495mm]
V =	2 7/16"	[62mm]
P -	38 1/4"	[972mm] @ N = 8"
	36 1/4"	[921mm] @ N = 10"
X =	24 3/4"	[629mm]
Y =	13"	[330mm]
Z =	10"	[254mm]

Model Specifications

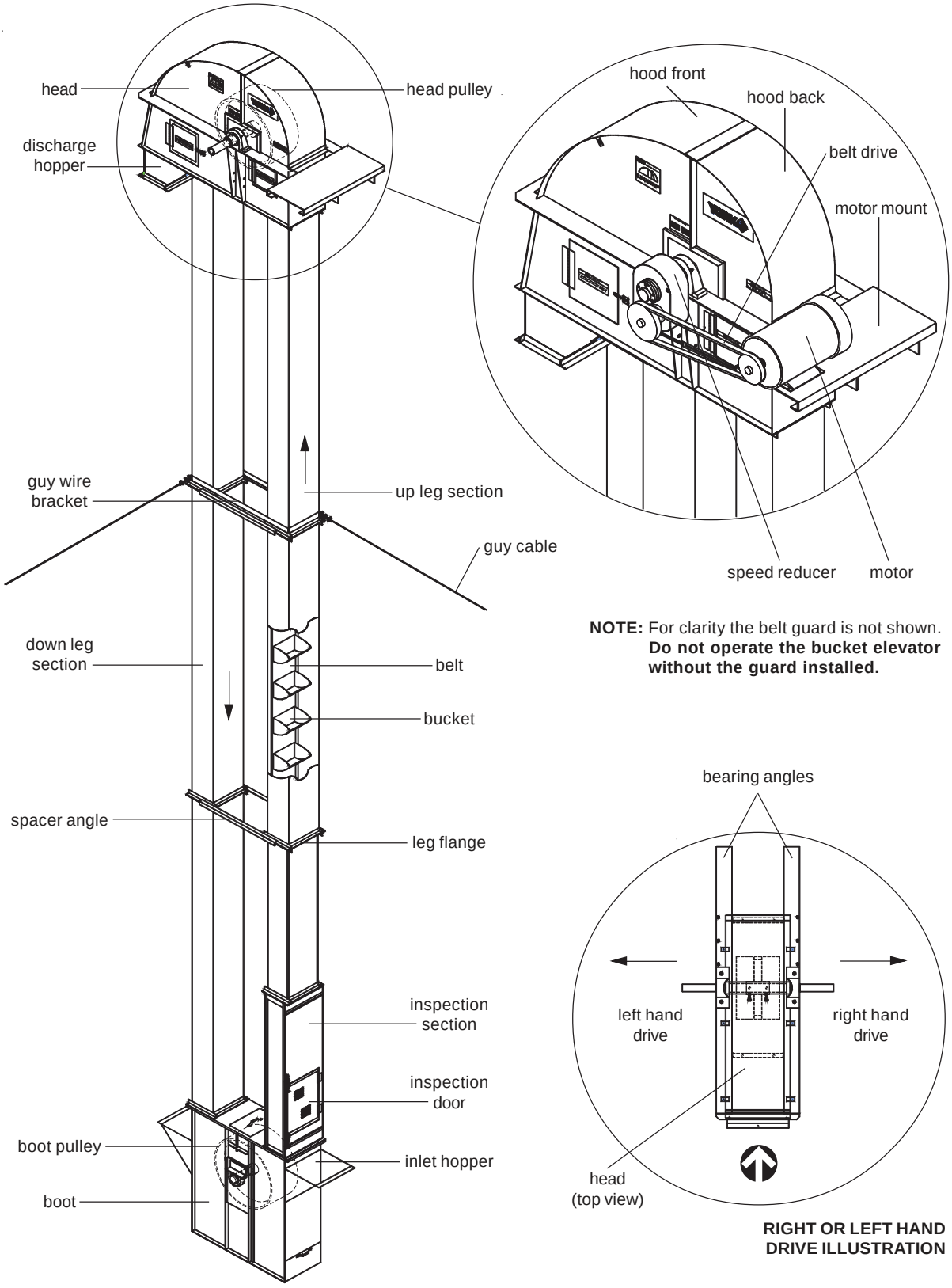
M - 16 Elevator

MODEL	capacity in bushels per hour WL + 10%	head pulley / RPM	cup size / cup spacing	head shaft / boot shaft	head shell / boot shell	legging	spouting required	belt size and specification / belt strength	bearings
16 - 10	1,000	16” [406mm] / 60	9” x 5” CC [228mm x 127mm] type / 9” [229mm]	2 - 3/16” [56mm] / 1 - 7/16” [37mm]	11 gage / 11 gage	14 gage “lockformed”	6” [152mm]	10” [254mm] PVC - static, oil and fire resistant (SOF) / 225# PIW	self aligning sealed ball bearings
16 - 15	1,500	16” [406mm] / 90	9” x 5” CC [228mm x 127mm] type / 9” [229mm]	2 - 3/16” [56mm] / 1 - 7/16” [37mm]	11 gage / 11 gage	14 gage “lockformed”	6” [152mm]		
16 - 20	2,000	16” [406mm] / 80	9” x 5” CC [228mm x 127mm] type / 6” [229mm]	2 - 3/16” [56mm] / 1 - 7/16” [37mm]	11 gage / 11 gage	14 gage “lockformed”	8” [203mm]		
16 - 25	2,500	16” [406mm] / 100	9” x 5” CC [228mm x 127mm] type / 6” [229mm]	2 - 3/16” [56mm] / 1 - 7/16” [37mm]	11 gage / 11 gage	14 gage “lockformed”	8” [203mm]		
16 - 30	3,000	16” [406mm] / 120	9” x 5” CC [228mm x 127mm] type / 6” [229mm]	2 - 3/16” [56mm] / 1 - 7/16” [37mm]	11 gage / 11 gage	14 gage “lockformed”	8” [203mm]		

M - 24 Elevator

MODEL	capacity in bushels per hour WL + 10%	head pulley / RPM	cup size / cup spacing	head shaft / boot shaft	head shell / boot shell	legging	spouting required	belt size and specification / belt strength	bearings
24 - 20	2,000	24” [610mm] / 50	9” x 6” [229mm x 152mm] / 8” [203mm]	2 - 7/16” [62mm] / 1 - 7/16” [37mm]	11 gage / 11 gage	14 gage “lockformed”	8” [203mm]	10” [254mm] PVC - static, oil and fire resistant (SOF) / 350# PIW	heavy duty ball bearing, pillow block
24 - 25	2,500	24” [610mm] / 60	9” x 6” [229mm x 152mm] / 8” [203mm]	2 - 7/16” [62mm] / 1 - 7/16” [37mm]	11 gage / 11 gage	14 gage “lockformed”	8” [203mm]		
24 - 30	3,000	24” [610mm] / 70	9” x 6” [229mm x 152mm] / 8” [203mm]	2 - 7/16” [62mm] / 1 - 7/16” [37mm]	11 gage / 11 gage	14 gage “lockformed”	8” [203mm]		
24 - 35	3,500	24” [610mm] / 65	9” x 6” [229mm x 152mm] / 6” [152mm]	2 - 7/16” [62mm] / 1 - 7/16” [37mm]	11 gage / 11 gage	14 gage “lockformed”	10” [254mm]		
24 - 40	4,000	24” [610mm] / 70	9” x 6” [229mm x 152mm] / 6” [152mm]	2 - 7/16” [62mm] / 1 - 7/16” [37mm]	11 gage / 11 gage	14 gage “lockformed”	10” [254mm]		

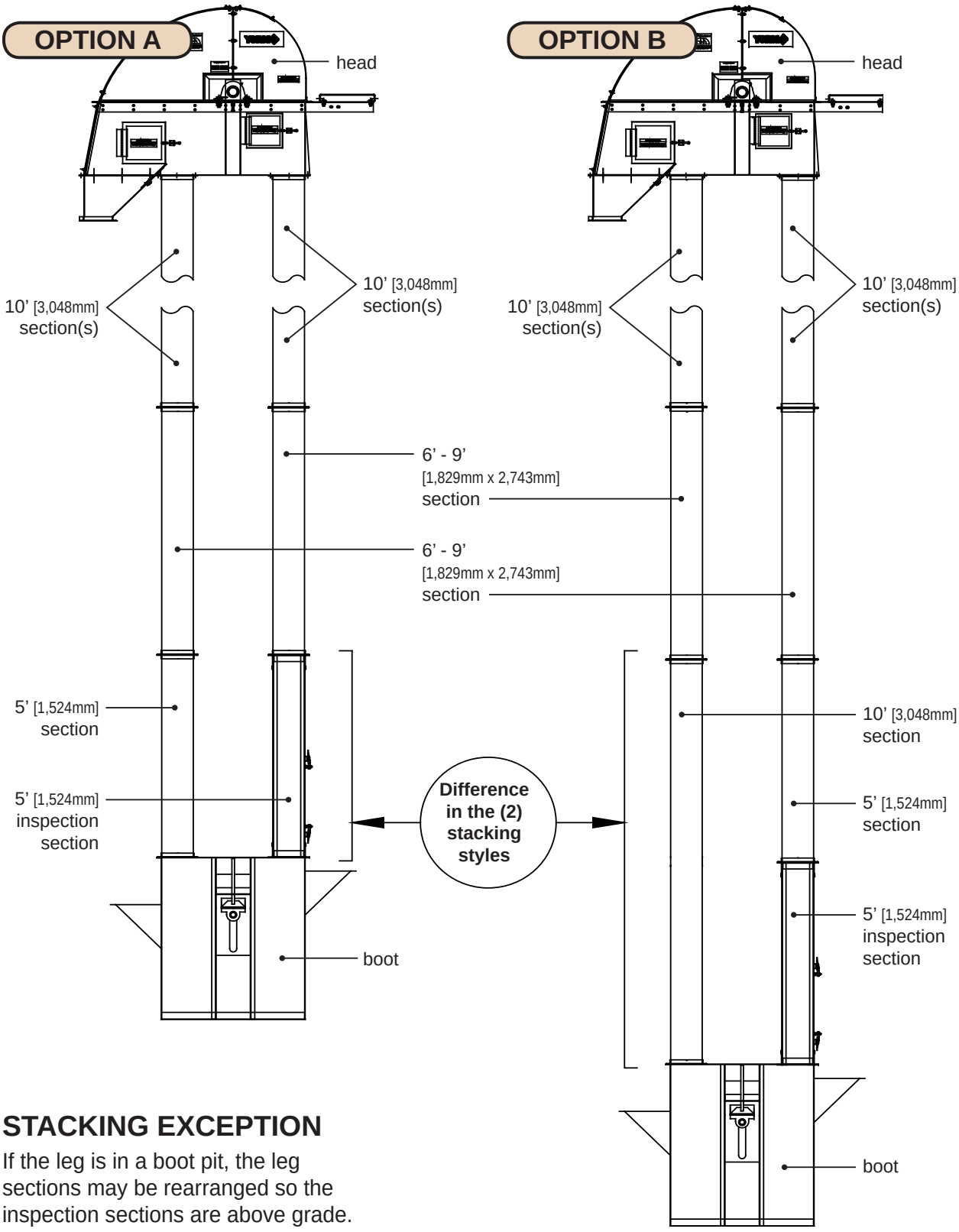
Parts Identification



NOTE: For clarity the belt guard is not shown. **Do not operate the bucket elevator without the guard installed.**

RIGHT OR LEFT HAND DRIVE ILLUSTRATION

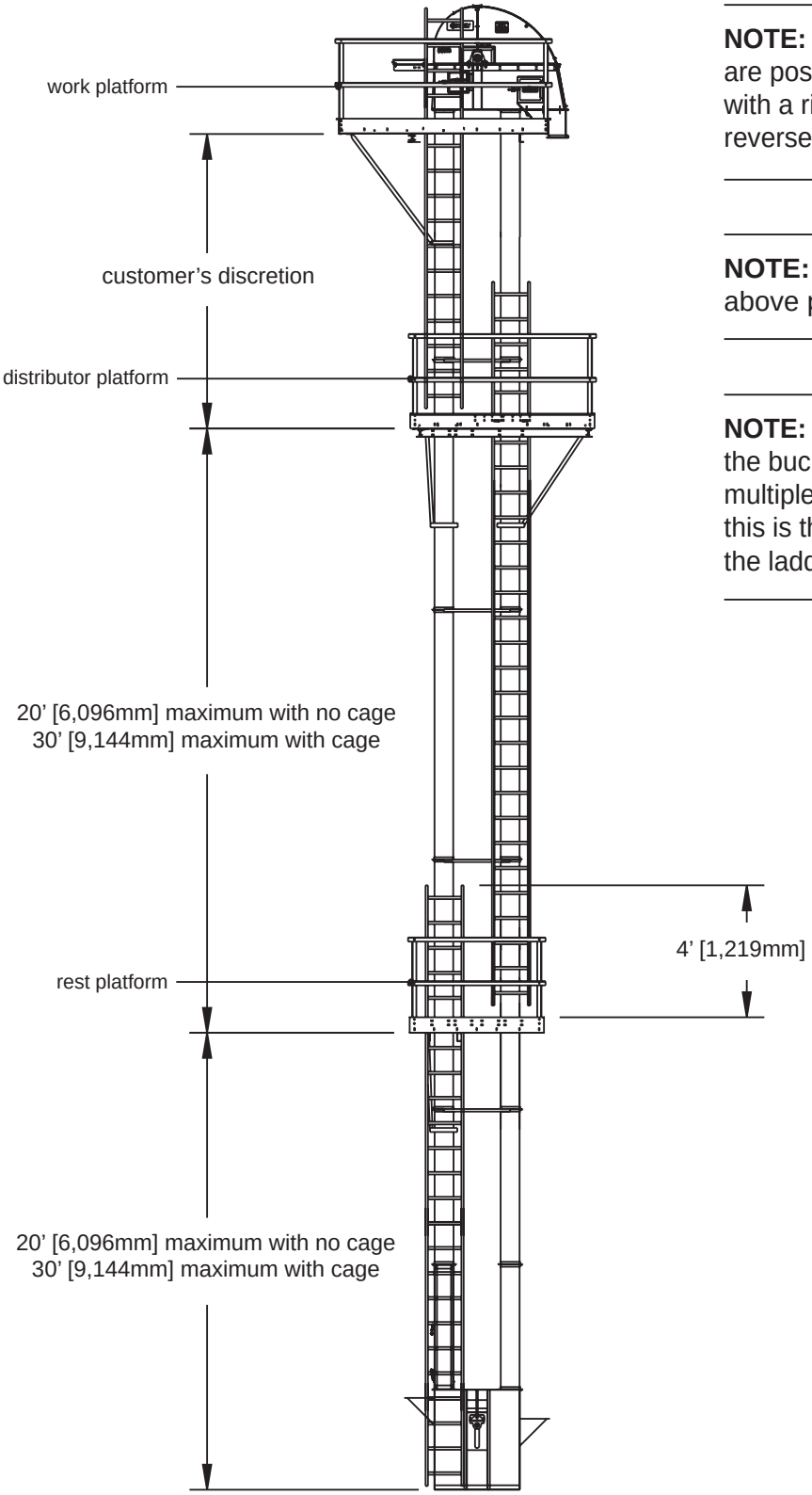
Stacking Drawing



STACKING EXCEPTION

If the leg is in a boot pit, the leg sections may be rearranged so the inspection sections are above grade.

Ladder and Platform Arrangement



NOTE: The platforms on this drawing are positioned for a head assembly with a right hand drive. All items are reversed for a left hand drive.

NOTE: Ladders need to extend above platforms by 4' [1,219mm].

NOTE: Depending on the height of the bucket elevator, the unit may have multiple rest platforms (rest stops). If this is the case, alternate them so that the ladder is not continuous.

5 Pre-Assembly

STRUCTURAL CAPACITY

Safety must be first in all planning for the installation and operation of the elevator. This elevator is designed to safely support its own weight and withstand winds up to 100 mph [160 km/h] for the height specified when properly guyed. It has not been designed to support or brace other equipment. **ALL DISTRIBUTORS, CLEANERS, AND/OR SPOUTING MUST BE APPROVED IN WRITING BY MFS/YORK/STORMOR WHEN SUPPORTED OR BRACED FROM THE ELEVATOR. OTHERWISE THE EXTRA ATTACHMENTS MUST BE INDEPENDENTLY SUPPORTED OR BRACED.**

ELEVATOR LOCATION

The elevator must be properly located to receive the incoming material and discharge it at the desired location. This requires an exact location for the boot. Determine whether the boot is to be fed from the down leg side, the up leg side or both sides of the elevator. The down leg side is recommended for light materials like ground feed. The up leg side is recommended for heavier free flowing materials like whole grains. The discharge height should be such that the spouting is at a minimum slope of 45º for whole grains. Contact MFS/YORK/STORMOR for specific recommendations on other materials.

On outside installations, check the planned location for the boot, head, spouting and guy cables for clearance to other structures. Driveways, overhead power lines and building structures can present special hazards and obstructions.

On inside installations, check the location for the leg as it passes through each floor. Additional clearance for the ladder must be provided through each floor.

BOOT FOOTING AND PIT

Enough area on the ground must be provided to adequately support the weight of the elevator and cable reaction loads in high winds. Table 1 shows footing loads for each model and height of elevator. Consult a local Structural Engineer for a properly designed boot footing.

If the boot is installed in a pit, or other permanent structure, adequate clearance must be provided to service the elevator. Of prime concern is the removal of the boot pulley and use of the clean-out door. On outdoor installations the pit will require a sump pump or drain.

Table 1. Boot Footing Loads

	M16	M24
160' [48,768mm]	---	38,500 [17,463kg]
140' [42,672mm]	---	31,900 [14,470kg]
120' [36,576mm]	26,100 [11,839kg]	27,800 [12,610kg]
100' [30,480mm]	22,500 [10,206kg]	23,900 [10,841kg]
80' [24,384mm]	18,600 [8,437kg]	19,800 [8,981kg]
60' [18,288mm]	12,500 [5,670kg]	13,500 [6,123kg]

Guy Cables and Anchors

The Leg must be braced every 20' [6096mm] from the head section to the top of the boot. Guy cables are generally used for bracing above ground level. Legs extending into pits (below ground level) are braced near the ground level. If the pit is over 20' [6096mm] deep, brace the leg every 20' [6096mm]. By bracing near the ground level the maximum overhead guy clearance is obtained to the first set of cables.

All connections to the leg for guy cables or bracing must be made with guy wire brackets. Guy wire brackets are to be located against the top edge of the leg section flanges. (4) cables, 90º apart are installed to each guy wire bracket. Anchor locations are shown on the next page. Anchor lengths are shown on page 27.

Anchors must be properly designed to withstand the cable loads. The total loads imposed on the anchors are listed in the table below. All anchors must be designed by a **Structural Engineer** to match soil and ground conditions. Install wire rope clips (cable clips) correctly. See the instructions starting on page 71!

WARNING! CARE SHOULD BE GIVEN TO PROTECT GUY CABLES FROM ACCIDENTAL DAMAGE. Trucks and farm machinery could cause serious damage to a cable and result in the elevator collapse.

Some protection is gained by guard fences and elevated anchors. Guard fences will keep equipment a safe distance from cables. Elevated anchors will help vehicles to pass under the cables near the anchor. The next page shows a typical elevator anchor.

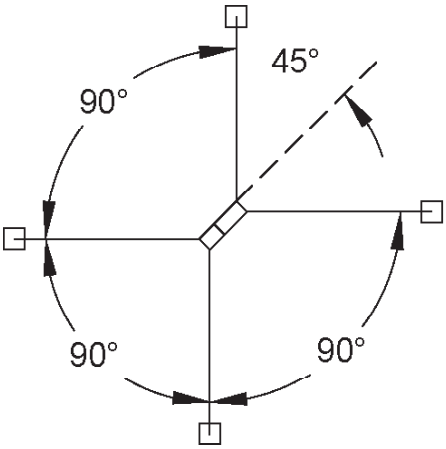
WARNING! ALL CABLES OR BRACES CONNECTED (OR AFFIXED) TO BUILDINGS OR OTHER STRUCTURES MUST BE APPROVED BY THE MANUFACTURER OF THE STRUCTURE or by a structural engineer.

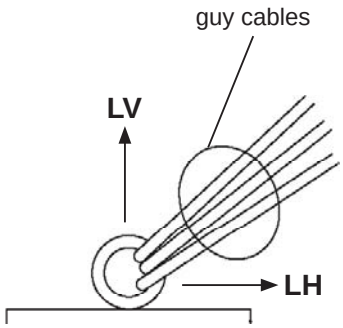
Table 2

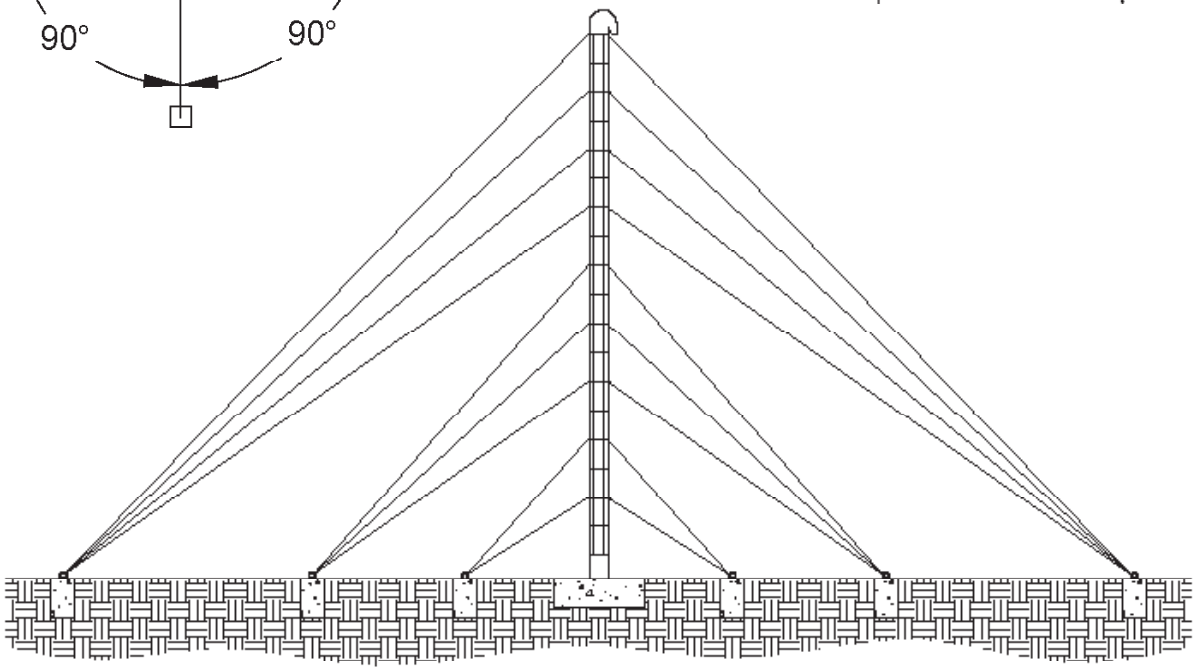
		Anchor A				Anchor B				Anchor C			
Model	Height H	Number of Sets	Horz.Dist. X	Horz. Load LH	Vertical Load LV	Number of Sets	Horz.Dist. Y	Horz. Load LH	Vertical Load LV	Number of Sets	Horz.Dist. Z	Horz. Load LH	Vertical Load LV
M16 and M24	**160' [48.77m]**	2	40' [12.19m]	5010 lbs [2,273kg]	3780 lbs [1,715kg]	2	80' [24.38m]	5040 lbs [2,287kg]	4,410 lbs [2000kg]	4	160' [48.77m]	10,100 lbs [4581kg]	8,160 lbs [3702kg]
	140' [42.67m]	3	60' [18.29m]	7520 lbs [3,411kg]	5030 lbs [2,282kg]	4	140' [42.67m]	10,100 lbs [4,581kg]	7,890 lbs [3579kg]				
	120' [36.58m]	2	40' [12.19m]	5010 lbs [2,272kg]	3780 lbs [1,715kg]	4	120' [36.58m]	10,010 lbs [4,540kg]	7,470 lbs [3388kg]				
	100' [30.48m]	2	40' [12.19m]	5010 lbs [2,272kg]	3780 lbs [1,715kg]	3	100' [30.48m]	7400 lbs [3,357kg]	5,910 lbs [2681kg]				
	80' [24.38m]	2	40' [12.19m]	5010 lbs [2,272kg]	3780 lbs [1,715kg]	2	80' [24.38m]	4870 lbs [2,209kg]	4,270 lbs [1937kg]				
	60' [18.29m]	3	60' [18.29m]	7330 lbs [3,325kg]	4880 lbs [2,214kg]								
	40' [12.19m]	2	40' [12.19m]	4910 lbs [2,227kg]	3650 lbs [1,656kg]								

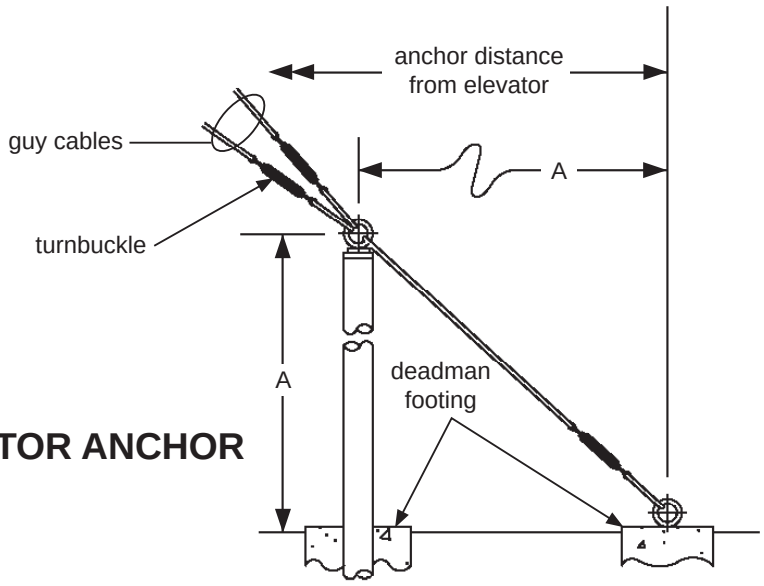
Horz. = Horizontal
Dist. = Distance

Cable Anchor Locations









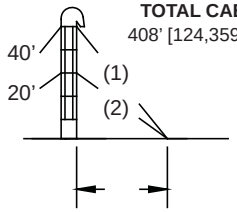
TYPICAL ELEVATOR ANCHOR

Cable Lengths

40' [12,192mm] leg

(1) 57' [17,374mm]
(2) 45' [13,716mm]

