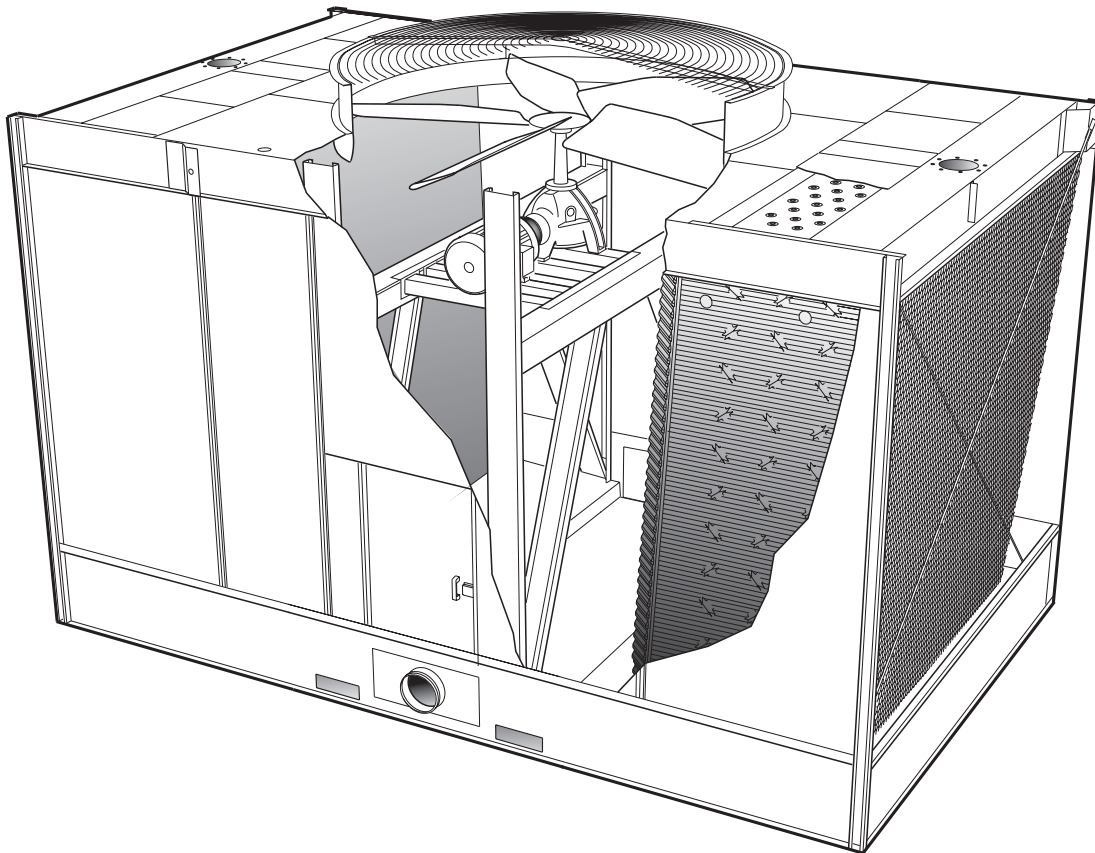


/ Marley NC Class Crossflow Cooling Tower /

Field Installation Manual 00-1287D



SPX

COOLING TECHNOLOGIES

WARNING

The location and orientation of the cooling tower can affect the safety of those responsible for installing, servicing or repairing the cooling tower. Since SPX does not dictate or determine where the tower is located or how it is oriented, SPX is not responsible for addressing the safety issues that are affected by the tower's location or orientation. The following safety issues should be considered by those responsible for designing the tower installation. Failure to consider and address these issues may result in substantial personal injury or death to those involved in installing, servicing or repairing the cooling tower.

- * Access to and from the fan deck.
- * Access to and from maintenance access doors.
- * Access for cleaning and other service.
- * Potential access problems due to obstructions surrounding the tower.
- * The possible need for handrails around the fan deck.
- * The possible need for ladders (either portable or permanent) to gain access to the fan deck or maintenance access doors.
- * The possible need for safety cages around ladders.