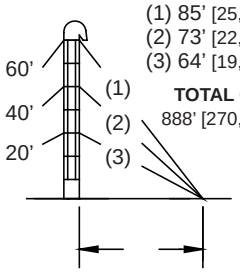
TOTAL CABLE:
408' [124,359mm]



60' [18,288mm] leg

(1) 85' [25,908mm]
(2) 73' [22,250mm]
(3) 64' [19,507mm]

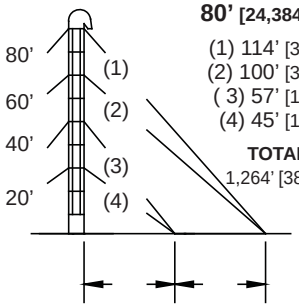
TOTAL CABLE:
888' [270,662mm]



80' [24,384mm] leg

(1) 114' [34,747mm]
(2) 100' [30,480mm]
(3) 57' [17,374mm]
(4) 45' [13,716mm]

TOTAL CABLE:
1,264' [385,268mm]



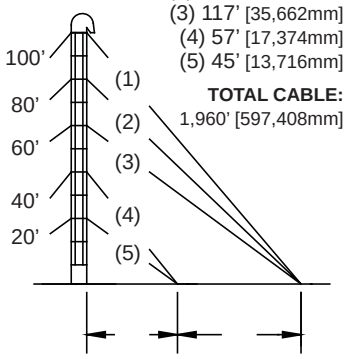
KEY:

180' = [54,864mm]
160' = [48,768mm]
140' = [54,864mm]
120' = [36,567mm]
100' = [30,480mm]
80' = [24,384mm]
60' = [18,288mm]
40' = [12,192mm]
20' = [6,096mm]

100' [30,480mm] leg

(1) 142' [43,282mm]
(2) 129' [39,319mm]
(3) 117' [35,662mm]
(4) 57' [17,374mm]
(5) 45' [13,716mm]

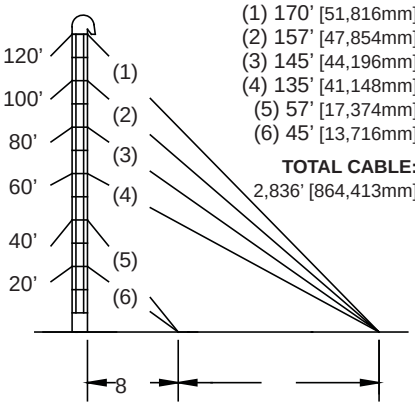
TOTAL CABLE:
1,960' [597,408mm]



120' [36,576mm] leg

(1) 170' [51,816mm]
(2) 157' [47,854mm]
(3) 145' [44,196mm]
(4) 135' [41,148mm]
(5) 57' [17,374mm]
(6) 45' [13,716mm]

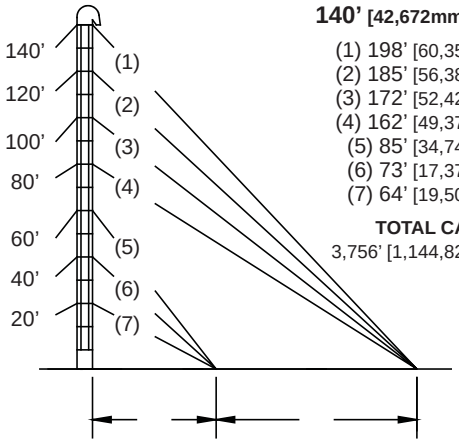
TOTAL CABLE:
2,836' [864,413mm]



140' [42,672mm] leg

(1) 198' [60,350mm]
(2) 185' [56,388mm]
(3) 172' [52,426mm]
(4) 162' [49,378mm]
(5) 85' [34,747mm]
(6) 73' [17,374mm]
(7) 64' [19,507mm]

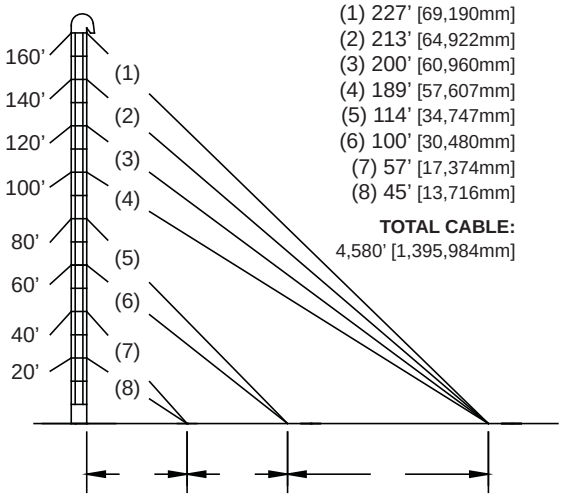
TOTAL CABLE:
3,756' [1,144,829mm]



160' [48,768mm] leg

(1) 227' [69,190mm]
(2) 213' [64,922mm]
(3) 200' [60,960mm]
(4) 189' [57,607mm]
(5) 114' [34,747mm]
(6) 100' [30,480mm]
(7) 57' [17,374mm]
(8) 45' [13,716mm]

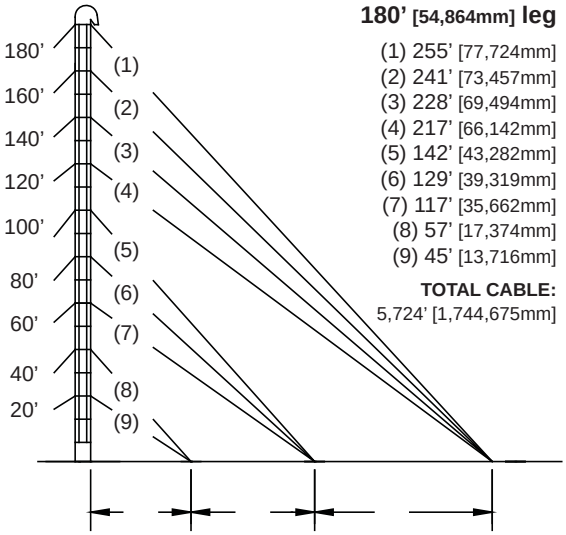
TOTAL CABLE:
4,580' [1,395,984mm]



180' [54,864mm] leg

(1) 255' [77,724mm]
(2) 241' [73,457mm]
(3) 228' [69,494mm]
(4) 217' [66,142mm]
(5) 142' [43,282mm]
(6) 129' [39,319mm]
(7) 117' [35,662mm]
(8) 57' [17,374mm]
(9) 45' [13,716mm]

TOTAL CABLE:
5,724' [1,744,675mm]



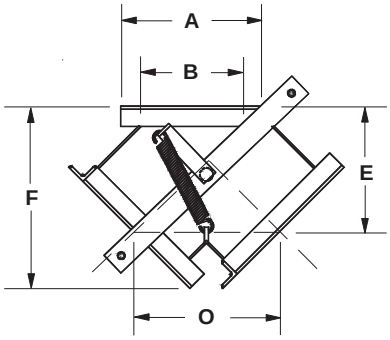
NOTES:

1. All cables are 3/8" [10mm] diameter.

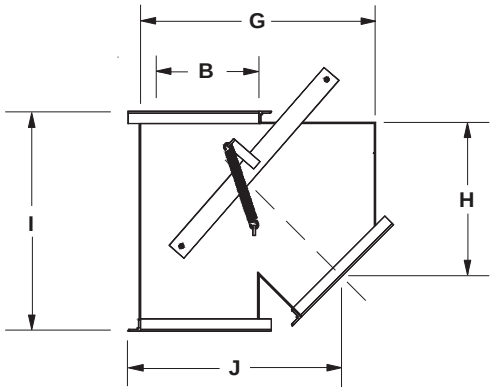
2. You must space guy cables in (4) equal directions.

3. Cable lengths shown are straight line lengths. They are based on the connecting heights shown on the left side of each example. These heights are from ground level to the connecting point on the guy wire bracket. No allowance in the length is made for sag, cable clamping, turnbuckles, or off level anchors.

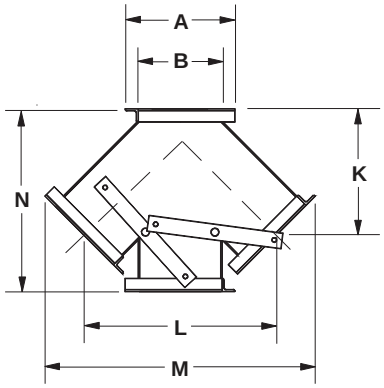
Spouting Accessories



2 - way valve

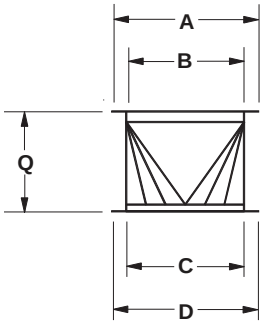


K valve

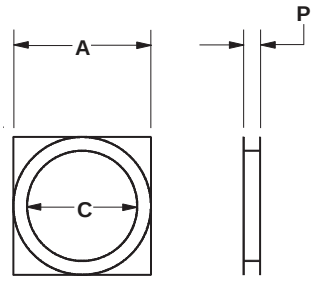


3 - way valve

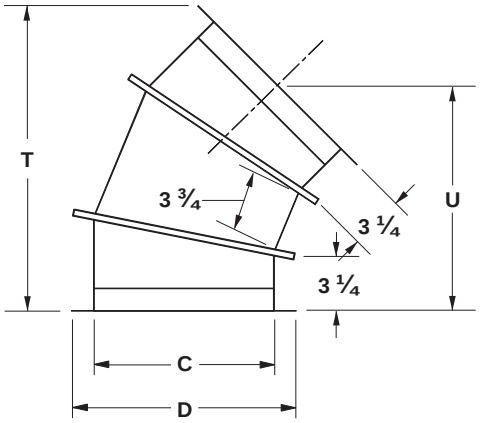
	6” [152mm] and 8” [203mm] valve	10” [254mm] valve
A	10 1/2” [267mm]	12 1/2” [318mm]
B	8” [152mm]	10” [254mm]
C	6” [152mm] = 6” [152mm] 8” [203mm] = 8” [203mm]	10” [254mm]
D	6” [152mm] = 8 1/2” [216mm] 8” [203mm] = 10 1/2” [268mm]	12 1/2” [318mm]
E	7 1/4” [184mm]	9” [229mm]
F	11” [279mm]	13 1/4” [337mm]
G	15 3/4” [400mm]	19 3/4” [502mm]
H	10 3/8” [264mm]	12” [305mm]
I	16 1/2” [419mm]	19” [483mm]
J	13 3/4” [349mm]	17” [432mm]
K	12” [305mm]	15 1/2” [394mm]
L	18 3/8” [467mm]	24 1/2” [622mm]
M	25 3/4” [654mm]	33 1/2” [851mm]
N	17 3/8” [441mm]	20 3/4” [518mm]
O	9 1/4” [235mm]	11 1/4” [286mm]
P	1 1/2” [38mm]	1 1/2” [38mm]
Q	6” [152mm] = 7 1/2” [191mm] 8” [203mm] = 7 5/8” [200mm]	8 1/2” [216mm]
R	35” [889mm]	35” [889mm]
S	6” [152mm] = 17 3/4” [451mm] 8” [203mm] = 18 3/4” [476mm]	19 3/4” [502mm]
T	6” [152mm] = 13” [330mm] 8” [203mm] = 16” [406mm]	20” [508mm]
U	6” [152mm] = 11” [279mm] 8” [203mm] = 13” [330mm]	16” [406mm]
V	6” [152mm] = 9” [229mm] 8” [203mm] = 10 5/8” [270mm]	13” [889mm]
W	6” [152mm] = 6 1/2” [165mm] 8” [203mm] = 7” [178mm]	9” [330mm]
X	6” [152mm] = 4 1/2” [114mm] 8” [203mm] = 3” [76mm]	4” [102mm]
Y	6” [152mm] = 20 1/2” [521mm] 8” [203mm] = 23 1/2” [597mm]	29 7/16” [748mm]
Z	6” [152mm] = 20 15/32” [520mm] 8” [203mm] = 22” [559mm]	27 1/2” [699mm]
AA	19 7/32” [488mm]	24 1/2” [622mm]



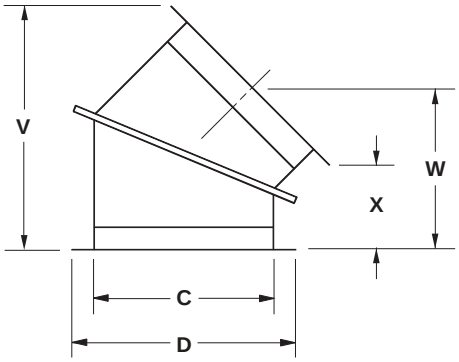
transition



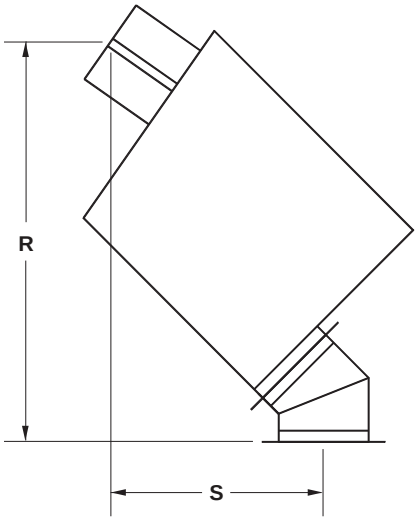
flat top adaptor



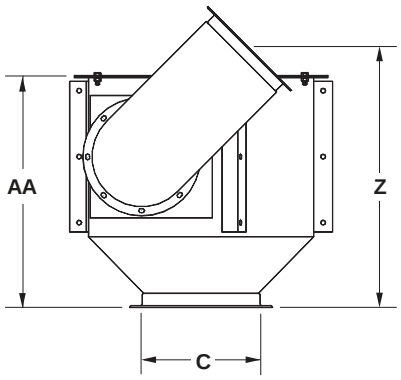
3 piece elbow

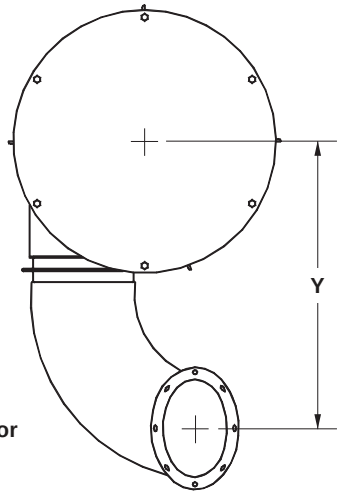


2 piece elbow



dead end

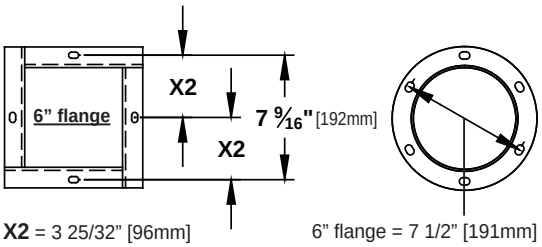




decelerator

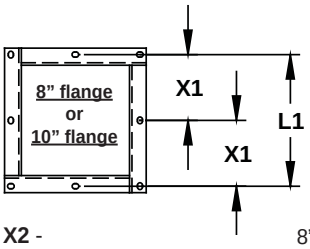
NOTE: Dead end, elbows, and decelerator dimensioned at 45º.

Square and Round Flanges



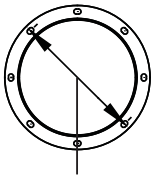
X2 = 3 25/32" [96mm]

6" flange = 7 1/2" [191mm]



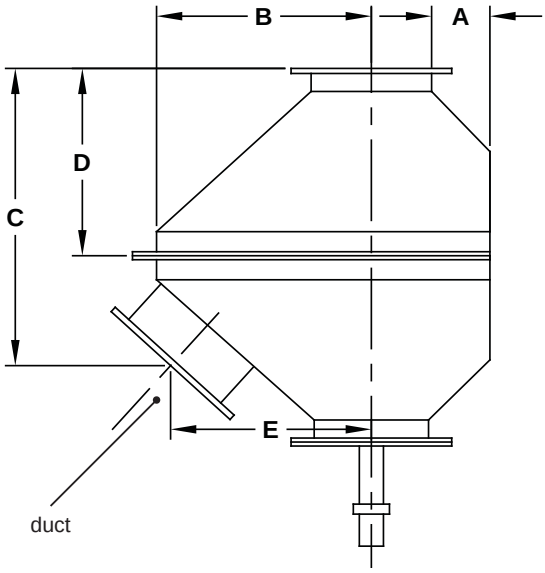
X2 -
8" valve = 4 13/16" [122mm]
10" valve = 5 25/32" [147mm]

L1 -
8" flange = 9 1/2" [241mm]
10" flange = 11 1/2" [292mm]



8" flange = 9 1/2" [241mm]
10" flange = 11 1/2" [279mm]

Distributor



Distributor Dimensions

6" [152mm] Diameter Distributor

	number of ducts						
	6	8	10	12	14	16	18
A	4" [102mm]	4" [102mm]	4" [102mm]	9" [229mm]	9" [229mm]	9" [229mm]	9" [229mm]
B	16" [406mm]	19" [483mm]	22" [559mm]	28" [711mm]	28" [711mm]	31" [787mm]	34" [864mm]
C	21 1/2" [546mm]	24 1/2" [622mm]	27 1/2" [699mm]	33 1/2" [851mm]	33 1/2" [851mm]	36 1/2" [927mm]	39 1/2" [1003mm]
D	15 1/2" [394mm]	18 1/2" [470mm]	21 1/2" [546mm]	27 1/2" [699mm]	27 1/2" [699mm]	30 1/2" [775mm]	33 1/2" [851mm]
E	15 1/2" [394mm]	18 1/2" [470mm]	21 1/2" [546mm]	27 1/2" [699mm]	27 1/2" [699mm]	30 1/2" [775mm]	33 1/2" [851mm]

8" [203mm] Diameter Distributor

	number of ducts						
	6	8	10	12	14	16	18
A	8" [203mm]	8" [203mm]	8" [203mm]	8" [203mm]	8" [203mm]	8" [203mm]	8" [203mm]
B	19" [483mm]	25" [635mm]	25" [635mm]	31" [787mm]	37" [940mm]	40" [1,016mm]	43" [1,092mm]
C	24 1/2" [622mm]	30 1/2" [745mm]	30 1/2" [745mm]	36 1/2" [927mm]	42 1/2" [1,080mm]	45 1/2" [1,156mm]	48 1/2" [1,232mm]
D	17 1/2" [445mm]	23 1/2" [597mm]	23 1/2" [597mm]	29 1/2" [749mm]	35 1/2" [902mm]	38 1/2" [978mm]	41 1/2" [1,054mm]
E	18" [457mm]	24" [610mm]	24" [610mm]	30" [762mm]	36" [914mm]	39" [991mm]	42 1/2" [1,080mm]

10" [254mm] Diameter Distributor

	number of ducts						
	6	8	10	12	14	16	18
A	7" [178mm]	7" [178mm]	7" [178mm]	7" [178mm]	7" [178mm]	14" [356mm]	14" [356mm]
B	22" [559mm]	25" [635mm]	31" [787mm]	37" [940mm]	40" [1,016mm]	45 1/2" [1,156mm]	48 1/2" [1,232mm]
C	27" [686mm]	30" [762mm]	36" [914mm]	42" [1,067mm]	45" [1,143mm]	50 1/2" [1,283mm]	53" [1,346mm]
D	19 1/2" [495mm]	22 1/2" [572mm]	28 1/2" [724mm]	34 1/2" [876mm]	36 1/2" [927mm]	42" [1,067mm]	45" [1,143mm]
E	20" [508mm]	23" [584mm]	29" [737mm]	35" [889mm]	38" [965mm]	43 1/2" [1,105mm]	46 1/2" [1,181mm]

Check Delivery

SEE THE PACKING LIST

Your elevator has been carefully checked before shipment. However, you should check your shipment after arrival to insure it is complete. Distribute the parts in an orderly fashion at the construction site to facilitate later assembly. Use the packing list that is provided with the shipment to verify that all parts have been received.

WARNING! DO NOT USE A BOOT OR LEG SECTION WHICH HAS BEEN DAMAGED. It may not be structurally safe.

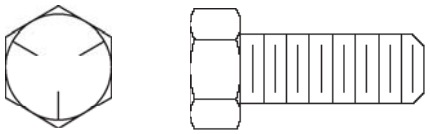
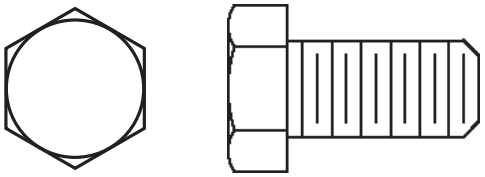
NOTE: Cups and belts should be stored in a dry location.

Hardware

WARNING! <u>UNDER NO CIRCUMSTANCES SHALL ANY OTHER BOLT BE SUBSTITUTED</u> FOR THOSE SUPPLIED BY MFS/YORK/STORMOR!

WARNING! Use only 3/8” diameter grade 5 bolts at leg section connections!

BOLT TORQUE (Approximate Torque Values)

Bolt Description	Bolt Grade	Torque	Bolt Identification
3/8” hex bolt	Grade 5	34 ft-lbs 46 N•m 4.7 kgf-m	
1/2” hex bolt	Grade 2	63 ft-lbs 85 N•m 8.7 kgf-m	

General Assembly Instructions

Actual elevator construction will differ between contractors depending on available equipment, crew experience and personal preference. However, we suggest the following procedure:

1. Set the boot on the footing.
2. Assemble the head section complete with the work platform, drive components and a minimum of a 10' [3,048mm] leg section.

Note: Crane time is reduced if approximately 30' [9,144mm] of legging, ladder, etc. can be installed to the head when it still rests on the ground.

3. Position the crane so the leg and all spouting can be constructed in (1) set up.
4. Sub-assemble leg sections together in 30' [9,144mm] segments with ladders, safety cages and any platforms. Remember, position the guy wire brackets and cables at 20' [6,096mm] intervals.

   Alternate Method - 4. *Some contractors prefer to lift the elevator in 10' [3,048mm] increments and bolt the leg sections on individually.*
5. Lift the elevator and continue to add sub-assembled leg sections until legs are complete.
6. Securely guy and plumb the elevator.
7. Install the belt and make a temporary splice.
8. Fasten the buckets to the belt and make a permanent splice.
9. Check for loose fasteners and check the operation of the elevator without material.

6 Assembly

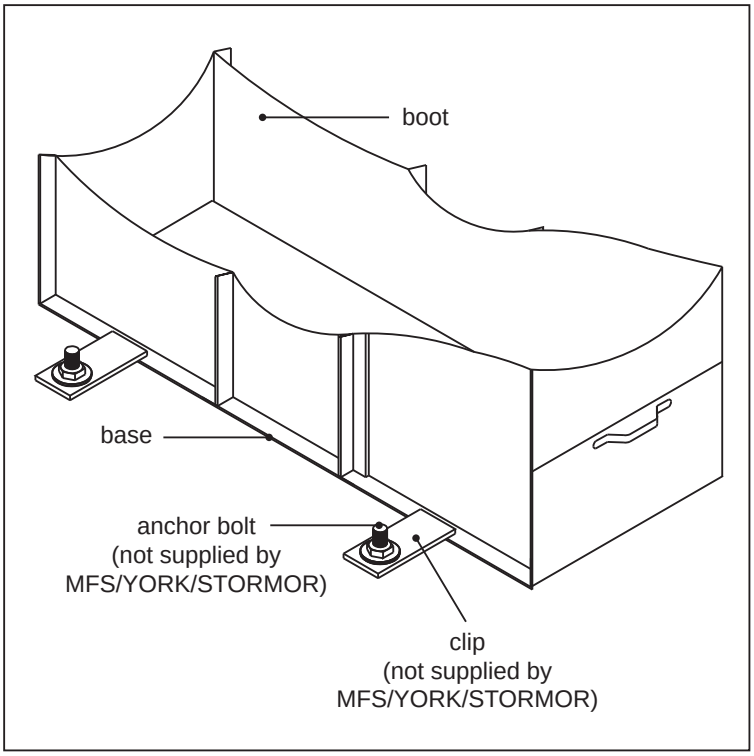
Important Note! Develop a layout plan of the elevator, elevator accessories and auxiliary equipment. Throughout construction, build your bucket elevator in accordance with the layout drawings for your elevator system. Make certain to plan for any future additions to the system.

Start Assembly

1

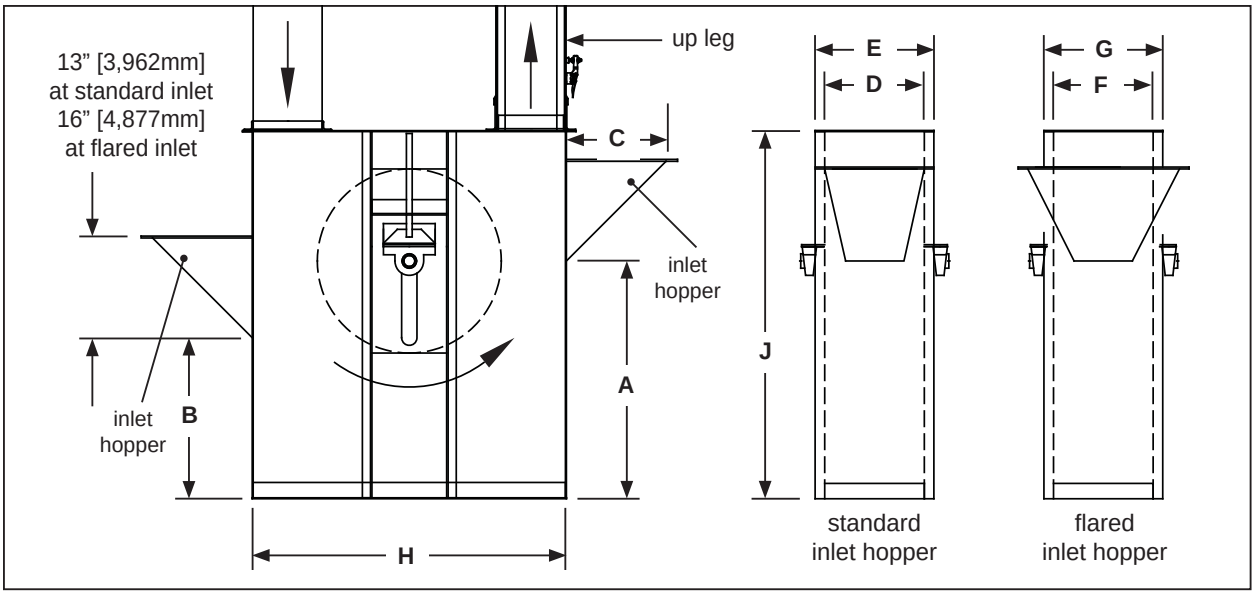
position the boot

Position the boot in the planned, correct location. The foundation must be dry and level. Keep the boot free of standing water. It may be necessary to use a sump pump if the boot is located in a pit. **It is vital that the boot must be anchored so the top flanges are level!** This may require that the boot base be shimmed or grouted. Shims need to be placed under each vertical boot stiffener. Securely fasten the boot to the concrete with machinery clips (or field fabricated plates) and anchor bolts (see the example at right).



a **BOOT BASE**

WARNING! It is vital that the boot be anchored so that the top flanges are level!



a **INSTALL INLET HOPPER(S)**

Model	A	B	C Standard	C Flared	D	E	F	G	H	J
M16	26” [7,925mm]	16” [4,877mm]	13” [3,962mm]	16” [4,877mm]	13” [3,962mm]	15 1/2” [4,724mm]	24” [7,315mm]	26 1/2” [8,077mm]	33” [10,058mm]	48” [14,630mm]
M24	31” [9,449mm]	21” [6,401mm]	13” [3,962mm]	16” [4,877mm]	13” [3,962mm]	15 1/2” [4,724mm]	24” [7,315mm]	26 1/2” [8,077mm]	41” [12,497mm]	48” [14,630mm]

2

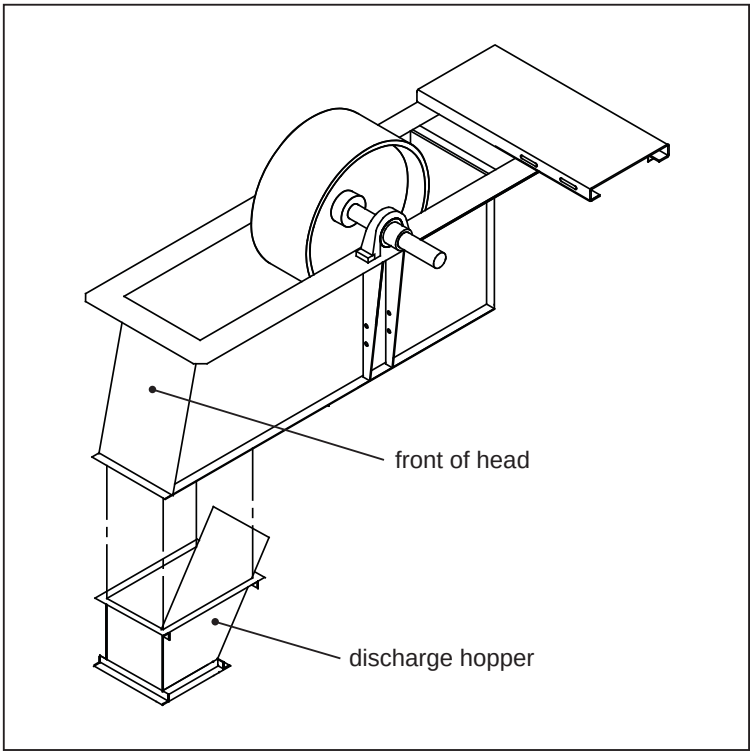
install the inlet hopper(s)

Although inlet hoppers can be installed on either end, we recommend you install them on the up leg side for free-flowing materials, such as whole grains. For light fluffy material a better cup fill will result if the inlet hopper is mounted on the down leg side. **Do not cut the opening for the inlet hopper lower than shown in example a above.** Doing so will reduce the capacity of the elevator.

3

install the discharge hopper

Remove the hood front and back from the head assembly. Elevate the head enough to install the discharge hopper to the front of the unit (example b). Use 3/8” hardware and install the discharge hopper as shown in example c.



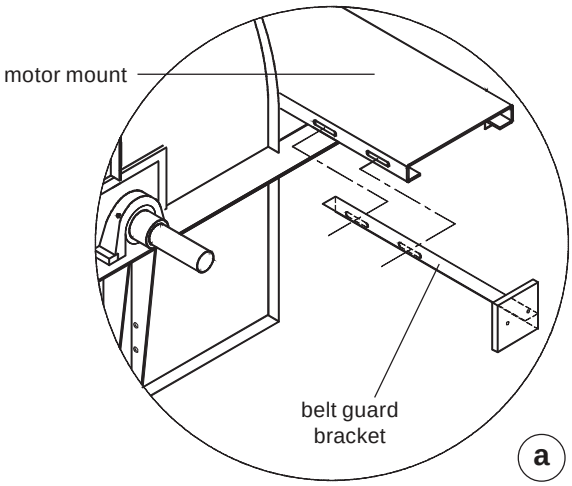
b **INSTALL THE DISCHARGE HOPPER**

Drive Assembly

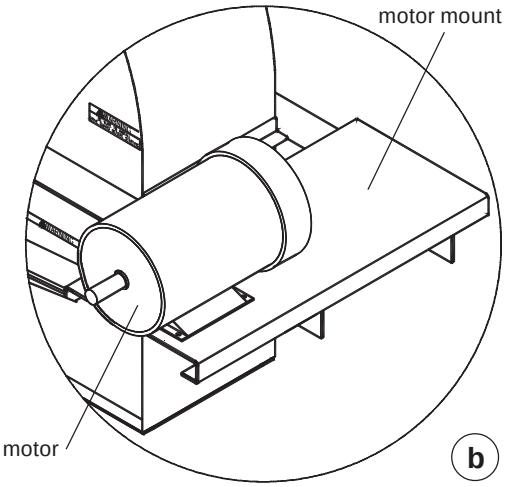
4

install the drive assembly

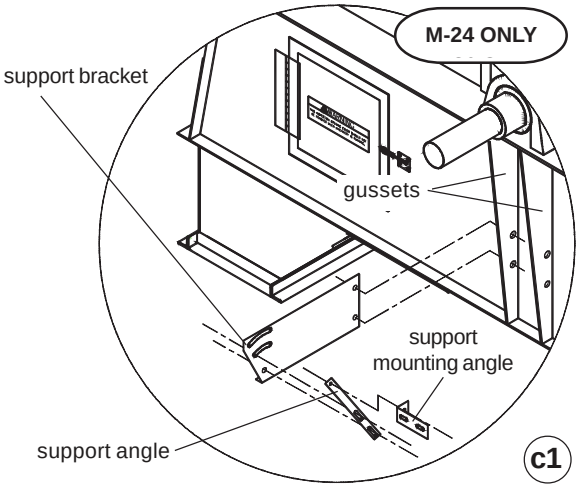
Assemble the motor, reducer, sheaves, belts and guard per the examples that follow and the instructions that accompany the drive components. See pages 65 - 67 for drive packages breakdowns.



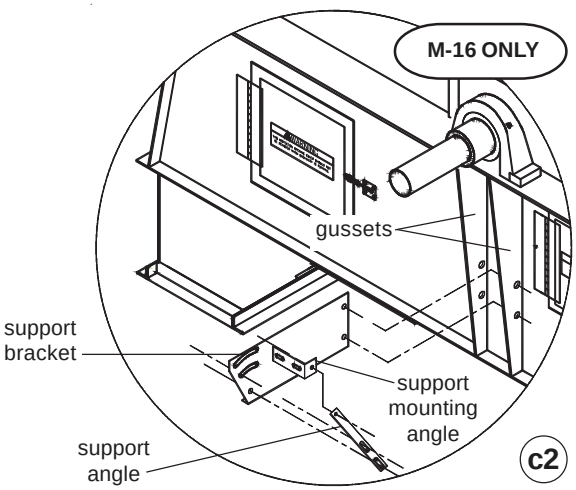
SET BELT GUARD BRACKET IN PLACE.



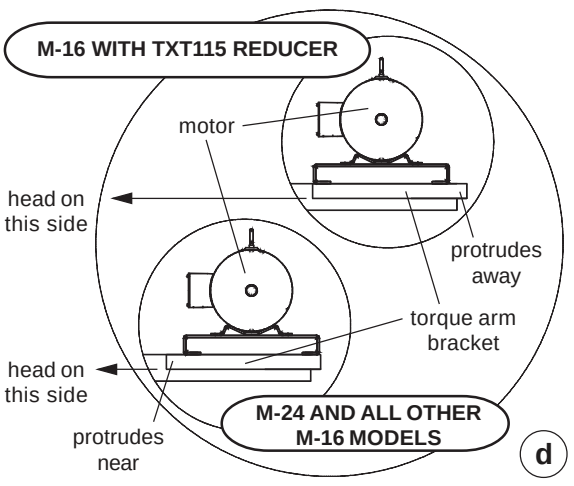
INSTALL MOTOR TO MOTOR MOUNT



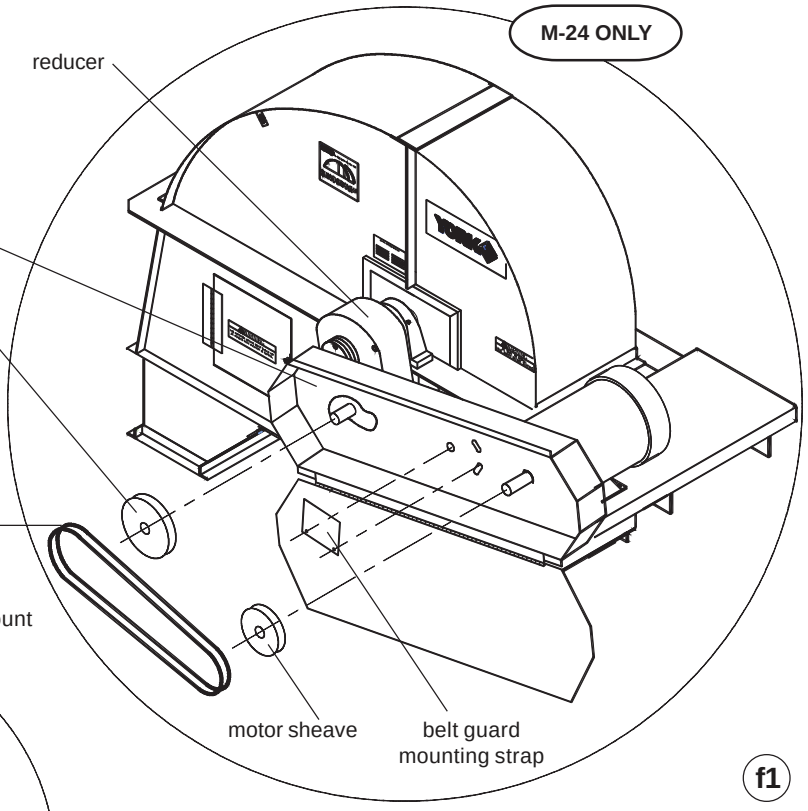
ADD THE SUPPORT BRACKET AND ANGLES.



ADD THE SUPPORT BRACKET AND ANGLES.



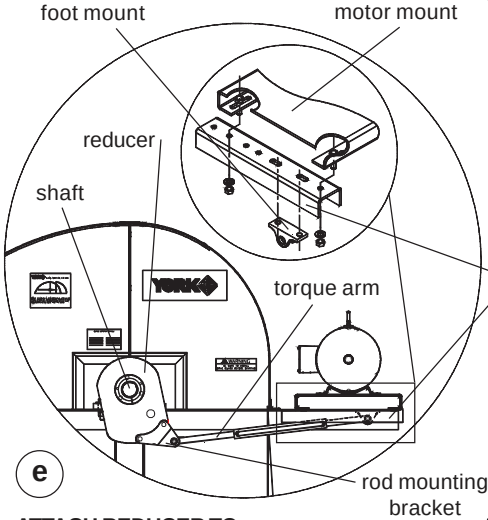
ATTACH THE TORQUE ARM BRACKET



f1

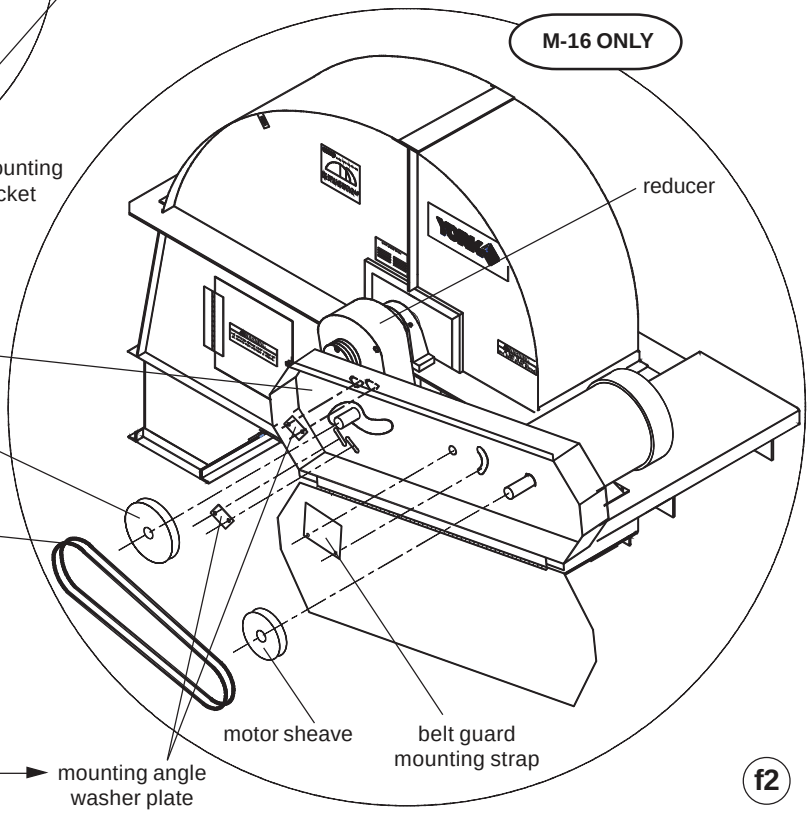
ADD REST OF GUARD ASSEMBLY

NOTE: The location where the torque arm foot mount attaches to the torque arm bracket may vary depending on the size of reducer.



e

ATTACH REDUCER TO HEAD ASSEMBLY



f2

ADD REST OF GUARD ASSEMBLY

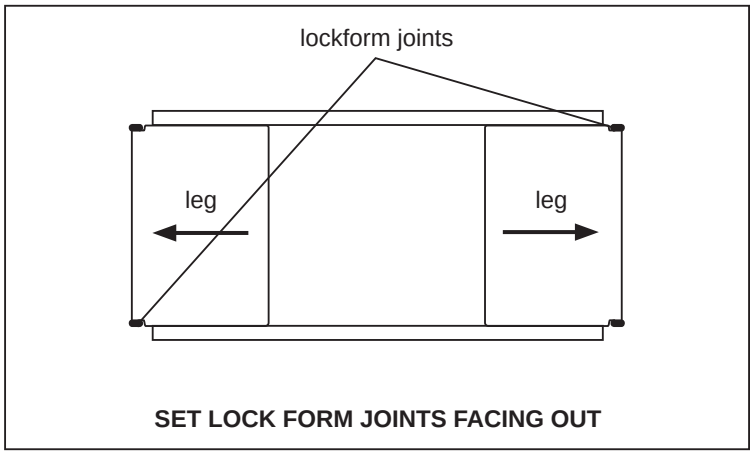
NOTE: This plate may be located in (1) of the (2) positions shown depending on the size of reducer. → mounting angle washer plate

Legs Position

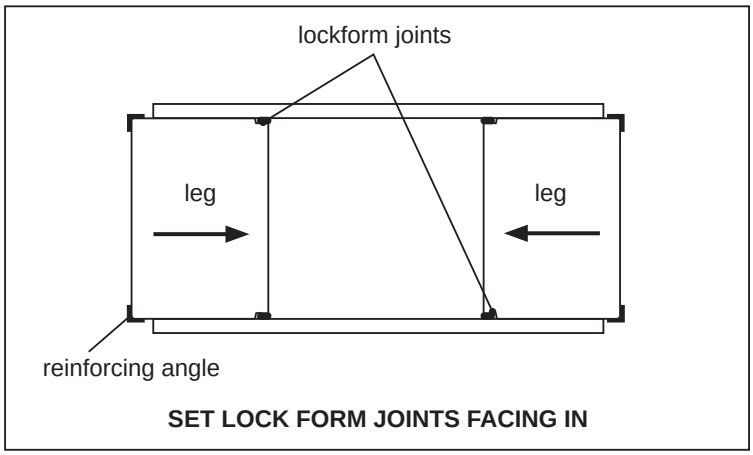
5

position elevator legs correctly

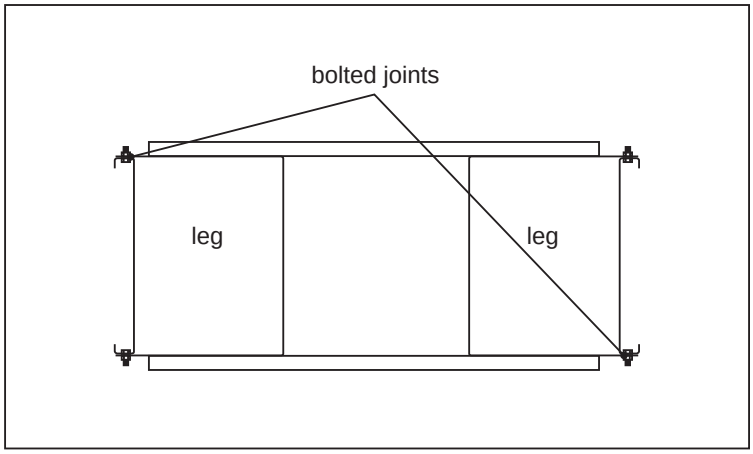
Make certain the legs are properly positioned throughout the complete assembly of this bucket elevator (as shown in the examples at right).



a **LEGS WITH NO REINFORCING ANGLES**



b **LEGS WITH REINFORCING ANGLES**



c **BOLTED LEGS**

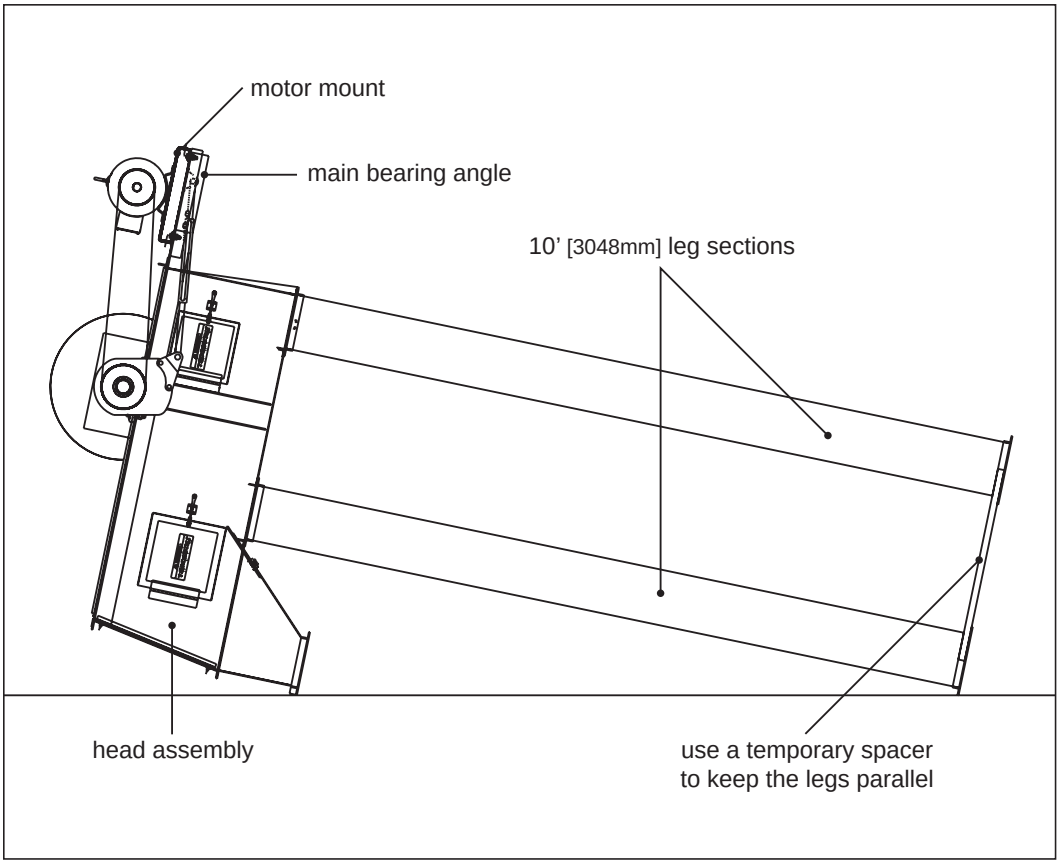
Install the First Legs

6

install the first (2) leg sections

Tip the head assembly toward the front so that the motor mount is up in the air (example a) and install (2) 10’ [3048mm] leg sections to the head. Install the upper ladder bracket to the main bearing angle on the side opposite the drive (example b, the next page).

NOTE: Make certain the legs are properly positioned here as well as throughout the rest of the assembly. See the previous page.



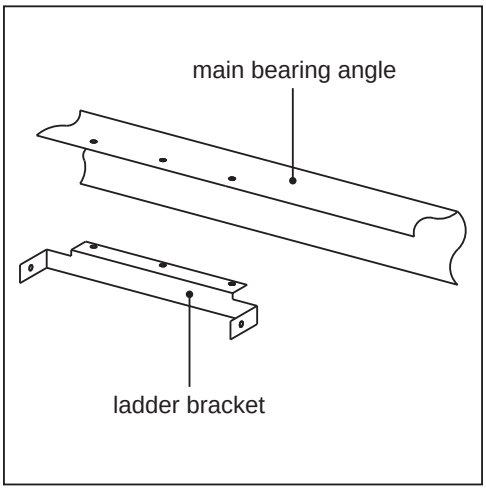
a **TIP THE HEAD ASSEMBLY WITH THE MOTOR MOUNT STICKING UP**

Work Platform

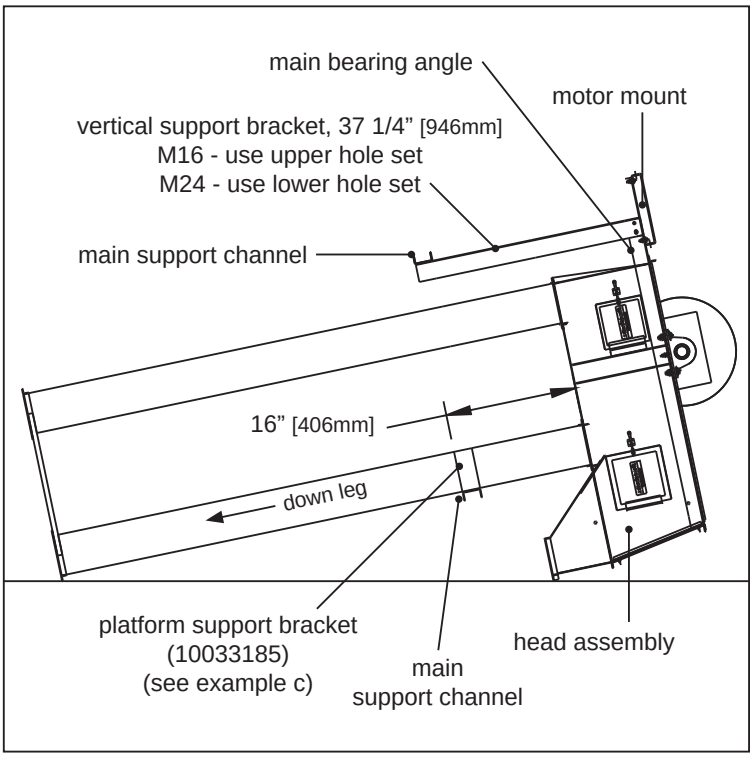
7

vertical channels & support bracket

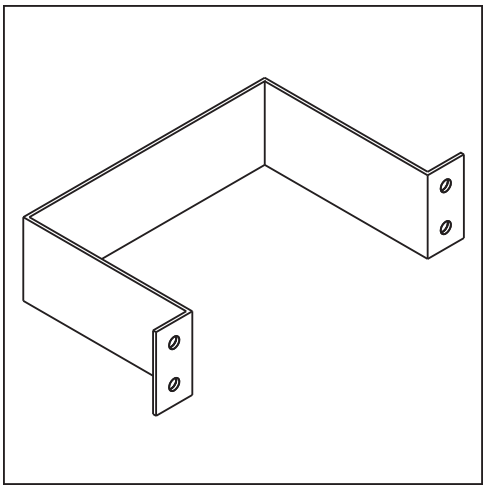
Install the vertical support bracket to the main bearing angles and the platform support bracket to the down leg in the position indicated in examples a - d. Bolt the main support channels to these brackets.