These are only some of the safety issues that may arise in the design process. SPX strongly recommends that you consult a safety engineer to be sure that all safety considerations have been addressed.

SPX offers optional equipment that may assist you in addressing some of these safety issues. Contact your Marley representative for information on these optional items.

CONFIDENTIAL- The contents of this document are confidential and constitute the exclusive property of the SPX Cooling Technologies, Inc and is intended for use in the construction (contractor) and maintenance (owner) of this cooling tower. This document and it's contents may not be made public in any manner, distributed or loaned to others, or reproduced or copied either in whole or part without prior written consent of SPX Cooling Technologies, Inc.

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Note: Optional equipment not listed above is installed using separate installation drawings and bills of material. These documents are located within the literature package and should be reviewed prior to starting assembly. Optional equipment may affect assembly sequence.

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ABOUT THIS MANUAL

To obtain maximum efficiency, it is strongly recommended that this entire manual be read before starting assembly. This assembly manual illustrates the field installation of standard and optional items that your tower may have. Due to shipping limitations these items cannot be installed in the factory. Review all manuals, drawings and bills of material prior to assembly. Contact your Marley sales representative if questions arise.

All steel parts are tagged for identification, as shown below.



Find Number: This is a three digit alpha/numeric number that ties everything together. Used throughout this manual, in the text it's the number in bold type **M35**, in the Figures, it's the number within the circle. It is also the first column in the BILL OF MATERIAL. In the bill of material, all tower components are listed in numerical order by this number.

Item Number: This number is used by Marley to manufacture and inventory the components of your cooling tower. Give this number to your Marley sales representative if an item is missing or a replacement item is required.

Drawing Number: (Reference only) This is the number of the drawing used to fabricate this item.

Description: (Reference only) All steel parts begin with SHEET or ASSEMBLY followed by the size of the sheet used to fabricate the item or a description of the assembly. Your tower may have a few fiberglass items which begin GRP.

Stainless Steel: This indicates when an item has been made from stainless steel. If the item is made from the standard galvanized material this will not be printed on the tag.

Bills of material (BOM) are separate from drawings and this manual. At the top of each bill there is a Drawing Number and the drawing description which indicates if the items on that bill will be installed per this assembly manual or per a special installation drawing. The find number, item number, description and quantity of items are all cross referenced on the bill of material. If a number is missing or hard to read, check the illustrations in this assembly manual first and then the bill of material to see if you can find it. As the tower is prepared for assembly, the quantities of each item should be checked against the bill of material.

NEED HELP!

If anything is missing or damaged, or you need help of any kind, contact your Marley sales representative as soon as possible. If you need help determining the representative in your area please call us at 1-800-4MARLEY or check the internet at www.spxcooling.com.

MEASUREMENT SYSTEM

This manual uses both, the English System and the Système International d'Unités (S.I.) systems of measurement. Fasteners are denoted and supplied in conformance with the English System.

TOOLS AND SUPPLIES

- HOIST.** 2500 pound (1140kg) capacity. For hoisting of motor on towers with field installed motors or MOA.
- 1/2" electric drill and bit set.**
- Socket wrench set.** You will be using 9/16" sockets a lot so it's a good idea to have more than one.
- Combination wrenches.** Mainly 9/16" up to 1 1/8". Adjustable wrenches are OK but not recommended.
- Screwdrivers.**
- Torque wrench.** 150 ft-lb (203 N-m) capacity
- Caulking guns.** Required for application of sealant.
- Pipe wrenches.**
- Drift pins** (*alignment tools*). These are extremely important to help line up all the holes. You should have more than one.
- Allen wrenches.**
- Protractor level.** For setting fan blade pitch.
- Dial Indicator kit.** Marley Item No. 115311M. For drive shaft alignment. Needed for motor outside airstream option only.
- Scaffolding, portable stairs** or other means of temporary access and support.
- Electric impact wrench** (*or air*). Optional, really makes the job go fast. You can get by without one but if you can get one you should.
- Wear protective clothing, gloves, nonslip footwear, hard hat and safety glasses.** Cooling towers are constructed of steel and could have burrs that can cause cuts. The surface of steel material may be slick. Protection from thrown or falling objects should be used at all times around a construction site.
- ACETONE solvent.** About a gallon (4 liters) and plenty of clean cotton rags.