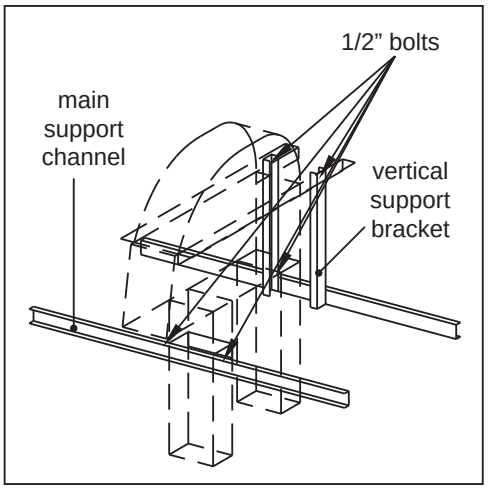
a **INSTALL THE LADDER BRACKET**



b **INSTALL PLATFORM SUPPORT BRACKETS AND CHANNELS**



c **PLATFORM SUPPORT BRACKET**

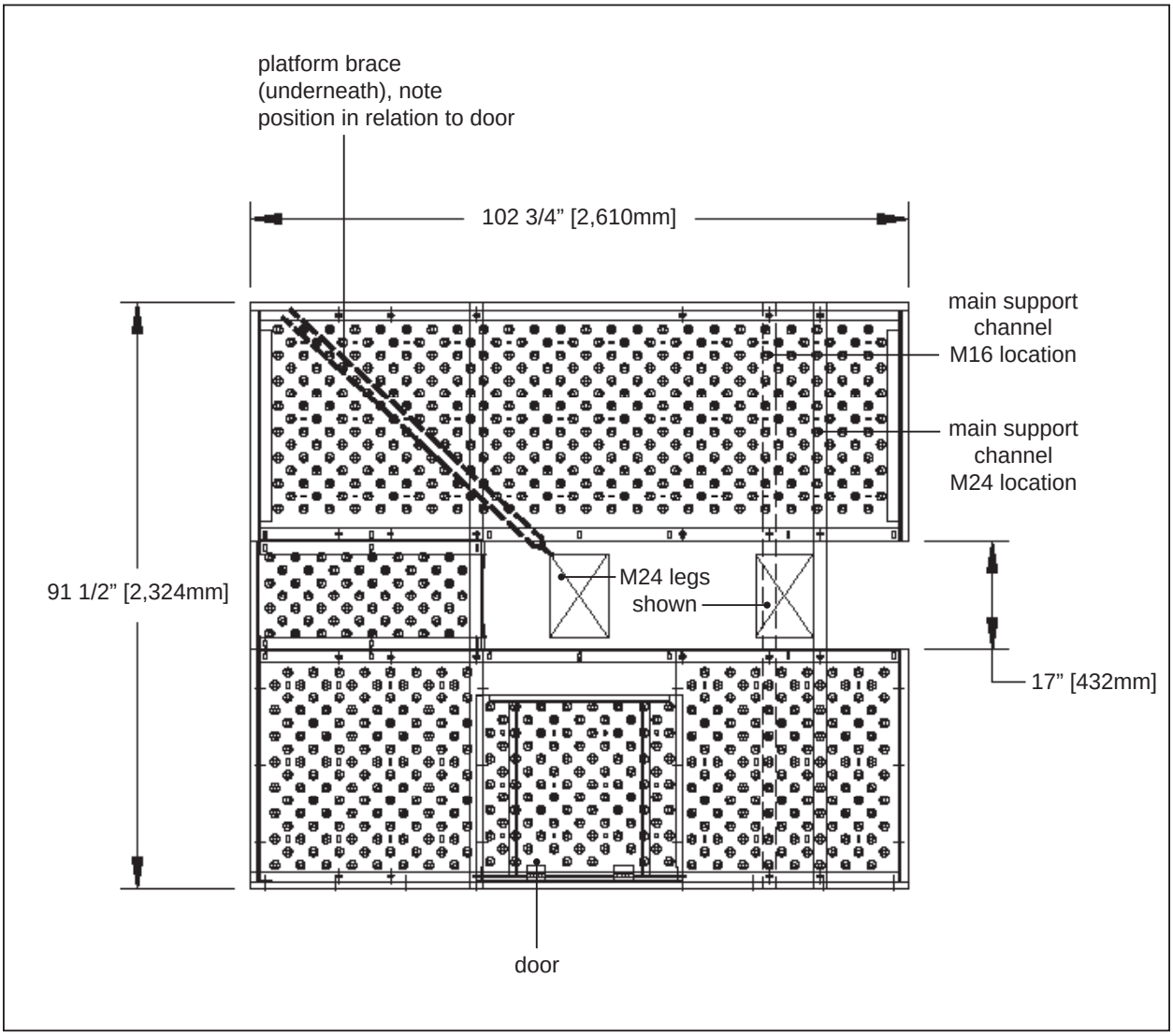


d **INSTALL MAIN SUPPORT CHANNELS WITH 1/2” BOLTS**

8

assemble the work platform

Assemble the basic platform on a flat surface (example a and example a on the next page). Make certain the unit is square and tighten all bolts.

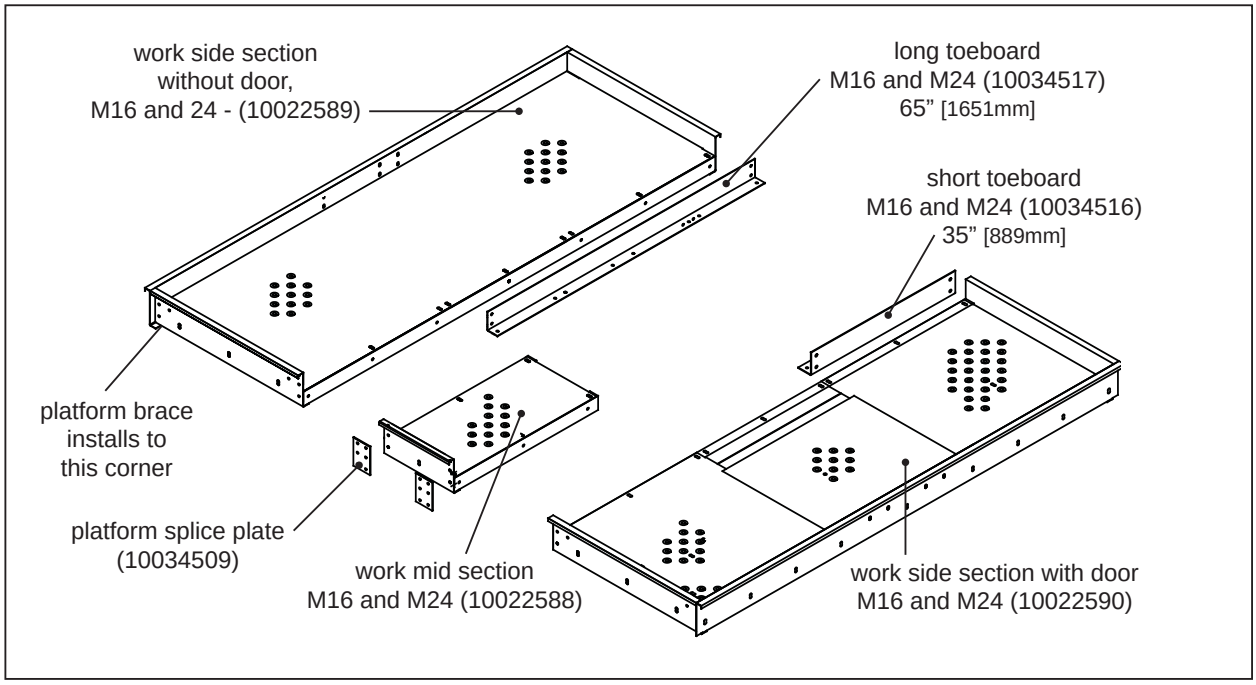


a **M16 AND M24 WORK PLATFORM DIMENSIONS**

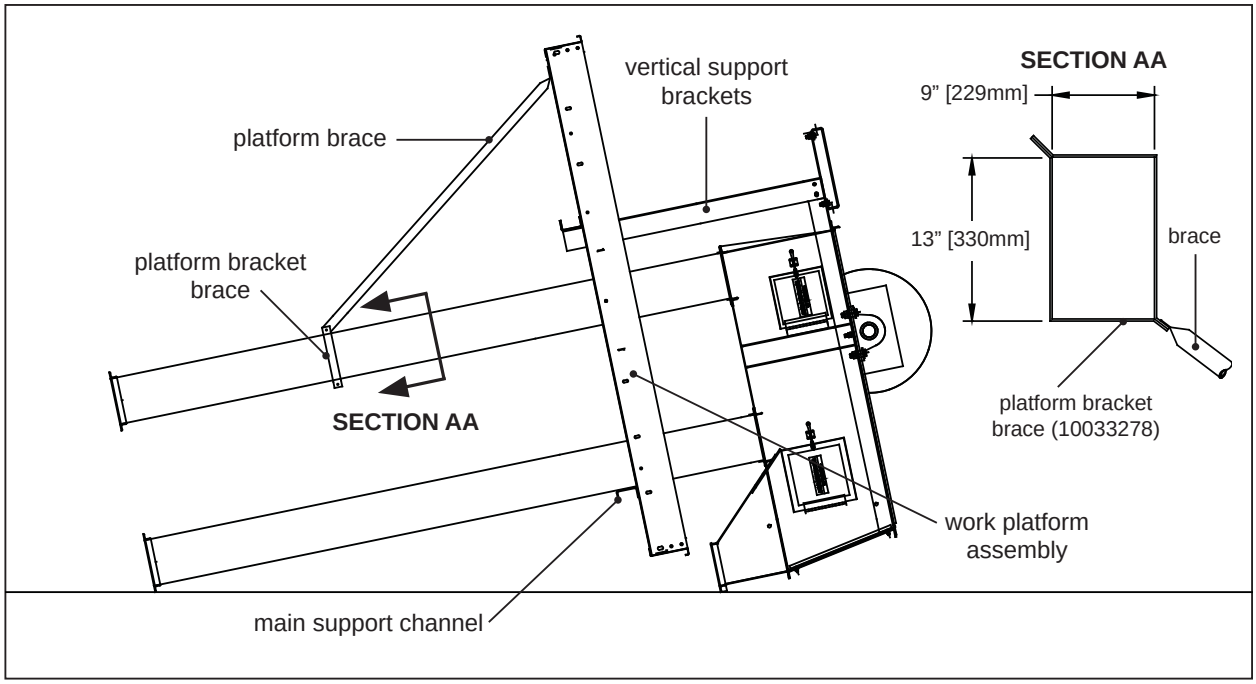
9

install the work platform

Lift the platform and slide it over the legs. Install it to the main support channels (example b). Install the platform brace to the corner on the side opposite the door (examples a - b).



a **ASSEMBLE THE WORK PLATFORM**



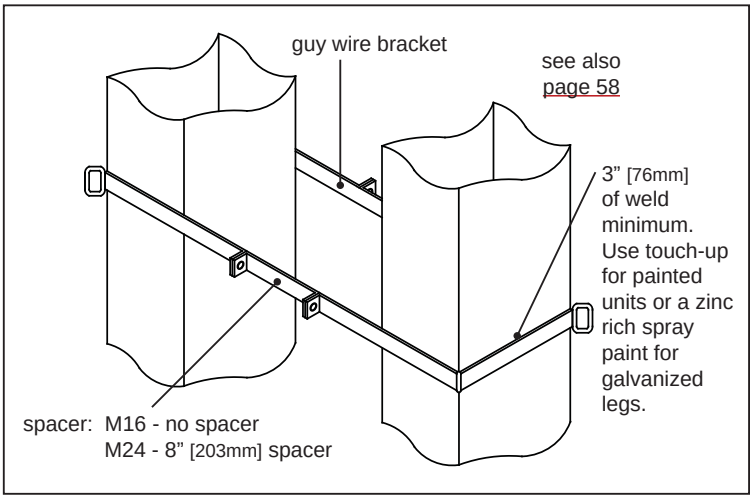
b **INSTALL THE WORK PLATFORM AND THE PLATFORM BRACE**

NOTE: Welding the guy wire bracket to the leg section will make the connection more secure at this location!

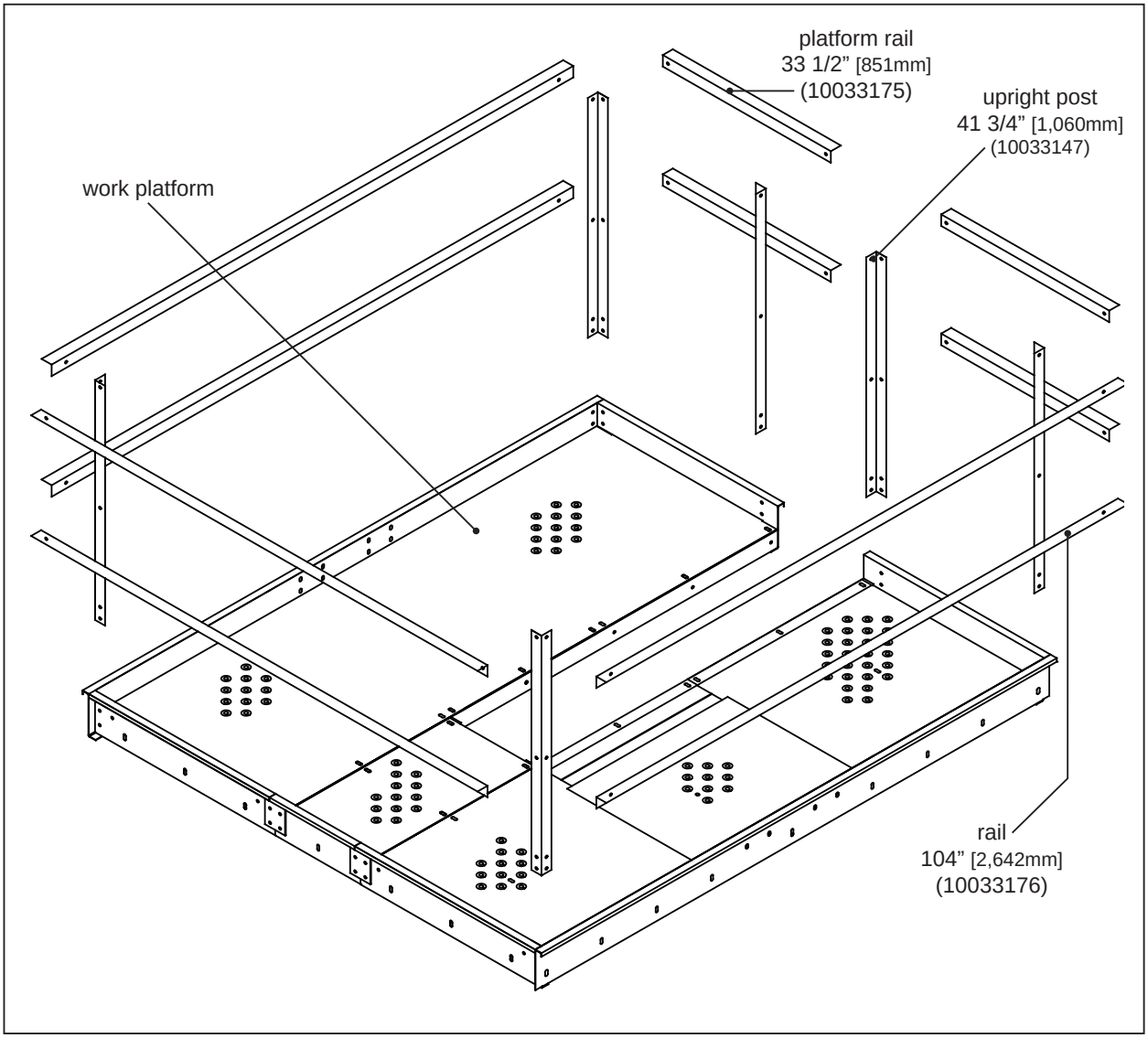
10

add the hand rails & guy wire bracket

Install posts and hand rails to the platform. **Securely tighten all platform bolts!** Fasten the guy wire bracket approximately 8" [203mm] below the work platform channels (example a).



a **INSTALL THE GUY WIRE BRACKET**



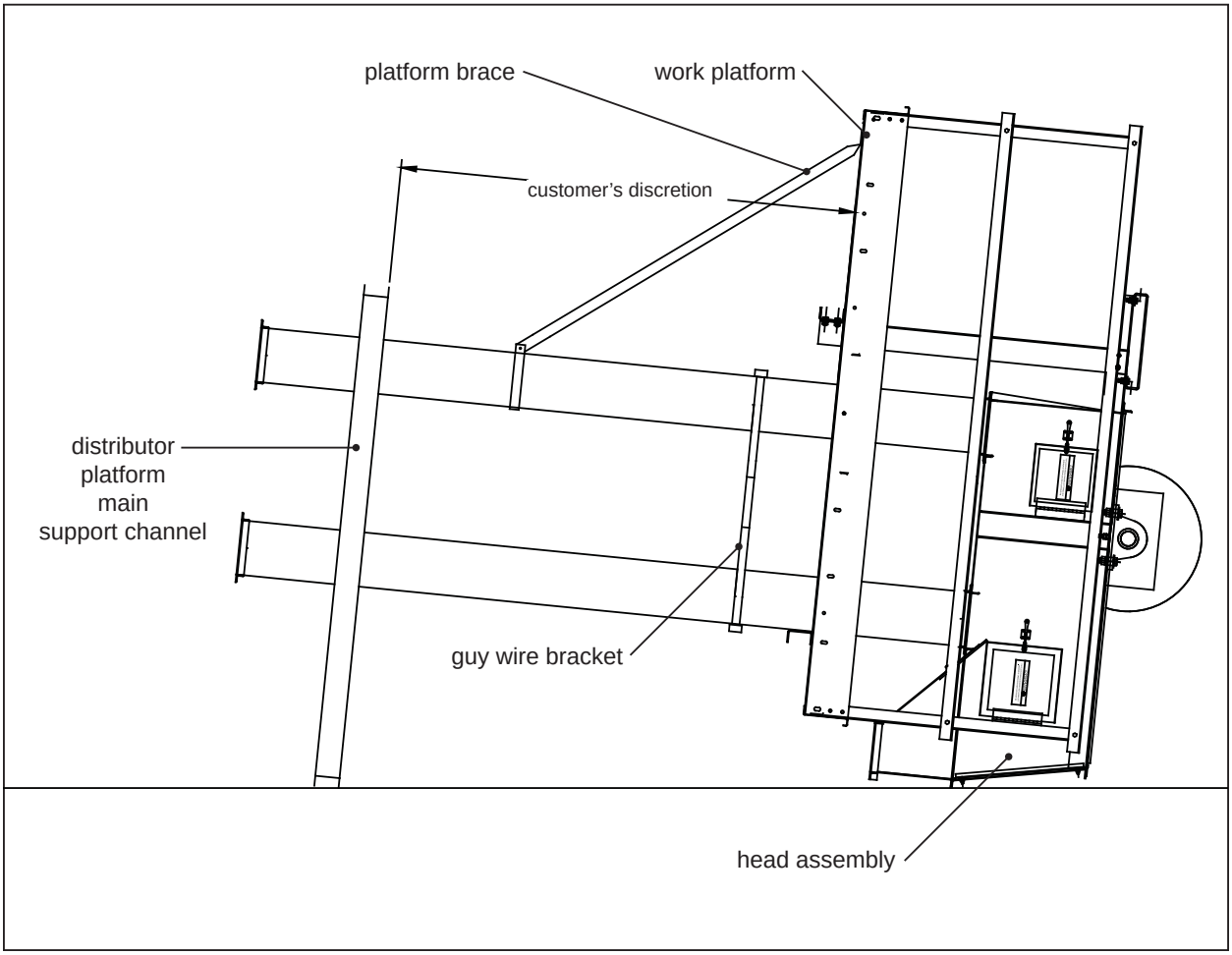
b **ASSEMBLE THE M16 AND M24 WORK PLATFORM RAILING**

Distributor Platform

11

distributor platform channels & brkts.

Bolt the distributor platform brackets and support channels to the legs at a point that allows easy access to work on the distributor and/or valving that may be supplied (example a and example a on the next page).



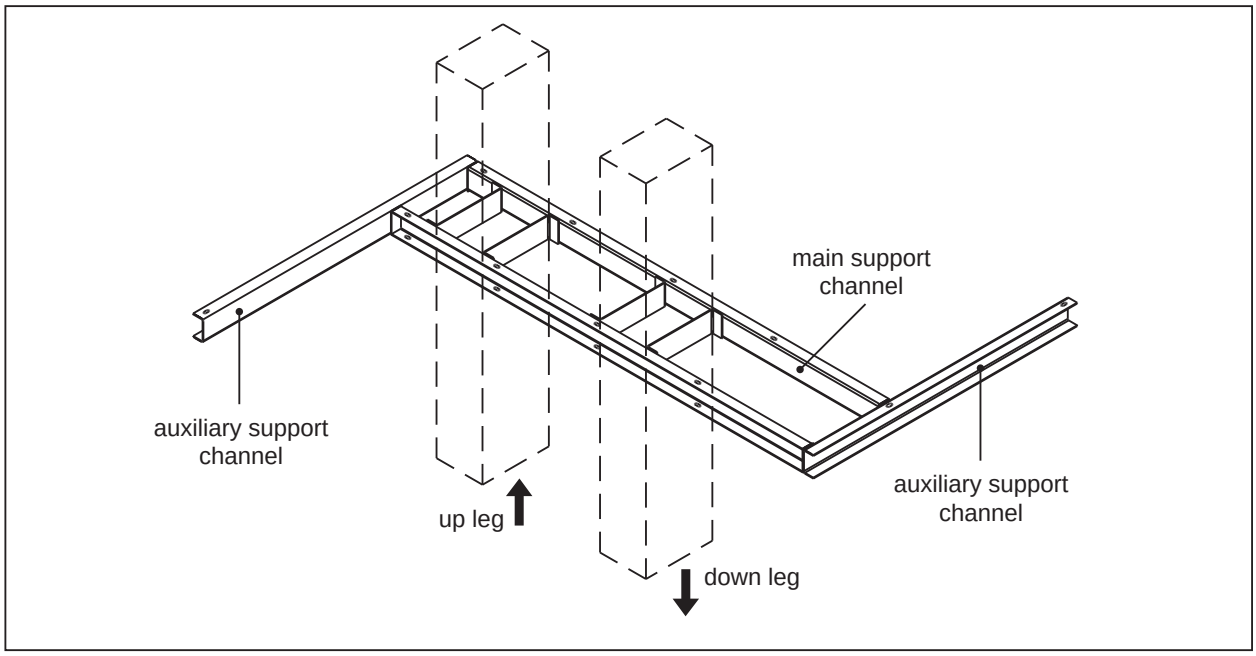
a **BOLT DISTRIBUTOR CHANNELS AND BRACKETS IN PLACE**

12

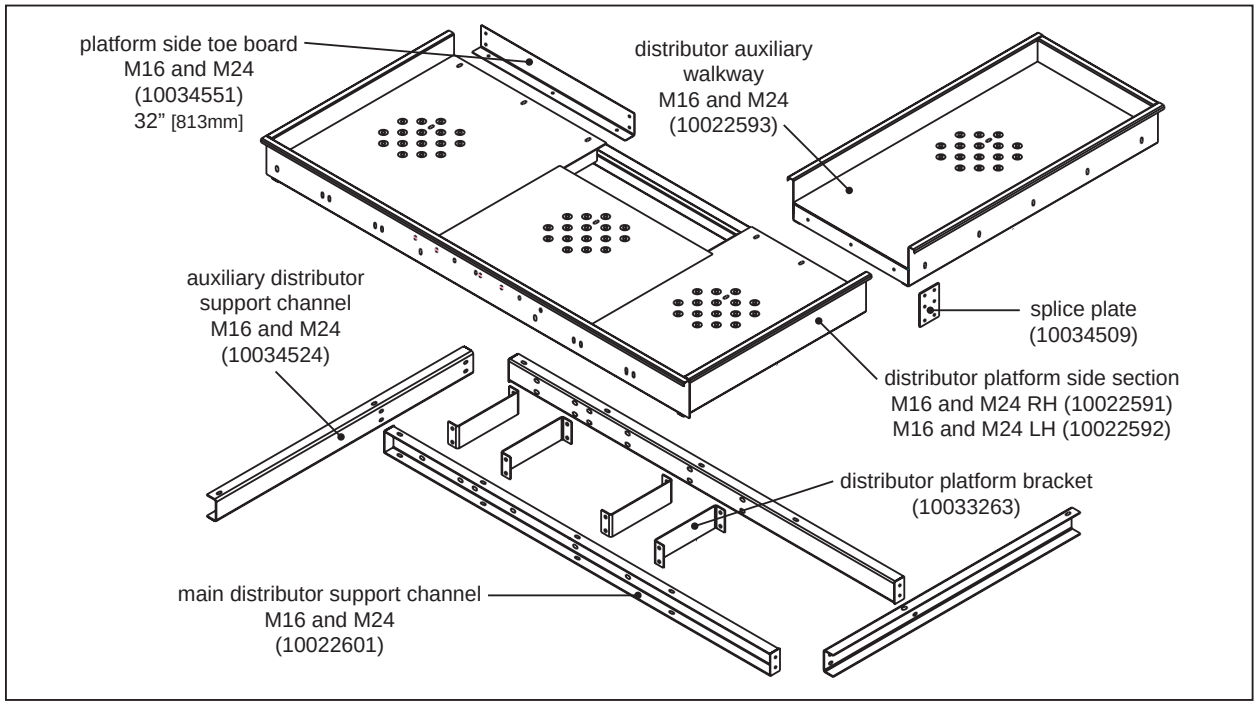
build the distributor platform

Put the distributor platform together by joining the parts in the manner shown in example c (the next page) and examples a - b. Make certain the unit is square and tighten all bolts.

NOTE: Components are shown for a right hand drive setup. Reverse for a left hand unit.