JOINT SEALING INSTRUCTIONS

Surface preparation instructions:

The following information covering surface preparation applies to all sealed joints whether sealer **Z11** or strip sealer **Z12** or **Z13** is being used. Years of experience has shown the instructions on surface preparation and sealing details do result in watertight joints. Inadequate attention to these details will result in joints that leak.

Do not apply either sealer if temperature is below 40° Fahrenheit (5° Celsius).

All flanges are to be straight. Rework kinks or bends that exist. Clean surfaces being sealed with acetone. If cloth is used, it must always be clean and dry. **Exercise caution in using solvents, always read labels and instructions.** Care should be taken *not* to wipe dirt or oil onto the cleaned surface from adjacent uncleaned area. Mating surfaces to be sealed must be kept clean and dry prior to assembly. No water, grease or dirt should contaminate cleaned area. Note that stainless steel requires a larger area to be cleaned because oil will recontaminate surfaces quickly. Oil will migrate through punched holes and around sheared edges.

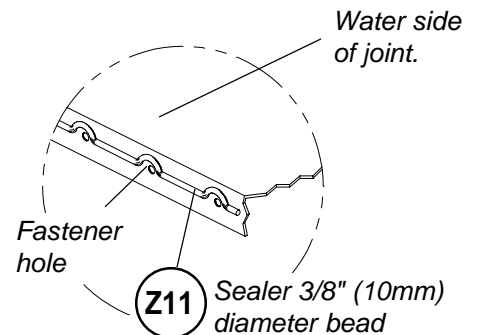
Application instructions for Sealer Z11 (Type A, B & C seals):

Sealer **Z11** comes in a 1/12th gallon (315ml) cartridge and is applied using a standard caulking gun. Apply sealer to the unassembled parts. The typical joint sealing details shown on this page and the following page are referenced throughout this manual. Care should be taken to fill voids and gaps at joints. After parts have been assembled, trowel excess sealant over joint, taking care to force sealant, back into joint, and not out of joint. *Do not use solvent to aid in applying sealer as solvent adversely affects bonding of sealant to metal.* Care should be taken to avoid leaving holes or air bubbles in sealant.

Do not subject sealed joints to waterloading for 48 hours at temperatures of 70° Fahrenheit (21° Celsius) and above. Lower temperature will require a longer cure time.



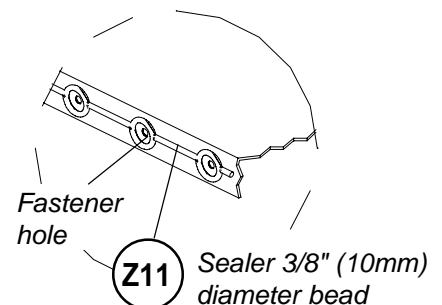
This symbol is used throughout the manual to indicate the locations where sealer **Z11** is required. The **A** refers to a “Type ‘A’ seal” which is a 3/8" (10mm) diameter bead of sealer **Z11** laid along the centerline of a row of holes curving over each hole it passes. Reference detail at the right.



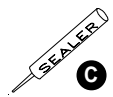
Type A seal
(Water on one side of joint)



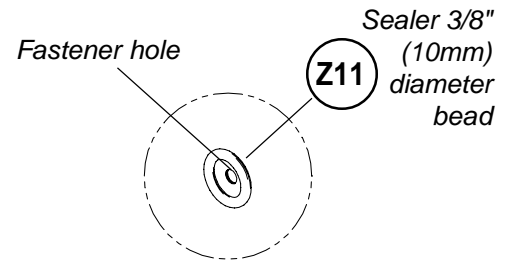
This symbol is used throughout the manual to indicate the locations where sealer **Z11** is required. The **B** refers to a “Type ‘B’ seal” which is a 3/8" (10mm) diameter bead of sealer **Z11** laid along the centerline of a row of holes curving completely around each hole it passes. Reference detail at the right.