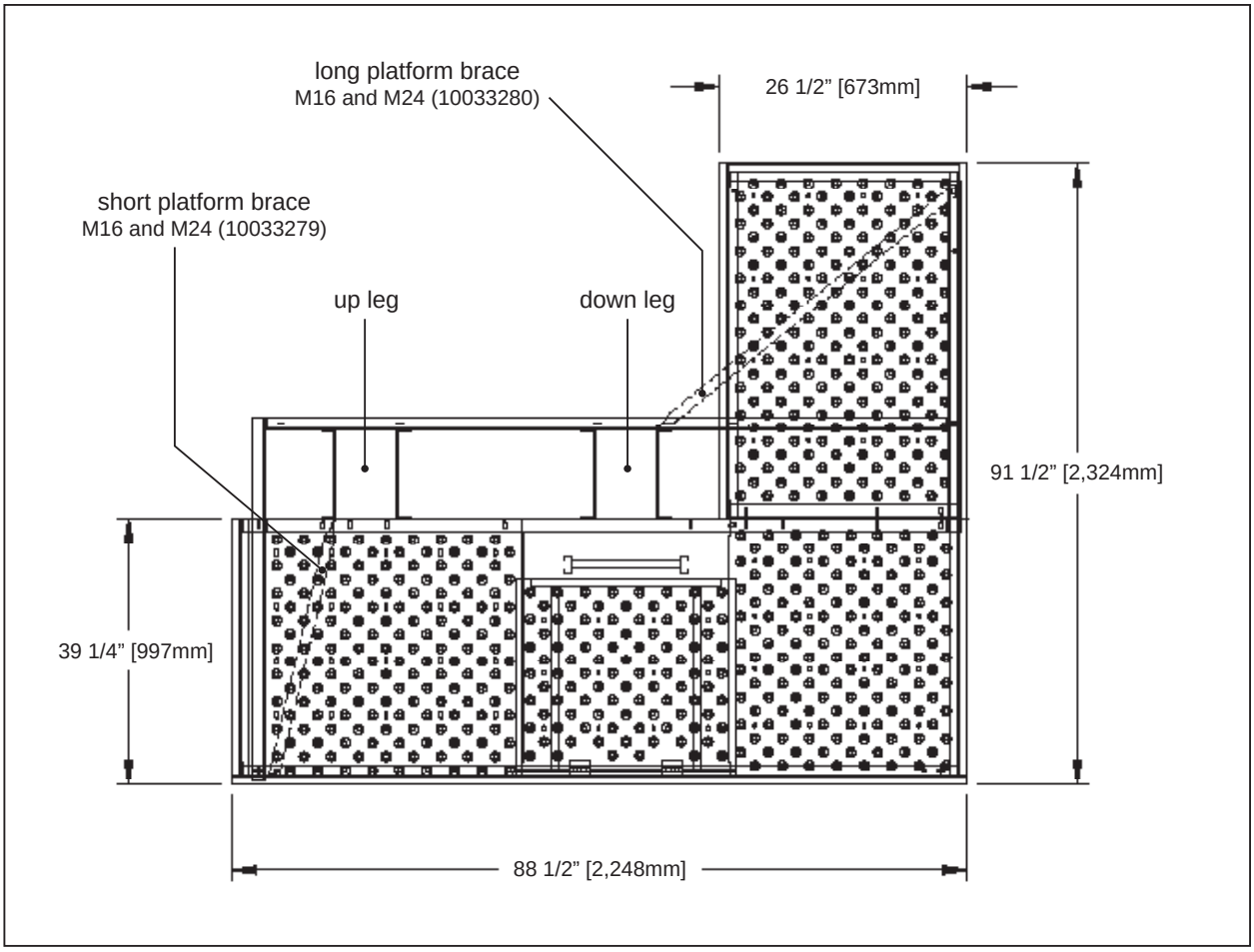
a **DISTRIBUTOR PLATFORM SUPPORTS DETAIL**



b **ASSEMBLE THE DISTRIBUTOR PLATFORM**

NOTE: Configuration shown is for a right hand drive setup. Reverse components for a left hand unit.

NOTE: Be certain to build the platform as shown on the previous page.



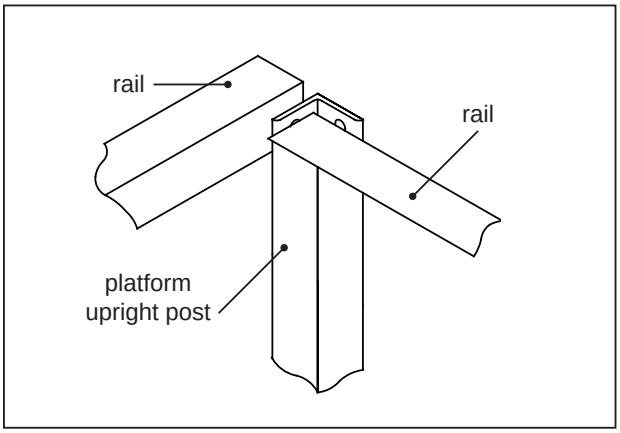
C **M16 AND M24 DISTRIBUTOR PLATFORM DIMENSIONS**

13

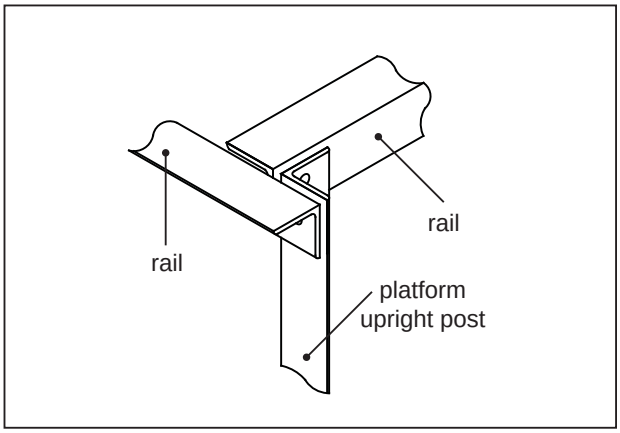
install posts, rails, and walk surface

Assemble the walkways to the support channels on the distributor platform (example c). Assemble posts and rails to the platform. Tighten all bolts.

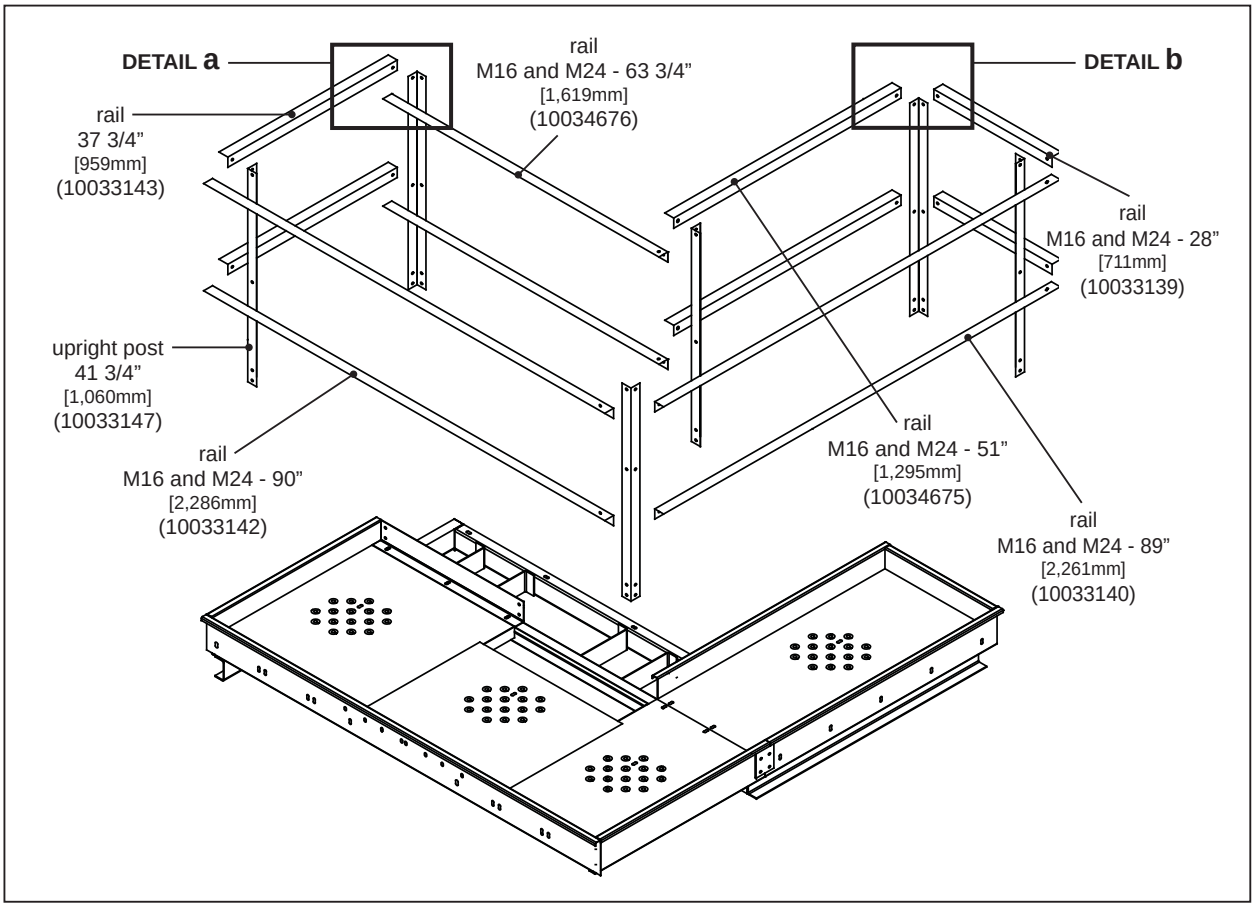
NOTE: The corner assembly in DETAIL b is not typical for the platform.



a **DETAIL a**



b **DETAIL b**



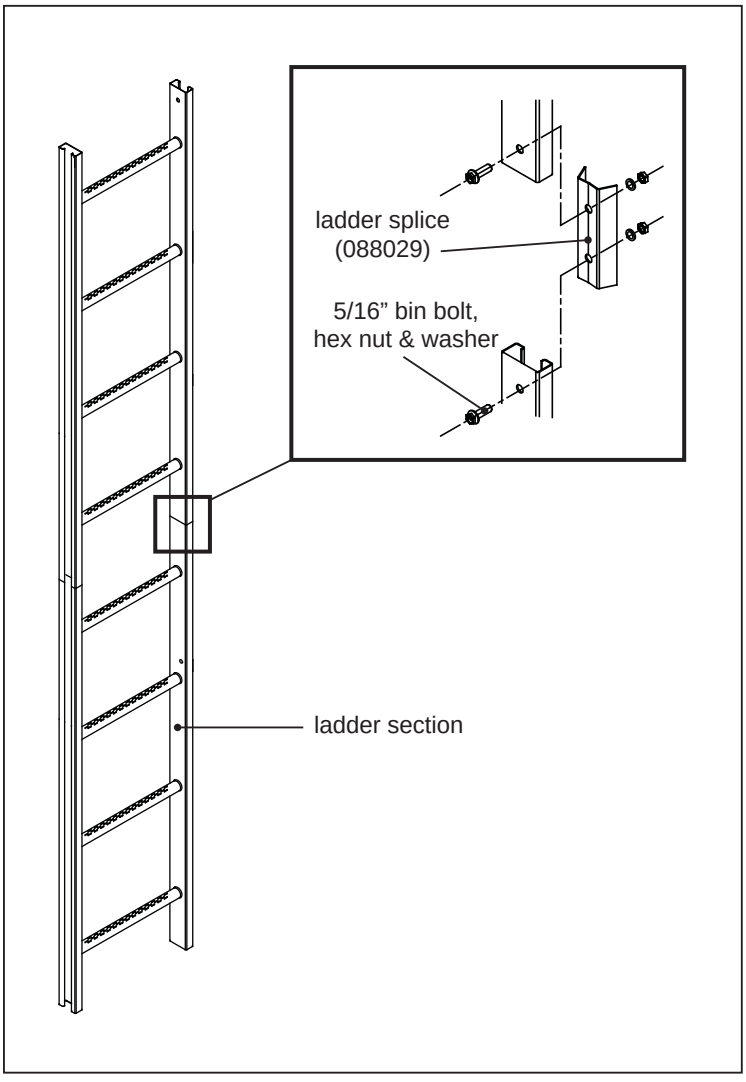
c **ASSEMBLE THE DISTRIBUTOR PLATFORM RAILING**

Ladders

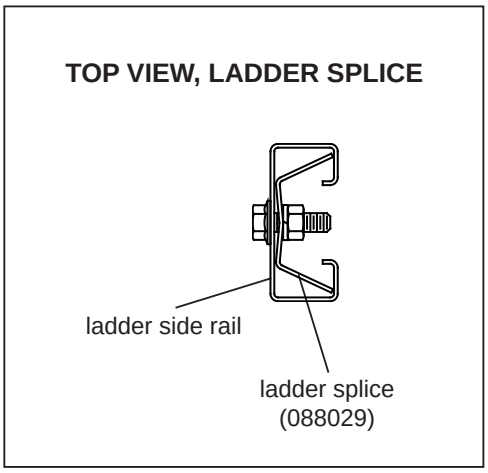
14

correctly install ladder clips and splices

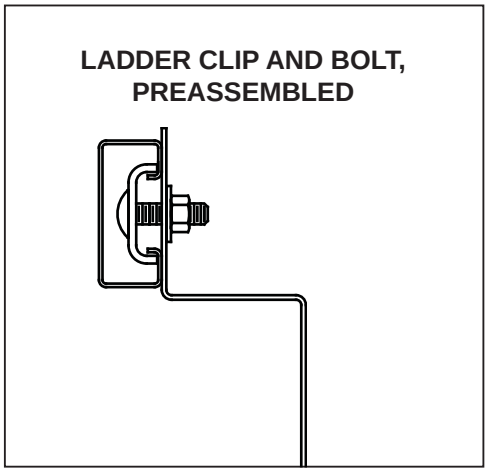
Before installing ladders, note how to correctly install ladder clips and splices. (examples a - g). Ladder splices are used to join ladder sections. Ladder clips are used to install ladder brackets and ladder cages to ladders. When installing the ladder be certain to follow all instructions regarding correct ladder bracket spacing and always **securely tighten all bolts!**



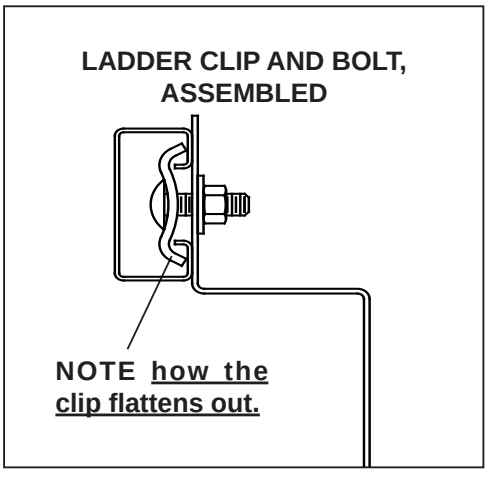
a LADDER CONNECTION ASSEMBLY



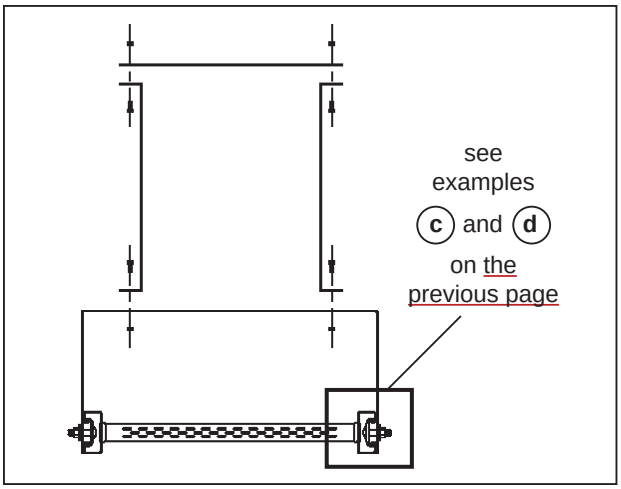
b TOP VIEW, LADDER SPLICE



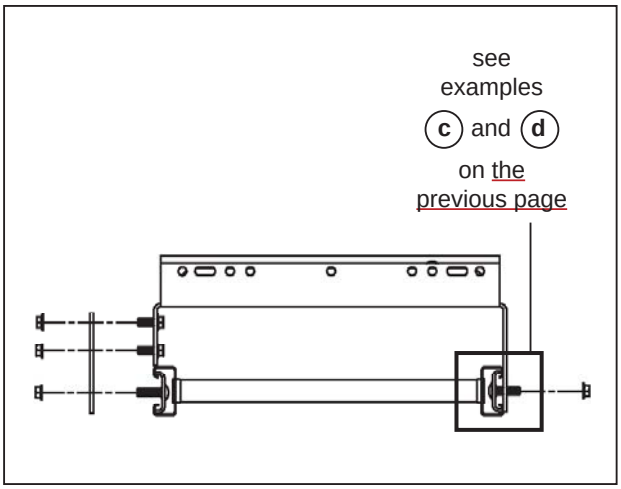
c TOP VIEW, LADDER CLIP AND BOLT



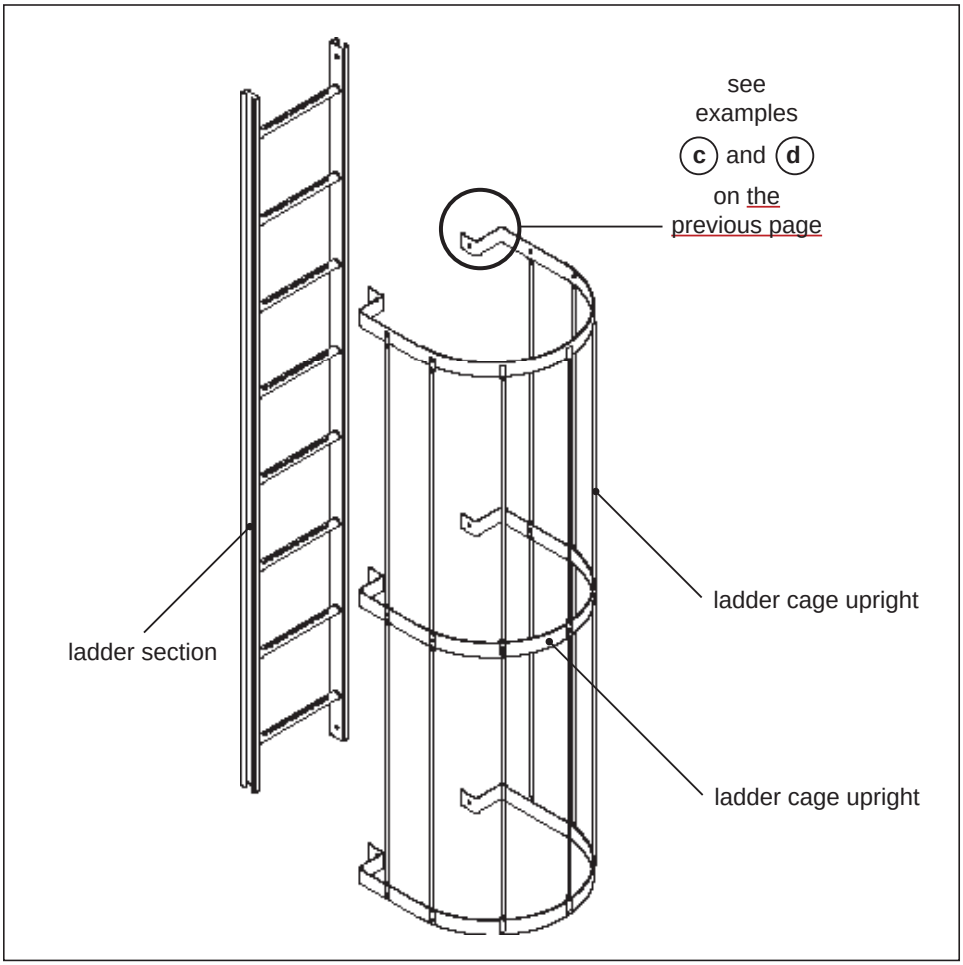
d TOP VIEW, LADDER CLIP AND BOLT



e LEG CASING LADDER BRACKET ASSEMBLY



f FLANGE LADDER BRACKET ASSEMBLY TOP VIEW



g LADDER WITH CAGE

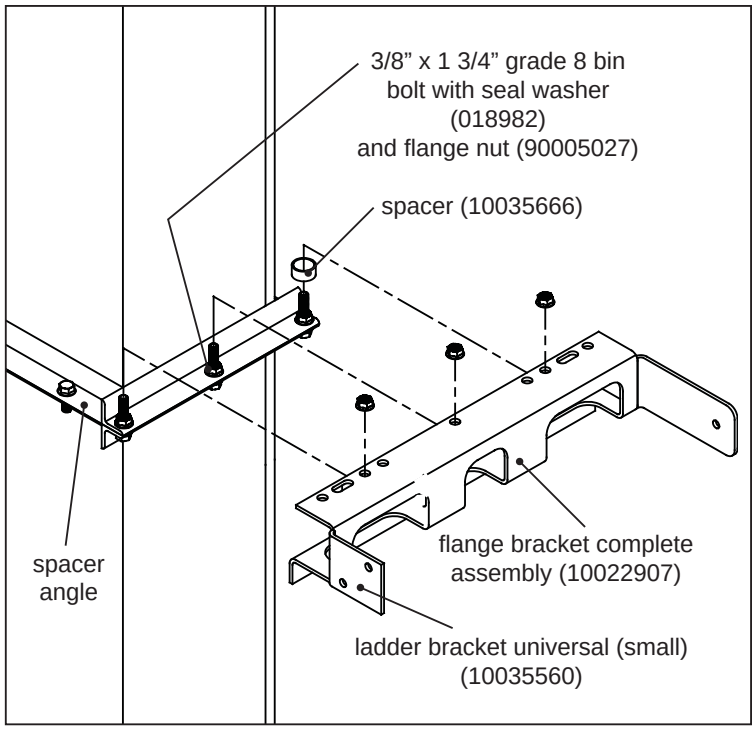
NOTE: OSHA Regulation -
Subpart D., Section 1910.27 (d) (iv) states in part: “Cages shall extend down the ladder to a point not less than seven (7’ feet [2135 mm]) nor more than eight (8’ feet [2438 mm]) above the base of the ladder.”

Securely tighten all bolts!

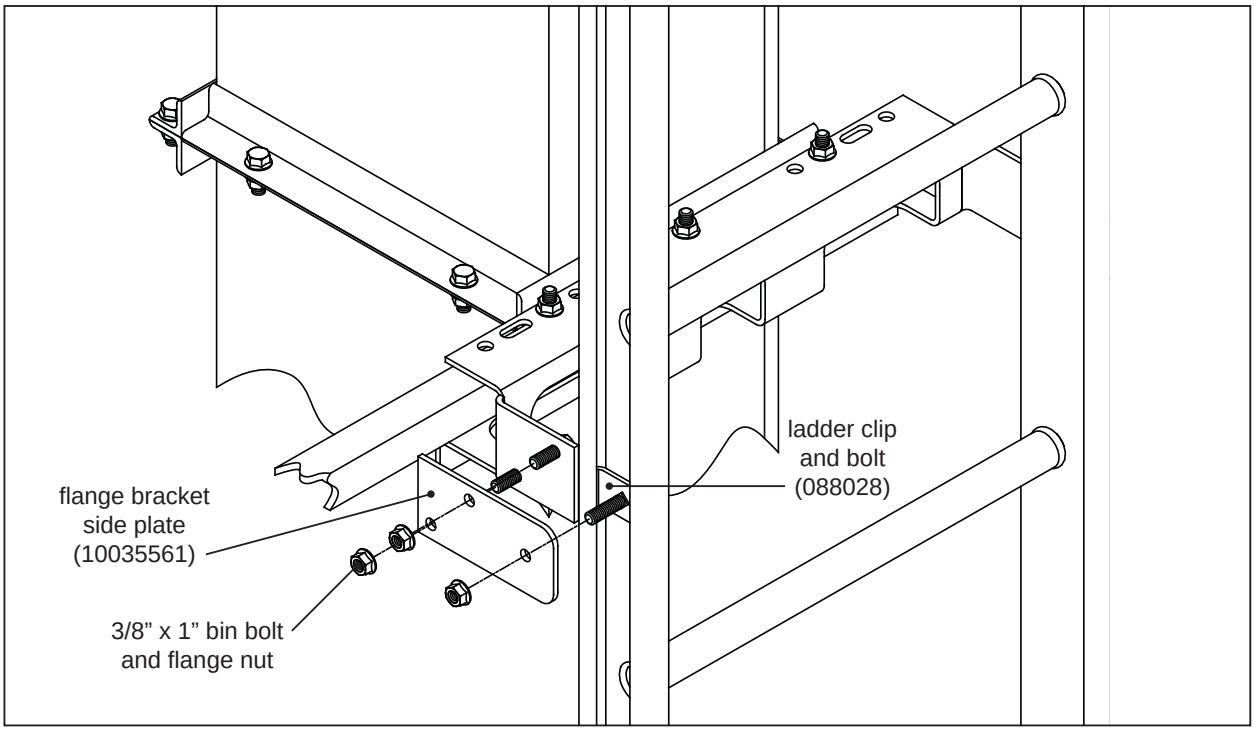
15

install ladders, flange ladder brackets

Where ladder brackets must be installed on the flanges, use the provided 3/8” x 1 3/4” bolts to secure the flange and spacer angle together. When adding the ladder bracket, install the included spacer on the end bolt. Align the ladder bracket over the bolts and secure with 3/8” flange nuts. When installing the ladder, place the bracket side plate, install a ladder clip and bolt, then fasten to the ladder bracket using 3/8” x 1” bolts and flange nuts. (see the example below).



a

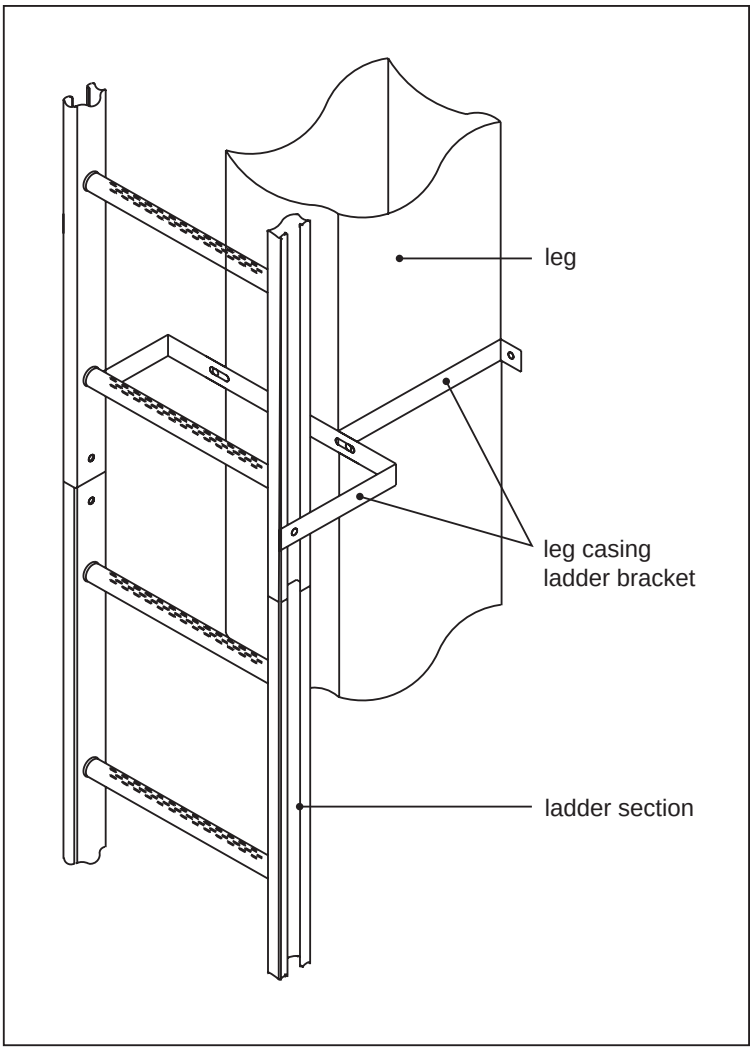


b **LADDER CLIP AND BOLT AND BRACKET SIDE PLATE INSTALLATION**

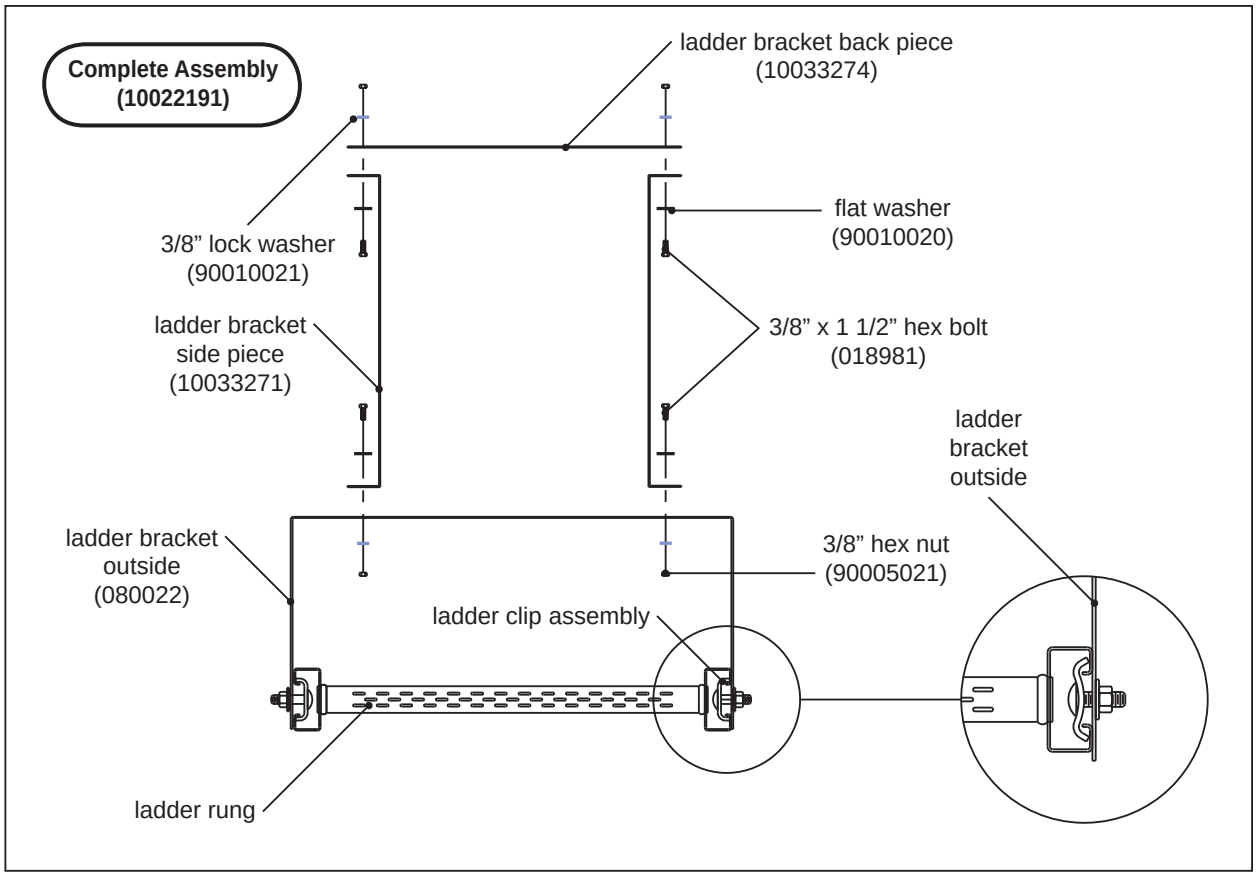
16

leg casing ladder bracket installation

Continue installing the ladders to the elevator legs (examples a - b on the previous page, example b on the next page, and the examples on page 54). Follow all ladder instructions and examples given on pages 49 - 55 when installing ladders. Your elevator should come with at least (1) ladder bracket assembly per every 10' [3048mm] of ladder. There should also be (1) extra ladder bracket for the work platform, and (1) extra for the distributor platform and (1) extra for the complete elevator. Install ladders to each stackable leg section before stacking your elevator. (See page 59 to view an example of a stackable leg section.) **See the stacking drawing sent with your order acknowledgement as individual elevators are stacked differently!**

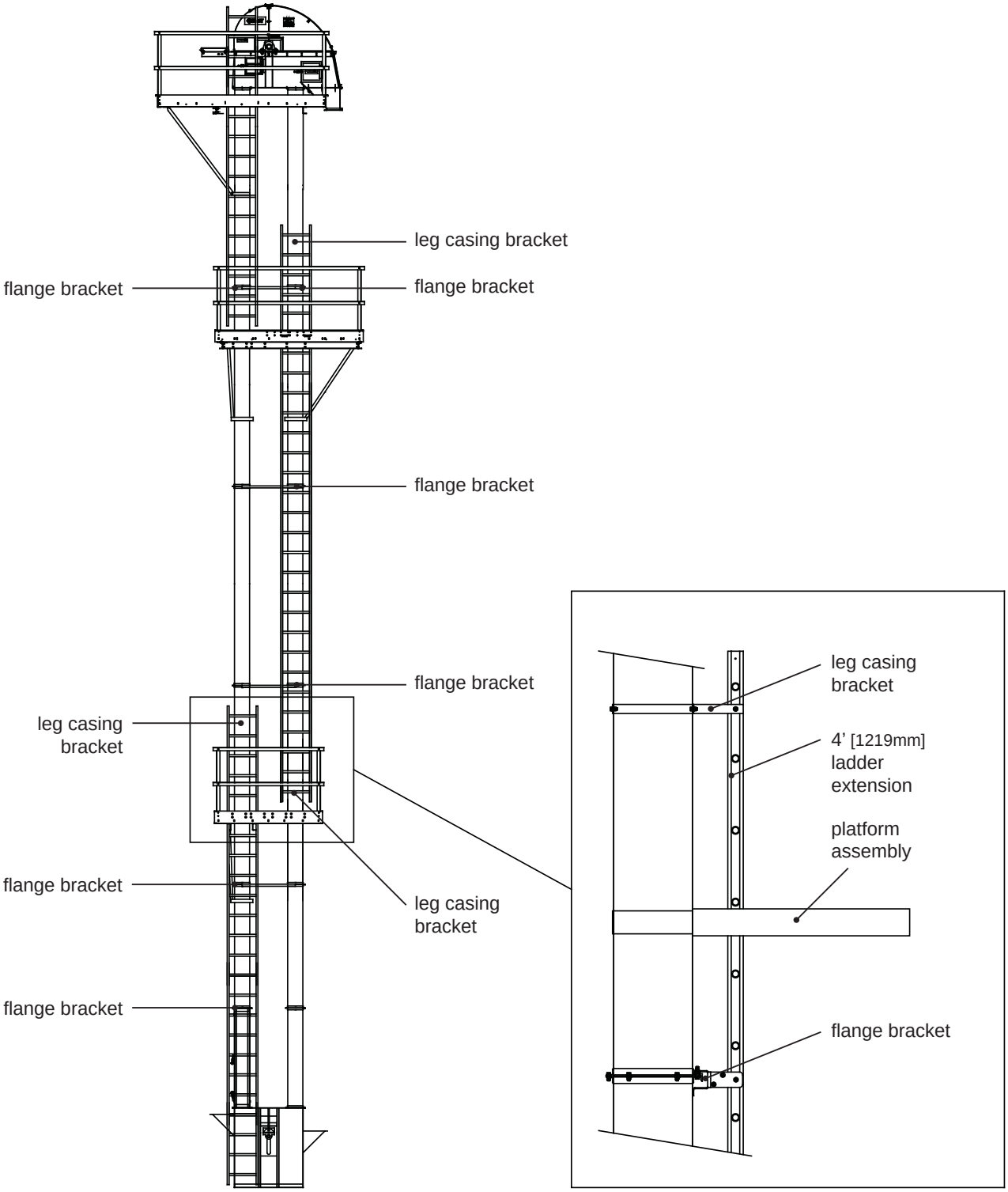


a **LEG CASING LADDER BRACKET INSTALLATION**



b **LEG CASING LADDER BRACKET ASSEMBLY TOP VIEW**

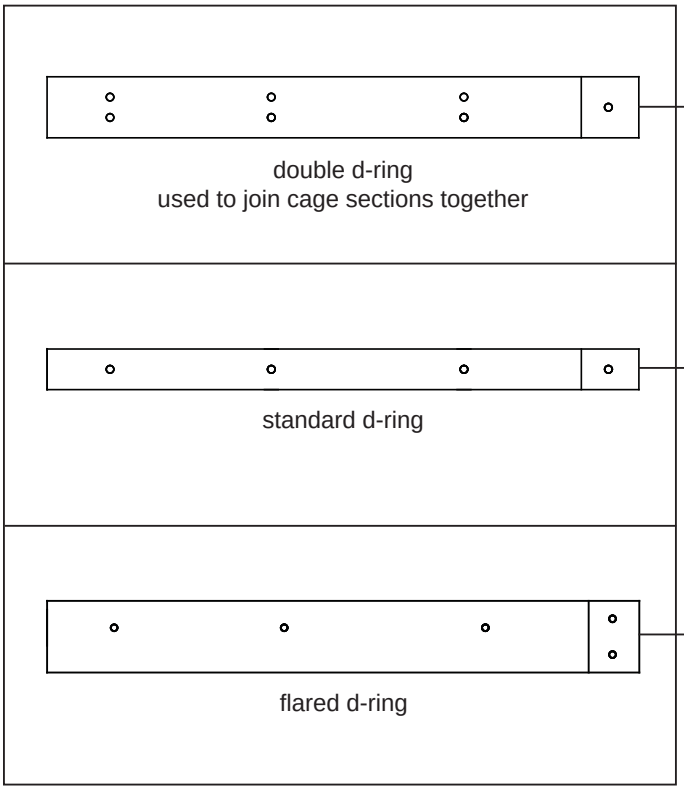
WARNING! Install leg casing brackets where necessary to secure ladder for safe ascension and descension, or at customer's discretion where desired.



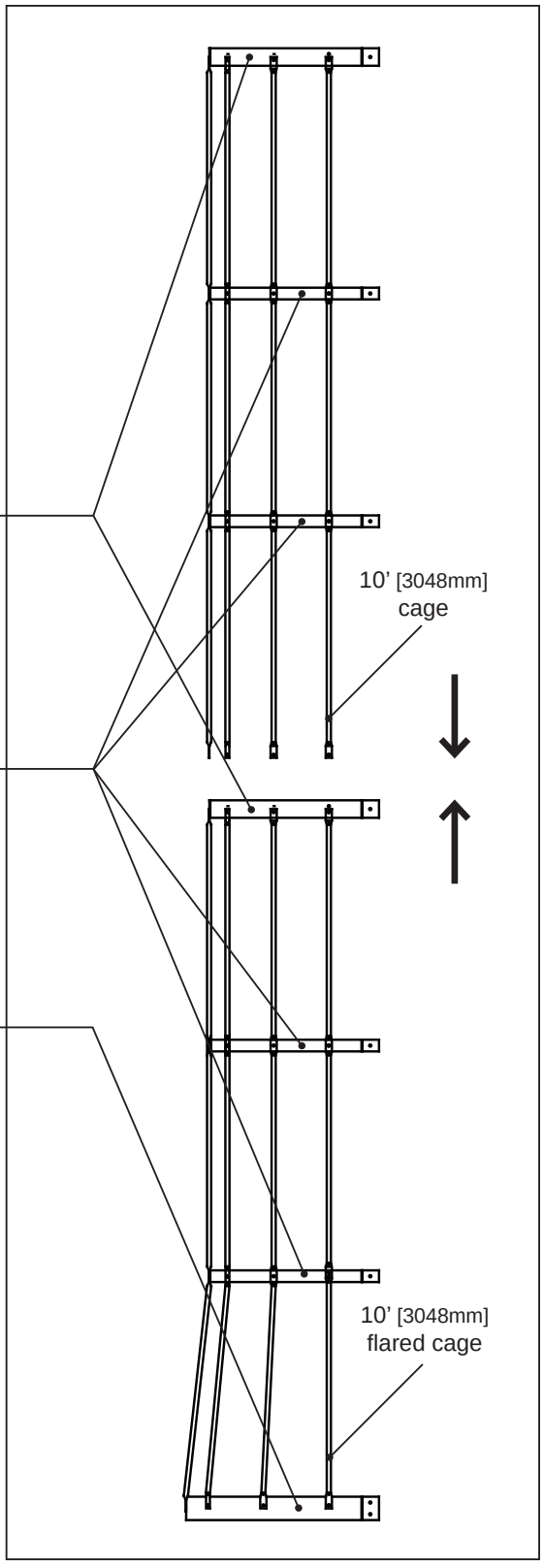
17

install ladder cages

Assemble the ladder cages as shown in the examples on this page and pages 49 - 50.



a **STANDARD, DOUBLE, AND FLARED D-RINGS**



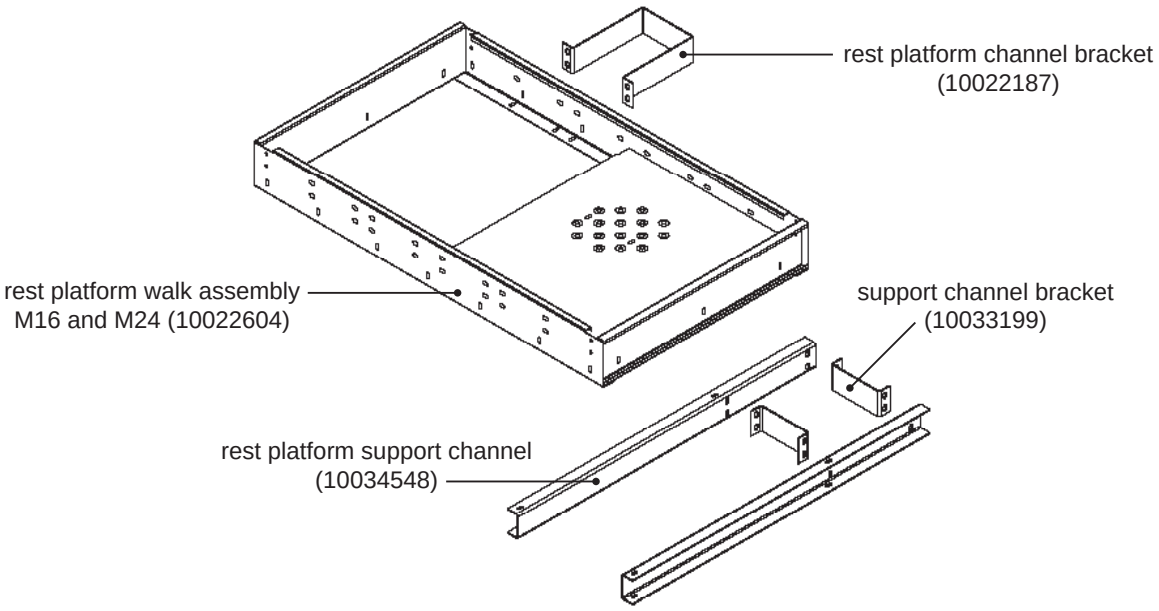
b **TYPICAL CAGE ASSEMBLY**

Rest Platform

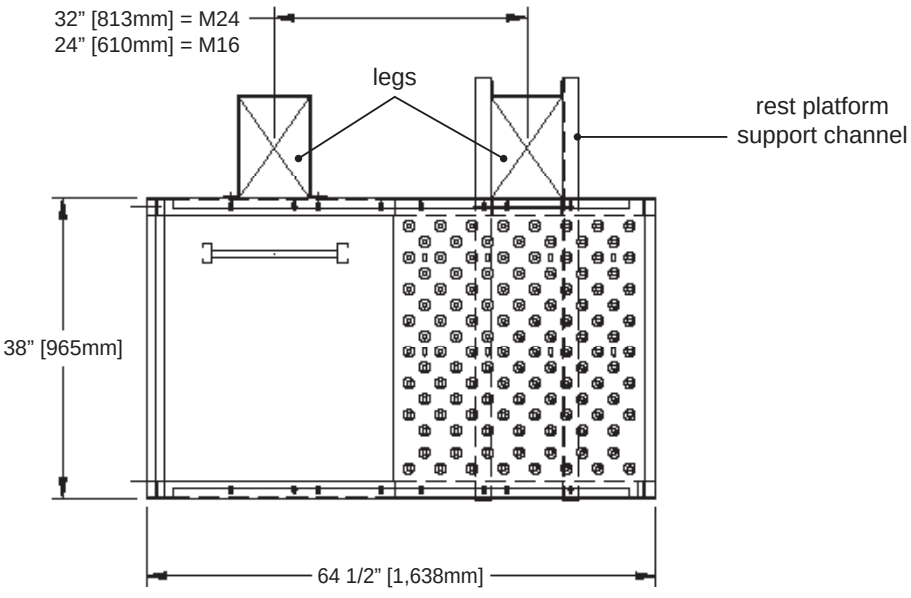
18

install the rest platform surface

Assemble the basic rest platform on a flat surface (examples a and b). Make certain the unit is square and tighten all bolts. Install the rest platform(s) to the legs at predesignated locations for each leg it installs to (example b). See page 23.



a **INSTALL BRACKETS AND CHANNELS TO THE REST PLATFORM**

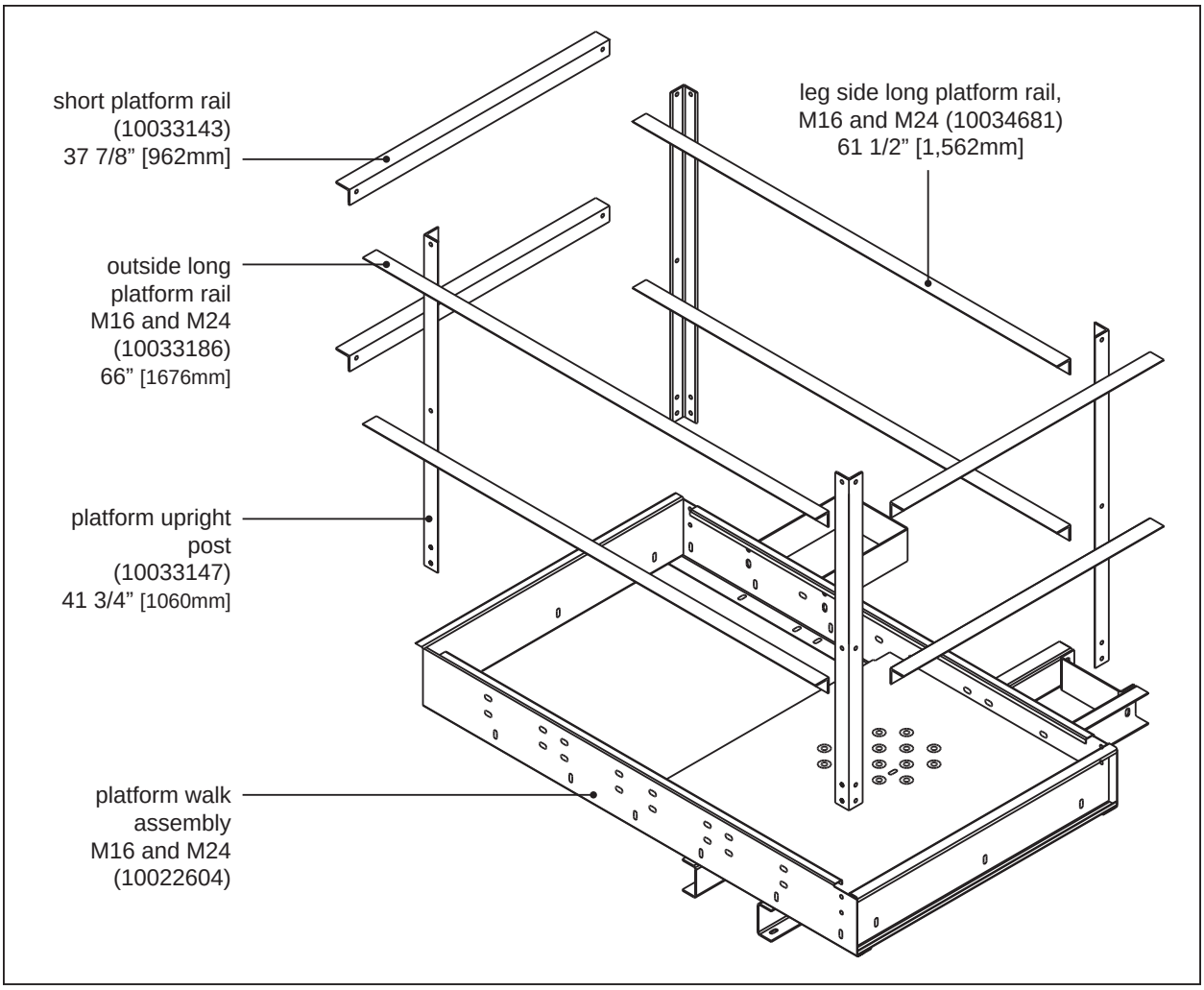


b **PLATFORM DIMENSIONS**

19

install rest platform handrails & posts

Install the posts and hand rails to the platform (example a). **Securely tighten all bolts on the platform.**



a **ASSEMBLE THE REST PLATFORM RAILING**

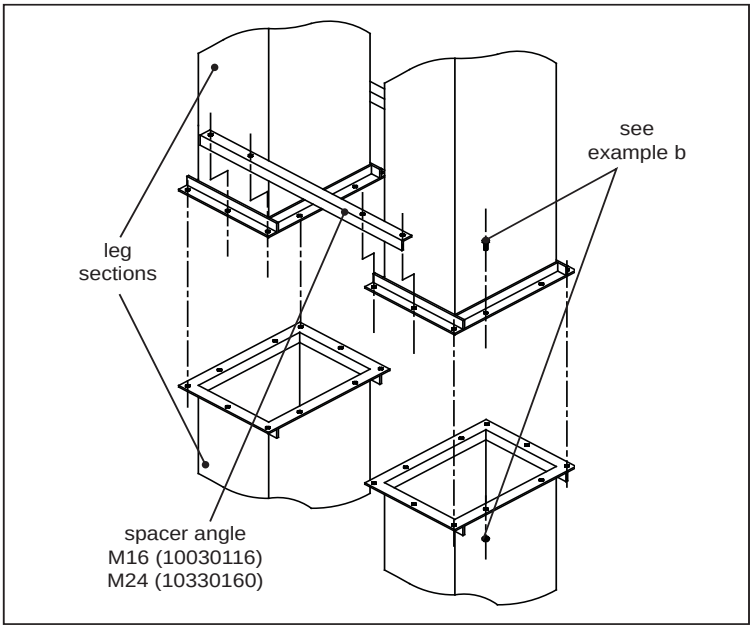
Stackable Leg Sections

20

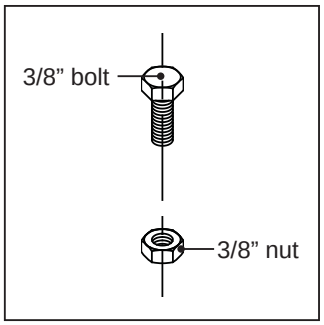
make stackable leg sections

Follow the stacking drawing for your elevator (the plans sent with the order acknowledgement). Refer to this stacking plan and start connecting leg to leg (example a) to build the pre-planned stackable leg sections.

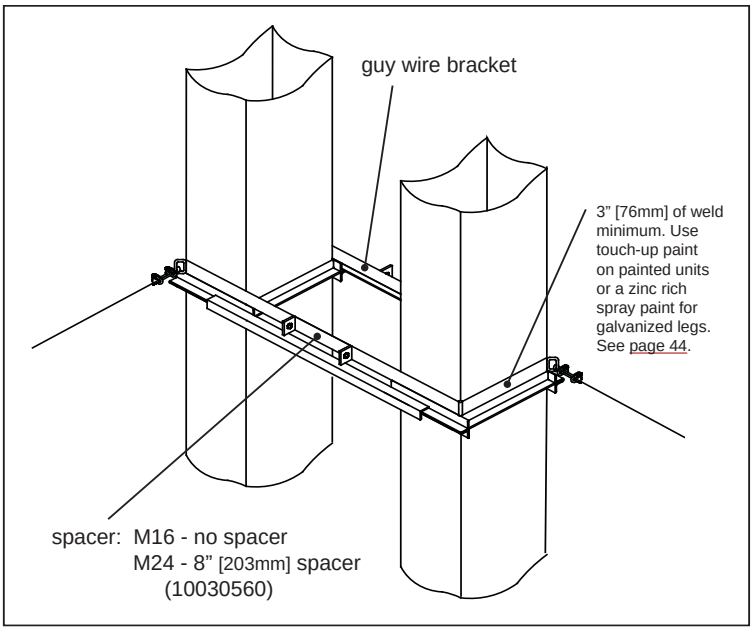
NOTE: Use a bead of caulking at all flange connections including the leg-to-boot connection.



a **CONNECT LEG SECTIONS**



b **TYPICAL, ALL HOLES**



c **TYPICAL GUY WIRE BRACKET INSTALLATION**

Note: Read this note before lifting sections as shown on the next page. Most contractors use this procedure: Lift the uppermost assembly section by looping a nylon choker or other strapping device around the shaft. Wire or install the head cover to the work platform when lifting the uppermost assembly section. This will eliminate a separate lifting of the head cover.

NOTE: If elevator sits in a pit, guying starts approximately 20' [6096mm] above grade.

21

install guy wire brackets

Follow the stacking drawing for your elevator and pages 25 - 27 to place guy wire brackets at preplanned leg connections (example c, the previous page). Remember: When completed, the elevator should have (1) guy wire bracket per every 20' [6096mm] (or less) of leg section.

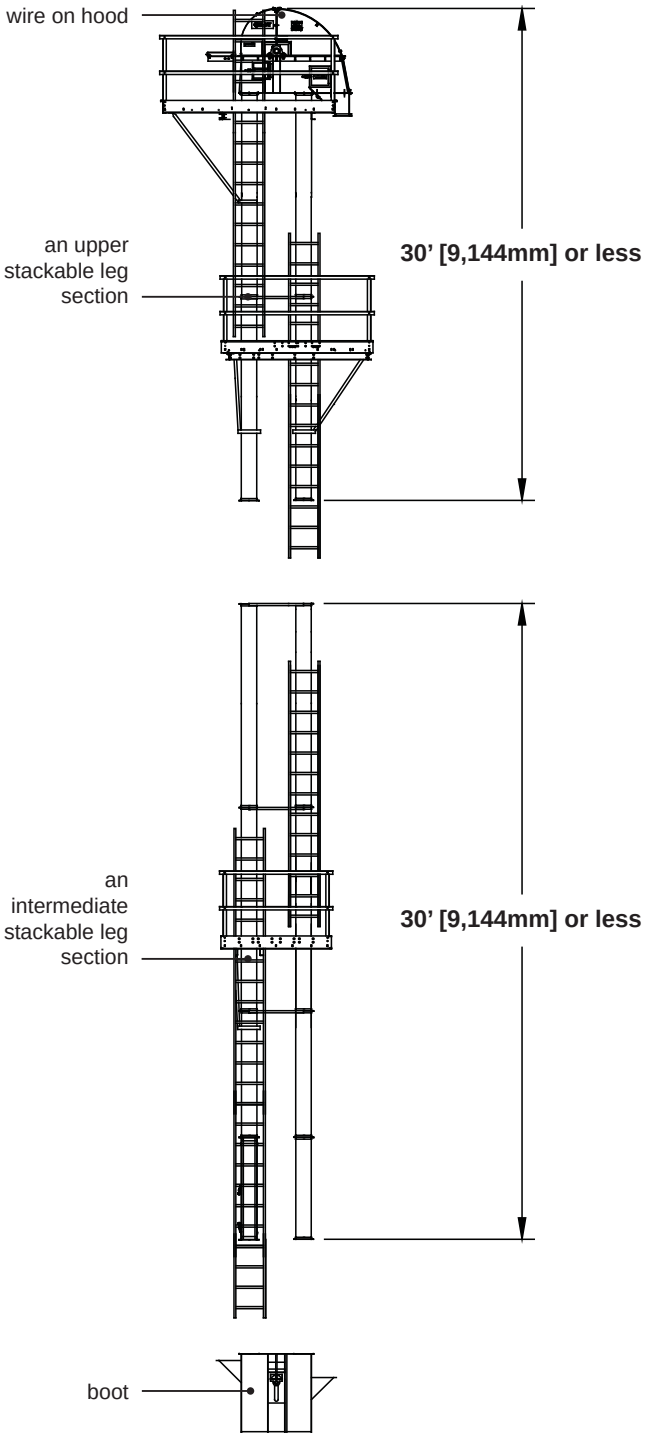
22

install stackable leg sections

Follow the stacking drawing sent with the order acknowledgement. Stack the stackable leg sections which are now assembled. Set (1) on another until the complete basic elevator assembly is (1) unit (example a). **See the important instructions on the next page that go with this step.**

Approx. Hoisting Weight - lb. [kg]

Component	Elevator Model	
	M16	M24
Head	460 [209]	615 [279]
Drive with Motor	160 [73]	280 [127]
Work Platform	718 [326]	718 [326]
Distributor Platform	559 [000]	559 [000]
10' [3048mm] Leg Section	300 [137]	300 [137]
10' [3048mm] Ladder	40 [18]	40 [18]
10' [3048mm] Cage	40 [18]	40 [18]
Rest Stop	198 [90]	198 [90]
Guy Cable/Bracket/ 10' [3048mm]	70 [32]	70 [32]
Miscellaneous	250 [113]	300 [113]



(a) STACKING THE ELEVATOR IN SECTIONS

Note: Welding the guy wire bracket to the leg section will make the connection more secure at this location.

Setting and Guying

Instructions

1. If the boot is located in a pit, the leg in the pit must also be laterally (horizontally) braced. The leg may be braced near ground level (work floor) to obtain maximum head clearance on the first set of cables above the ground level.
2. **Before setting the leg on the boot, be certain that the head section is in an exact plumb position to the boot. Use a transit (or transits) to check its position.** Use a bead of caulking at the flanges and set the leg into position. Bolt the flanges together.
3. Connect each guy cable to its anchor. See page 26. Start connecting the lower set of cables first and progress towards the top. Locate a turnbuckle in each cable at a convenient distance from the anchor. Extend the turnbuckles as far as possible for later adjustment. See pages 25 - 27 and 71 - 72 for anchor and cable clamping information.
4. Use (2) transits to keep the leg straight and plumb when tightening the cables. Locate (1) transit in line with (1) row of anchors and about 50' [15,240mm] further away from the leg than the furthest anchor. This transit will be used for adjusting cables extending to the right and left of it. Set a second transit 90 degrees from the first transit in line with the second row of anchors to adjust cables extending in the other (2) directions. When plumbing the leg, tension the cables to 600-700 pounds [273-317kg].
5. Tighten (2) opposite cables on the same level together. Keep the leg straight when tightening the cables. This will balance the tension in the (2) cables. Tighten all (4) cables at each level before proceeding upward to the next level of cables.
6. A final recheck on the plumbing is made with a plumb bob. **If the leg is not perfectly plumb, there can be difficulty experienced with the belt not running true.** Insert a plumb bob into the up leg section from the head section. Lower the plumb bob past the inspection door. Tie the plumb line to a cross board over the top of the head frame. Locate the line so it clears all sides inside the leg. Note the position of the plumb line at the top end and bottom end.. The distance to the sides of the leg must be the same at the top and bottom. If it is not the same within 1/2" [13mm], readjust the guy cables. Readjustment of the transits may be helpful to maintain the straightness of the leg.

Note: Either end or the center of a turnbuckle may turn and loosen the cable. (1) method of securing the cable is to lace a short length of cable through the ends and center of the turnbuckle and secure the cable with cable clips. This also deters unauthorized persons from loosening the cables.

Belt and Buckets

WARNING! After all cables have been tensioned and the leg rechecked for plumb and straightness, secure the turnbuckles from loosening.

23

install buckets to the belt

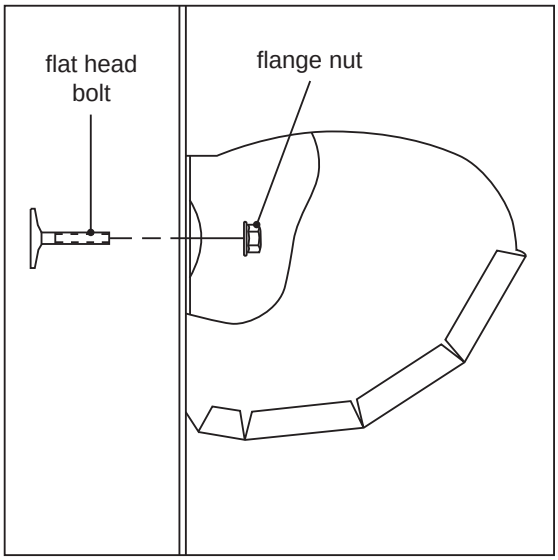
Install the buckets to the belt using the pre-punched holes in the belt (see the examples on this page). Tighten the nuts so that the head draws in flush with the belt surface.

24

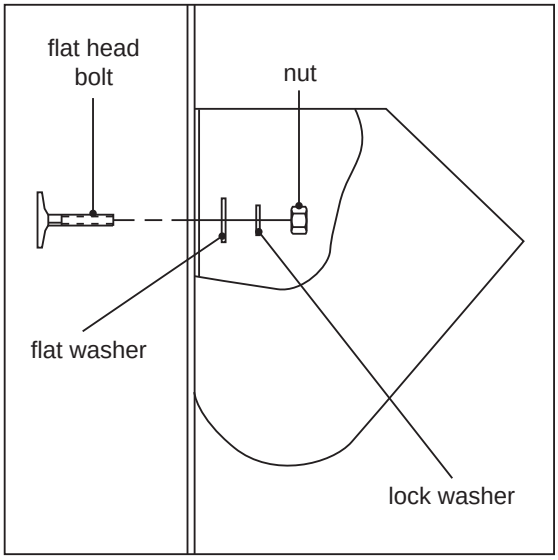
thread assembled belt into elevator

Remove the inspection door cover. (Do not do this if winds exceed 20 mph [32 km/h].) From the top of the elevator thread a rope down the leg to the point where the inspection door is located. Fasten the rope to the assembled belt. Using a come-along pull the belt through the inspection opening to the top of the leg, wrap it over the head pulley, and thread it down the other leg.

Note: Let the belt hang over the head pulley for 24 hours. This will allow gravity to stretch the belt and will provide some initial belt stretch. This will minimize future belt stretch.



a **STEEL BUCKET INSTALLATION**



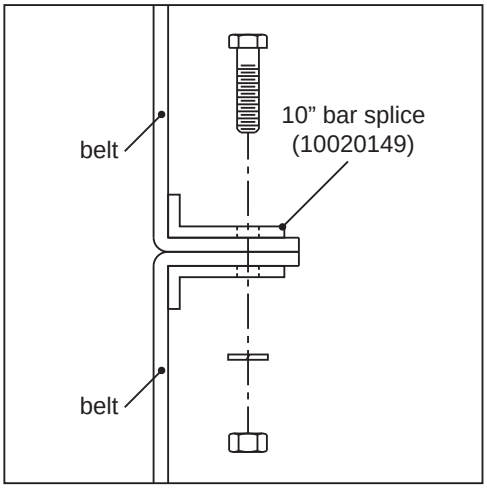
b **PLASTIC BUCKET INSTALLATION**

Belt Splice

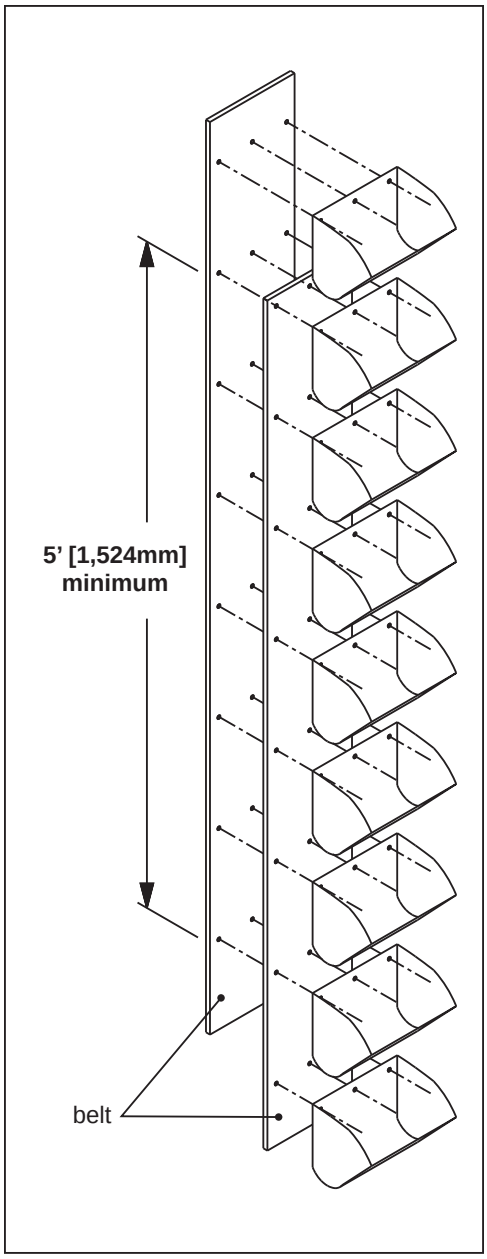
25

make the final belt splice

Adjust the boot pulley into its highest position with the take-up screws. Pull the belt around the boot pulley and back up to the inspection opening to make the final belt splice. Belt splice clamps are shipped with each elevator. An alternate method is the lap splice as shown in example b. Reinstall the inspection door cover when complete.



a FINAL BELT SPLICE



b LAP SPLICE

WARNING! It is very important that the final belt splice is made square with the belt to insure a straight running belt.

26

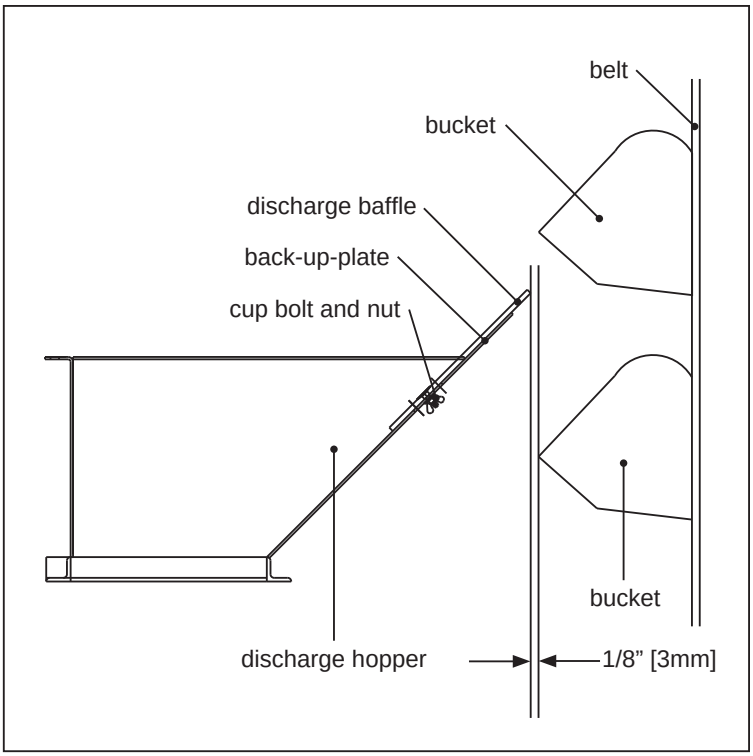
adjust the belt tension

Belt tension is adjusted by use of the take-up assemblies at the boot. Tension the belt to remove all slack. Lower the boot pulley 1" [25mm] more if your bucket elevators is under 60' [18,288mm] and 2" [50mm] if your elevator is over 60' [18,288mm]. Steering (centering) action is accomplished by adjusting (1) side of the boot tighter than the other. The belt will move to the slack side. **The belt must have enough tension to keep the head pulley from slipping under a full load condition.** There should be no "rattling" when the elevator runs empty.

27

adjust the discharge baffle

The discharge hopper is located in the head discharge section. It deflects the material from the buckets so only a minimal amount of material returns down the leg (called "back legging"). Adjust the hopper so it will clear the buckets by 1/8" [3mm] (see example at right). This adjustment should be made when the splice is located at the discharge baffle. Install the head front and back to the head housing using the hold-down clips.



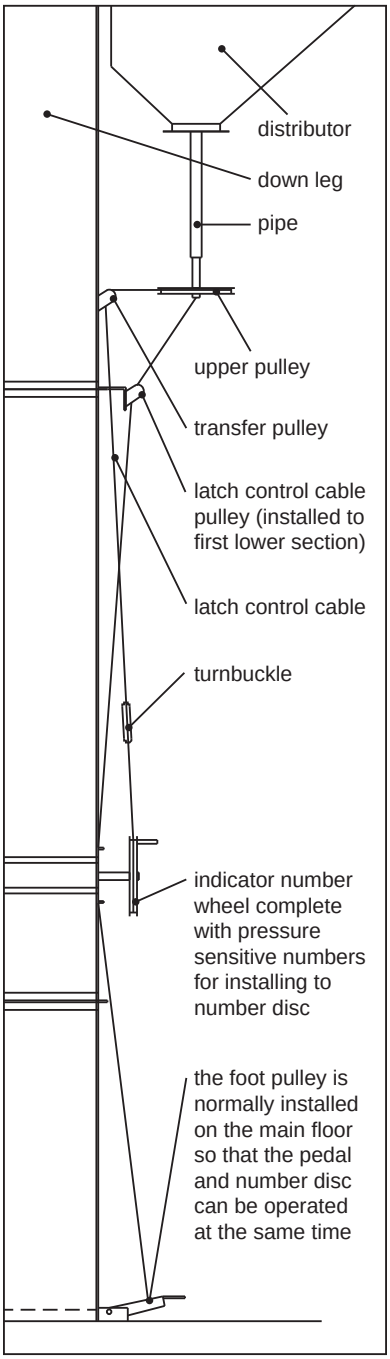
a **ADJUST THE DISCHARGE BAFFLE**

Wire Rope Indicator

28

install the wire rope indicator

Typical Installation Instructions



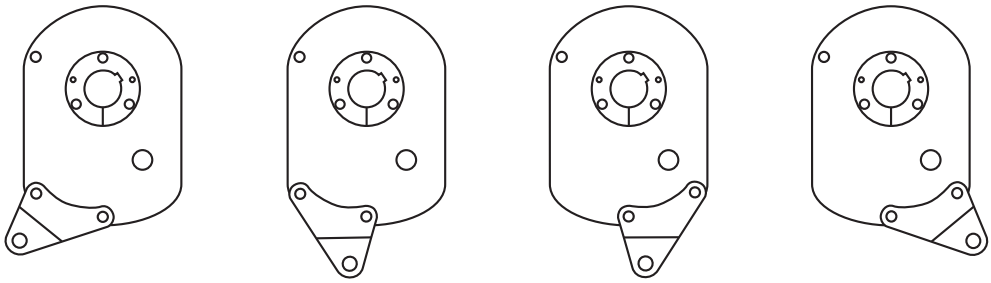
a

The drawing at the left designates the various parts of the indicator that are supplied for cable control.

1. Install the upper pulley to the pipe on the bottom of the distributor and tighten the set screws securely.
2. The upper transfer pulley should then be installed to the elevator leg casing, making certain that the upper pulley is in line with the transfer pulleys which will make the cable run freely.
3. The latch control transfer pulley is supplied so that the cable that controls the latch cable can run down the side of the leg casing. To prevent as much drag as possible on the cable, this pulley should be located so that the cable is at a 45° angle.
4. On taller installations, you may want to use intermediate cable guides to prevent the cable from whipping around and becoming caught or tangled. These can be installed where you deem necessary.
5. Install the indicator wheel so that it can easily be operated from the work room floor. Install it to the leg using the provided clamps.
6. Locate the foot pedal so that it can be operated at the same time the number disc is being turned.
7. The amount of cable needed can be determined by taking the height of the distributor above the work floor times three (x3). When installing the cable, be certain that it is secured to both the top and bottom pulleys so that it cannot slip. If possible, start at the bottom, run up through the transfer pulley, wrap the cable twice and secure. A turnbuckle is supplied to splice the cable with and to adjust tension.
8. Install the cable to the spout latch inside the distributor and run it down through the pipe, through the latch control cable pulley and install to the foot pedal.
9. The adhesive-backed numbers can be placed on the number disc, as the spouts moved from opening to opening. Place the numbers so that when vertical, it indicates which spout is located for feeding.
10. For easier operation, ensure that all control cables are not rubbing on flanges or other obstructions.

Drive Packages

TORQUE ARM MOUNTING BRACKET POSITIONS



A B C D

Model 16 Horsepower Requirements

Horsepower and Drive Requirements						Drive (Class 1)
Discharge Ft.	1000 HP	1500 HP	2000 HP	2500 HP	3000 HP	
20	2	2	2	2	3	
25	2	2	2	3	3	
30	2	2	3	3	5	
35	2	2	3	5	5	
40	2	3	3	5	5	
45	2	3	5	5	5	
50	2	3	5	5	7.5	
55	2	3	5	5	7.5	TA1
60	3	5	5	7.5	7.5	(60)
65	3	5	5	7.5	7.5	
70	3	5	5	7.5	7.5	
75	3	5	7.5	7.5	10	
80	3	5	7.5	7.5	10	
85	5	5	7.5	10	10	
90	5	5	7.5	10	10	
95	5	7.5	7.5	10	15	
100	5	7.5	7.5	10	15	TA2
105	5	7.5	10	10	15	(100)
110	5	7.5	10	10	15	
115	5	7.5	10	15	15	
120	5	7.5	10	15	15	

Model 24 Horsepower Requirements

Horsepower and Drive Requirements						Drive (Class 1)
Discharge Ft.	2000 HP	2500 HP	3000 HP	3500 HP	4000 HP	
25	3	5	5	5	5	TA1 (60)
30	3	5	5	5	5	
35	3	5	5	5	5	
40	3	5	5	5	7.5	TA2 (100)
45	5	5	5	7.5	7.5	
50	5	5	7.5	7.5	7.5	
55	5	7.5	7.5	7.5	10	
60	5	7.5	7.5	7.5	10	
65	5	7.5	7.5	10	10	
70	7.5	7.5	10	10	10	
75	7.5	7.5	10	10	15	TA3 (120)
80	7.5	7.5	10	10	15	
85	7.5	7.5	10	15	15	
90	7.5	10	10	15	15	
95	7.5	10	10	15	15	
100	7.5	10	15	15	15	
105	7.5	10	15	15	20	TA4 (200)
110	10	10	15	15	20	
115	10	15	15	15	20	
120	10	15	15	20	20	
125	10	15	15	20	20	
130[1]	10	15	15	20	20	
135[1]	10	15	15	20	20	
140[1]	10	15	20	20	25	
145[1]	15	15	20	20	25	
150[1]	15	15	20	20	25	

Truss Kits, 6” - 12” Diameter Downspouts

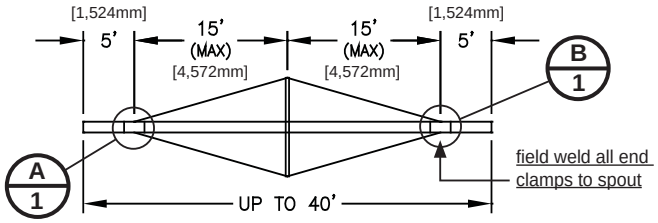
29

install downspouts and truss kits

Install trusses. Use approximate dimensions shown in these examples. Set spout flat on the ground.

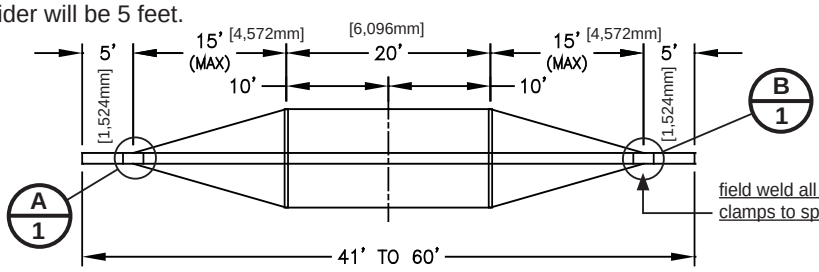
Note: The detail drawings for the examples below are on page 70.

example a



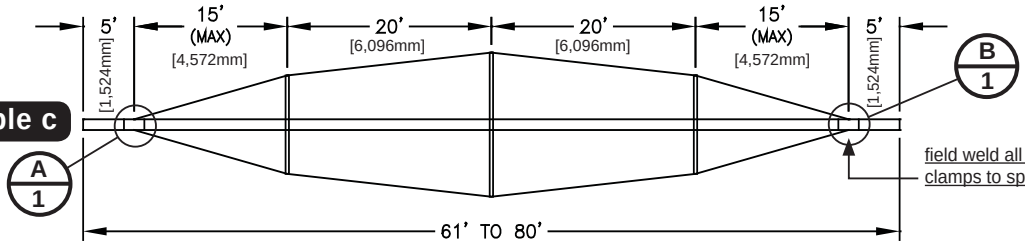
40 ft. (above) and **60’ (below)** truss kits should be installed with approximate dimensions as shown. Overall diameter of 24” spider will be 5 feet.

example b



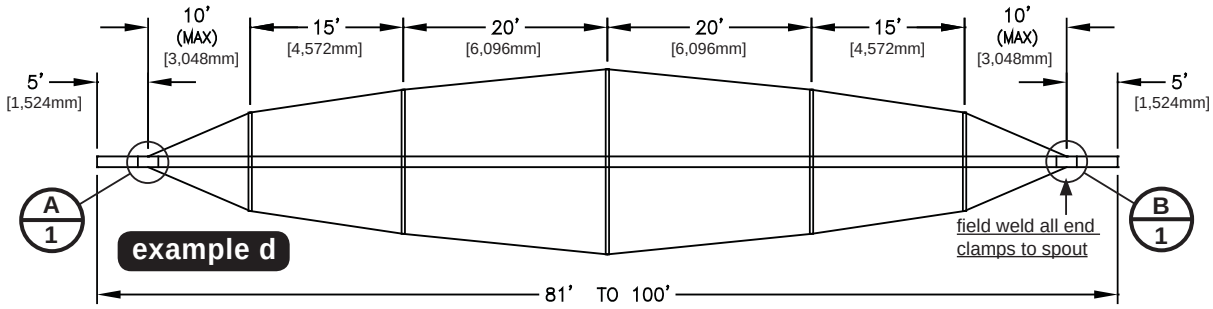
80 ft. (below) truss kits should be installed with approximate dimensions, as shown. Overall diameter of 48” spider will be 8 feet and diameter of 24” spider will be 5 feet.

example c



100 ft. (below) truss kits should be installed with approximate dimensions, as shown. Overall diameter of 66” spider will be 10-1/2 feet. 48” spider will be 8 feet and 24” spider will be 5 feet.

example d



SI conversions:

ft = [mm]
5’ = [1524mm]
8’ = [2438mm]
10 1/2” = [3,200mm]
40’ = [12,192mm]
60’ = [18,288mm]
80’ = [24,384mm]
100’ = [30,480mm]

inches = [mm]
24” = [610mm]
48” = [1,219mm]

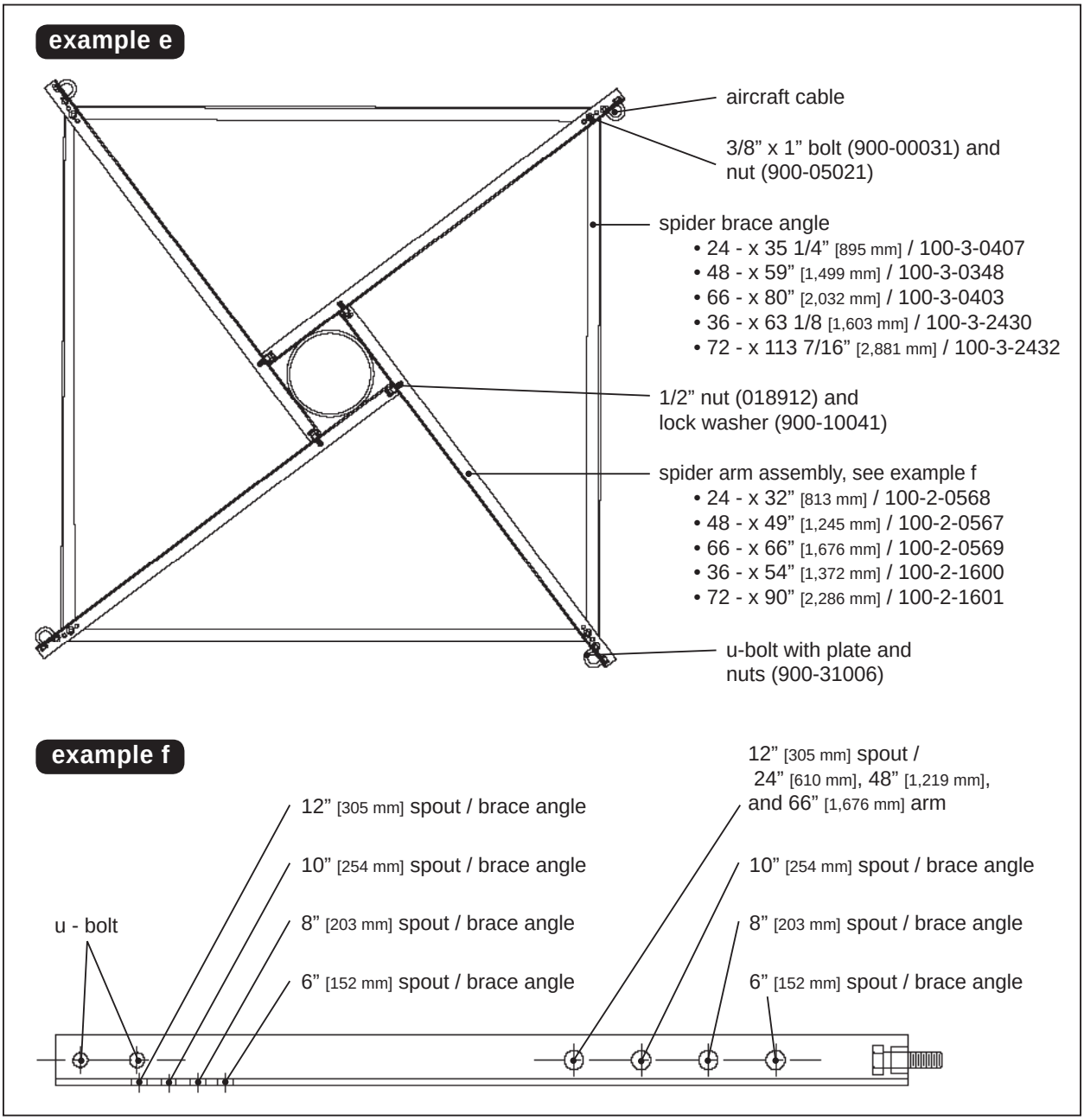
Typical Spider Arm

31

install the spider arm assemblies

Identify and set apart the different arm assemblies. Install the arm assemblies to the spouts at the proper locations.

Note: These truss kits are designed to safely support their own weight with material (48 lb/ft^3 [768 kg/m^3] maximum) flowing through the down spout, or wind loads up to 100 mph [160 km/h]. They are not designed to support or brace other equipment or spouting longer than the truss kit size!



TYPICAL SPIDER ARM ASSEMBLY

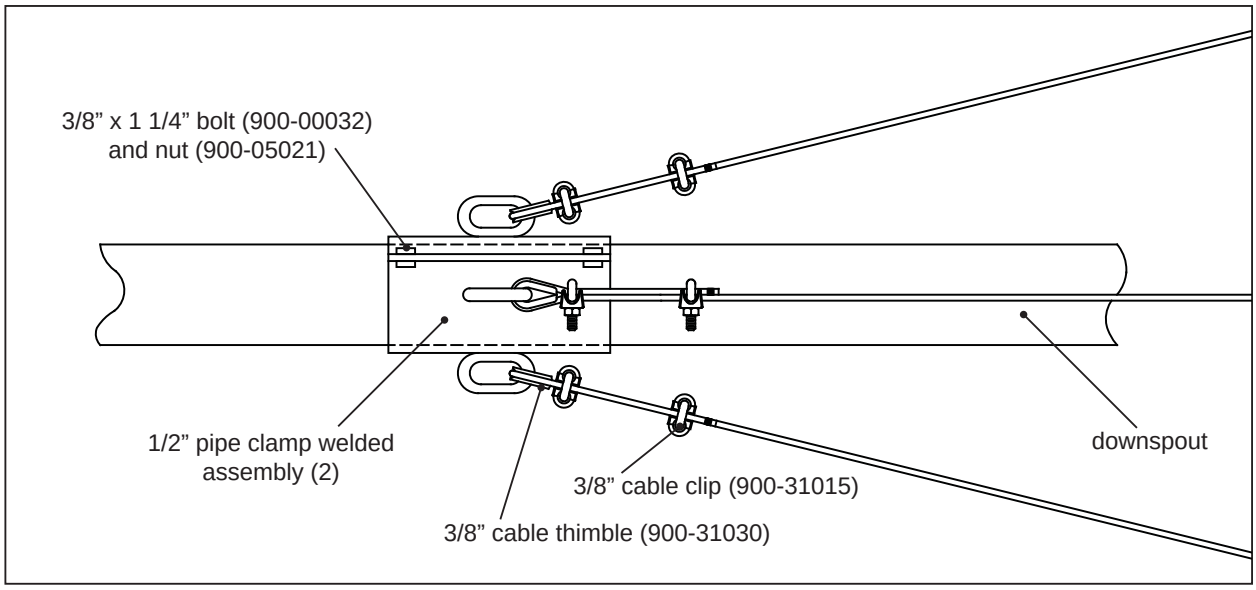
Truss Cables

31

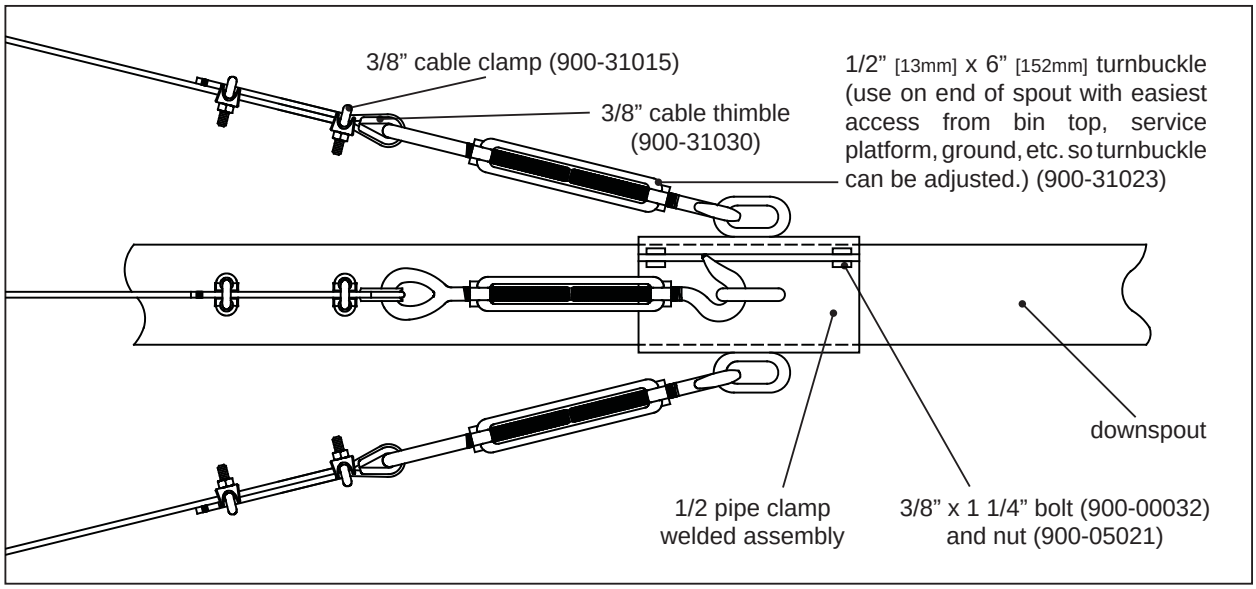
install the cables

Install the cables to the arm assemblies. Tighten the cables (see examples A/1, B/1, and pages 71 - 72. Install the spouts into place. **Be certain to install the wire rope clips following the instructions in this manual!**

Important Note: Bottom cable(s) should be taut enough to keep the downspout straight. Top cables should be drawn up snug!



A/1 **DETAIL OF PIPE CLAMP**



B/1 **DETAIL OF PIPE CLAMP**

Wire Rope Termination

WARNING!

- **Failure to read, understand, and follow all Wire Rope Termination instructions on this page and the next page may cause death or serious injury!**
- **Read and understand these instructions before using wire rope clips.**
- **Match the same size clip to the same size wire rope.**
- **Do not mismatch wire rope clips with wire rope clips made by other manufacturers.**
- **Prepare wire rope end termination only as instructed.**

Note: **A wire rope termination made in accordance with the instructions, and using the number of clips shown has an approximate 80% efficiency rating. This rating is based on the catalog breaking strength of the wire rope.**

WARNING! **Failure to make wire rope terminations in accordance with the instructions or failure to regularly check and retighten to recommended torque will cause a reduction in the wire rope efficiency rating noted on this page!**

Wire Rope Clip Installation

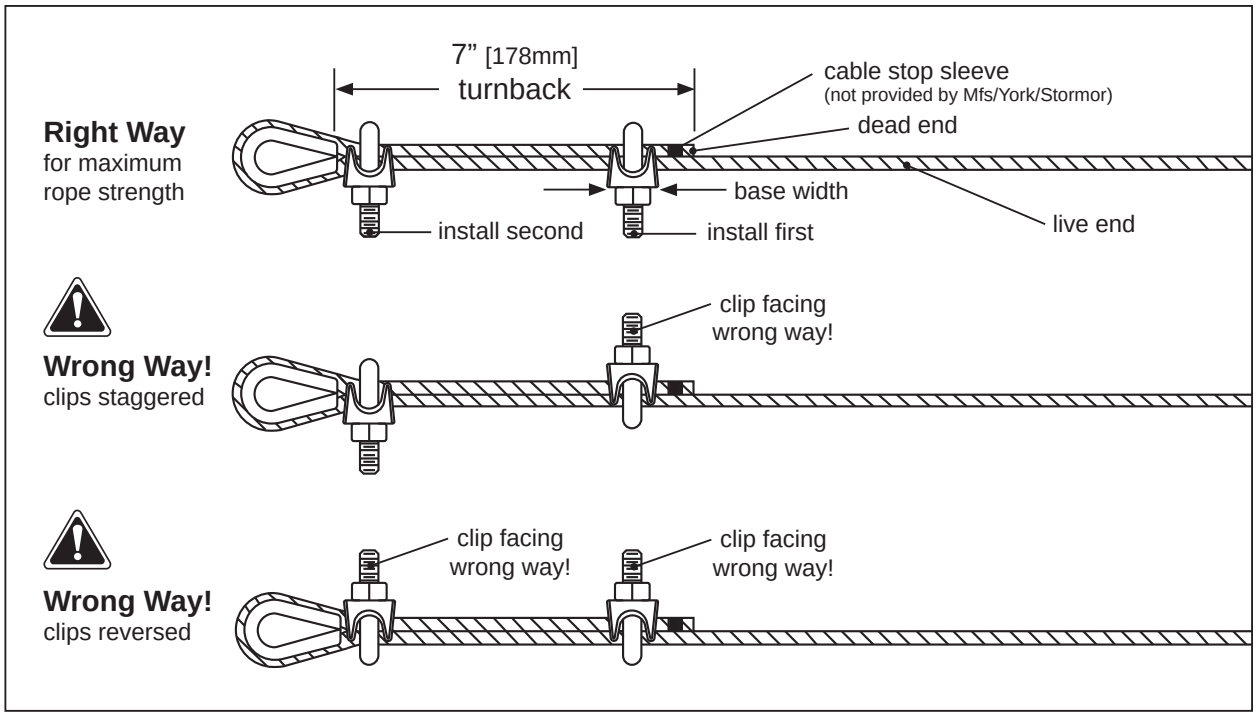
1 **TURN BACK** the specified amount of rope from the thimble. Apply the first clip approximately (1) base width from the dead end of the wire rope (Install the U-bolt onto the dead end of the wire rope, and install the saddle onto the live end of the wire rope.

2 **APPLY THE NEXT CLIP** as near the loop or thimble as possible. Turn on nuts firm but do not tighten.

3 **SPACE ADDITIONAL CLIPS**, if required, between the first (2). Turn on nuts - take up rope slack - tighten all nuts evenly on all clips to recommended torque.

NOTICE!

4 **APPLY THE INTITIAL LOAD** and retighten nuts to the recommended torque. Rope will stretch and shrink in diameter when loads are applied. Inspect regularly and retighten.



a **WIRE ROPE TERMINATION; WIRE ROPE CLIP INSTALLATION**

Belt Tension

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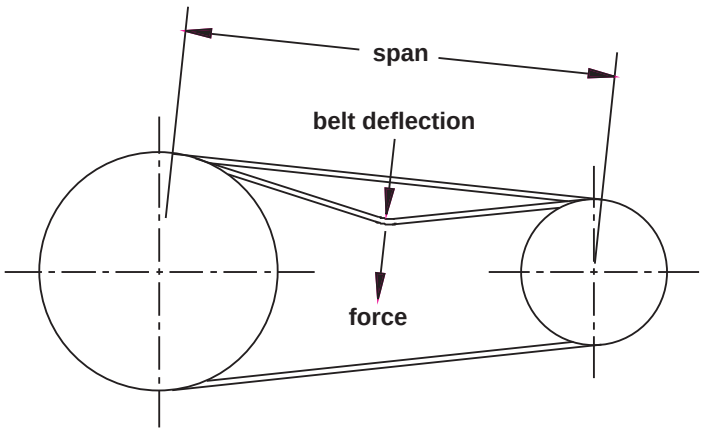
adjust the belts

Tighten the (4) jackscrews hex nuts at the motor base to adjust the V-belt. Maintain shaft alignment. Adjust the motor base equally at all (4) jackscrews. Tighten the V-belts to the correct tension. When the V-belt tension is correct, tighten the top on the jackscrews to lock the motor base in position. Belt deflection is 1/64" [0.4mm] per 1" [25.4mm] of span.

Belt deflection is 1/64" [0.4mm] per inch of span at proper belt tension!



(a) BELT INSTALLATION AND TENSION

Drive Belt Deflection Force

Cross Section	Smallest Sheave Diameter Range	Motor RPM	Belt Deflection Force	
			Normal	New
3VX	2.65 - 3.65	1750	4.2	6.2
	4.12 - 6.90	1750	5.3	7.9
5VX	4.4 - 6.7	1750	8.8	13.2
	7.1 - 10.9	1750	13.7	20.1

7 Start-Up and Operation

NOTE: Your drive belt must be properly tensioned. See page 73.

1. Start Up Inspection

Before operating the elevator, check all areas for **SAFETY** and machine damage which could happen during construction.

a. Has the leg been correctly plumbed, guy cables tensioned, and cables secured from loosening?

b. Check all set screws in drive sheaves, head and boot pulleys, shaft bearings to make certain they are tight. Follow the torque recommendations of the manufacturer(s).

c. Check lubrication of all bearings and gear reducer.

d. Operate the elevator empty under power for a period of time. Be certain cups are traveling in the right direction. Be certain the belt is running on center over the head and boot pulleys. **Keep personnel away from moving parts.**

e. Install the hood, motor drive shields, inspection section screen, door, all covers/guards, and the boot clean-out doors.

f. Review the possibility of vehicle damage to leg or guy cables.

g. Children and unauthorized persons should not have access to the electric controls or the climbing ladder.

h. Are pits designed to prevent personal injury?

i. Has the electrical equipment been installed to meet safety codes? This includes explosion proof equipment where used.

2. Completion of Flow System

To complete an elevator system, other connections must be made to the leg. These will need to be completed before placing the leg into service.

3. Operating the Elevator

Since the elevator has been previously operated without material, it may now be tested under load. It is suggested that the flow systems be checked next. Allow only a small amount of grain to enter the elevator when it is running. Check that the material can flow through the system, connections, valves, distributors, etc. After all flow paths have been checked, the elevator may be loaded to capacity.

4. Check the Elevator for:

a. Back legging (grain returning down the leg).

b. Head pulley slippage.

c. Proper cup filling.

d. Electrical current draw on the motor.

5. An inspection of the elevator is recommended after the first 8-10 hours of operation.

Inspect each of the following:

a. Check all bolts holding the cups to the belt for tightness.

b. Make certain the belt is running in the center of the leg past the inspection station.

c. Inspect motor drive for looseness of pulleys, sprockets, belts, chains or torque arm.

d. Check for oil leakage or overheating of the gear reducer.

e. Head pulley hub bolts & set screws.

Troubleshooting

Trouble	Problem	Cause / Solution
back legging (material falling down the down leg)	see also “material backlegging” under troubleshooting, “cups not filling”	
	belt too loose	tighten or shorten belt when needed
	head shaft speed not correct	correct sheaves, check motor speeds (drives calculated on motor speeds of 1,750 RPM
	damaged cups	replace or straighten / find out the cause for damage
	spouting too flat	angle to be 45° or steeper for dry material, wet material requires steeper angles
	overfeeding	check conveyor output / make adjustments at inlet
	air locked	vent may be needed at the boot or in the head
	boot pulley out of adjustment	move take up rods to center pulley
	conveying light material	replace the buckets with perforated buckets
	wrong style cup	consult MFS/YORK/STORMOR for proper cup
belt excessive slipping, burning, or melting	belt slipping or worn head pulley	the belt is loose / tighten it
		lagging worn off head pulley / replace lagging
belt is running to (1) side (belt will not track)	belt on boot pulley not running on center	belt too loose to give guidance / tighten or shorten the belt as needed
		boot pulley not level / re-check and align pulley
		material build-up on boot pulley / clean pulley
	belt on head pulley not running on center	leg out of plumb / re-check and plumb legs
	belt on head pulley not running on center	leg out of plumb / re-check and plumb legs
	head pulley not level / re-check and align pulley	belt loose and slipping / tighten or shorten the belt as needed
		cups not filling evenly / check and adjust intake
		belt splice crooked or slipped / straighten and tighten splice
	legging bent due to stress / damage	repair or replace bent section
	legging on pulley worn	replace with new lagging kit
	bearings on head uneven	shim lower side until belt centers. Or, move (1) head bearing forward or backward within bearing slots
	head pulley has no crown	replace pulley
	bearing worn	defective bearing at head or boot / needs replacement
	boot pulley out of adjustment	move take up rods to center the pulley

Trouble	Problem	Cause / Solution
belt loose	tighten belt	adjust the boot pulley
		redo the splice or remove a section of belt
boot pulley build-up	excessive powder or sticky material	slatted boot pulley required
cups damaged	belt loose	check boot tension or replace belt
	leg bowed and catching	re-plumb
	obstruction within leg	repair or remove
	cups too large for casing	replace with proper size cups
	belt not running smooth	may require a different style splice
cups not filling or **reduced rated capacity**	under feeding	check conveyor output
		cups running above inlet or improper hopper installation / adjust inlet hopper; see page 35.
		plugging / check for and remove any inlet plugging
	material back-legging the down leg	discharge spouting too small or plugged / check for and remove any spouting plugging
		incorrect belt speed / adjust speed
		incorrect baffle adjustment / adjust it; see page 63.
		improper cup design / call MFS/YORK/STORMOR
	inlet opening too small	increase opening
	incorrect belt speed	wrong drive sheaves / obtain correct sheaves
		incorrect motor speed / adjust speed
		incorrect reducer ratio / change ratio
		head pulley slipping
		drive belt slipping
	cups short on volume	cups caked full of material (wet or powder type) / material too wet
		improper cup size / type material
	boot pulley high	lower pulley in boot to insure full loading of cups
	air lock	either vent the bin or the bucket elevator
	spouting too small or flat	check instructions for sizing
	belt loose	see troubleshooting, belt loose
	obstruction in boot or head	remove obstruction and replace damaged cups
	cups caked or bent	visually inspect, clean or replace damaged cups
cups overfilling	overloading elevator	inlet feed exceeding capacity of leg / adjust feed
		belt speed too slow / adjust speed
		belt slipping on head pulley / tighten belt
		improper cups / obtain proper cups

Trouble	Problem	Cause / Solution
motor cannot start belt	backstop reversed	backstop installed wrong / reinstall correctly
	motor rotation reversed	wired wrong / wire correctly
	boot filled with material	material not shut off when leg was stopped
	damaged reducer	broken gears or bearings / replace them
	cup caught in leg	loose cup or belt
motor starter kicking out	motor overloaded	leg being overloaded / adjust load
		line voltage low
		wrong drive sheaves
	motor too small	current draw excessive
	starter not sized to motor	heaters wrong size
	motor / starter device defective	fix or replace
noise and vibration excessive	cups hitting	obstruction in leg
		bent or damaged cups / see troubleshooting, bent cups
		belt loose / tighten the belt
		cups striking base of boot / adjust boot pulley and tighten belt / see troubleshooting, belt loose
		excessive belt speed / adjust speed
	motor drive noise	failed bearings in motor, head shaft or boot shaft / replace as needed
		failed bearings in gears or reducers / replace as needed
		low oil level in reducer / add oil
		cups not filling evenly / check and adjust intake
		belt splice crooked or slipped / straighten and tighten splice
	legging bent due to stress / damage	repair or replace bent section
	lagging on pulley worn	replace with new lagging kit
	bearings on head uneven	shim lower side until belt centers or move (1) head bearing forward or backward within bearing slots
	head pulley has no crown	replace pulley
	bearing worn	defective head or boot bearing / needs replacement
	boot pulley out of adjustment	move take up rods to center the pulley
reducer overheating	low or overfilled gear lubricant	not filled according to manufacturers instructions / refill
	wrong grade or weight of lubricant	see manufacturers instructions and replace
	reducer overloaded	wrong size reducer / obtain proper size
	reducer failing	worn gears or failed bearings

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Recent Significant Manual Changes:

8-08 [1] Revision Changes

1. Model M30 13x9 information was removed throughout.
2. More SI units were added at various locations throughout the manual.
3. Numerous other changes were made throughout the entire manual.

3-09 [1] Revision Changes

1. Pages 4, 5, 36, 57, 58, 59, 69, 74, 75, 76, and 77. Text corrections were made.
2. Page 47. A couple drawing corrections were made.
3. Pages 78 - 82. The index was regenerated.
4. Changes were made throughout the manual to aide in reducing the pdf file size.
5. Other minor changes were made throughout this manual.

6-09 [1] Revision Changes

1. Page 15. A warning decal replacement was made.
2. Pages 16 and 17. A couple drawing corrections were made.
3. Page 32. The bolt torques were updated.
4. Page 64. A type correction was made.
5. Pages 66 and 67. The drive packages information was changed.
6. Page 69. Improvements were made to the instructions on this page.
7. Page 70. Some changes were made to reduce the pdf file size.

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