Type B seal



This symbol is used throughout the manual to indicate the locations where sealer **Z11** is required. The **C** refers to a "Type 'C' seal" which is a 3/8" (10mm) diameter bead of sealer **Z11** laid completely around each hole in a row of holes. Reference detail at the right.



Type C seal

Application instructions for Strip Sealer Z12 & Z13 (Type D, E & F seals):

Strip sealer is supplied in 1/2" (12mm) **Z13** and 1" (25mm) **Z12** widths. It is intended that the 1" (25mm) wide sealer be used unless noted otherwise.

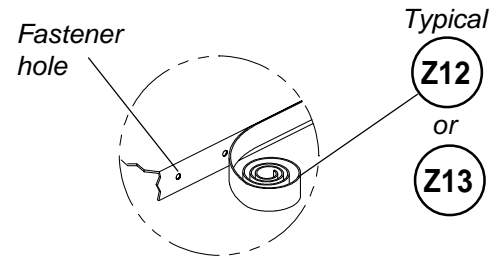
Apply *continuous* pieces of strip sealer to the unassembled parts. *Do not splice pieces except where turning a corner. Cut with a sharp instrument, do not stretch or tear.*

Gaps at joints and corners can be filled by stretching a piece of strip sealer to obtain the proper thickness. Then work it into the joint to fill gap and create an even surface.

After parts are set together, use a drift pin or other pointed object to puncture sealer at each fastener hole, where required.



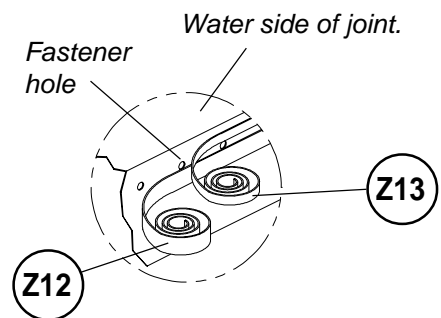
This symbol is used throughout the manual to indicate the locations where a single layer of strip sealer **Z12** or **Z13** is required. Reference detail at the right.



Type D seal



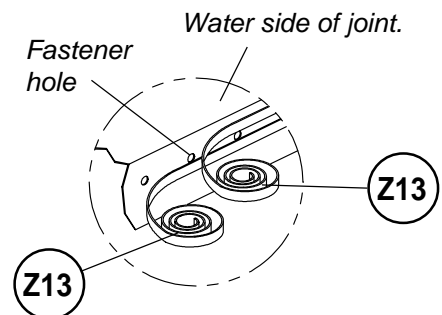
This symbol is used on collection basin joints to indicate the locations where two layers of strip sealer are required. Align bottom edge of strip sealer **Z13** with top edge of bolt holes. Align top edge of strip sealer **Z12** with bottom edge of bolt holes. Reference detail at the right.



Type E seal



This symbol is used on distribution basin joint to indicate the locations where two layers of strip sealer are required. Align bottom edge of first strip sealer **Z13** with top edge of bolt holes. Align top edge of second strip sealer **Z13** with bottom edge of bolt holes. Reference detail at the right.



Type F seal

A FEW WORDS ABOUT FASTENERS

Stainless steel fasteners:

Stainless steel fasteners are sensitive to galling. This is when you notice a sudden increase in the force needed to turn a nut before parts are clamped. Apply anti-seize compound included with the tower to the threads of the bolt before installing the nut. If a nut does not easily spin on a bolt do not try to force it. Chances are it will seize. Some extra hardware is included to replace problem hardware.

Due to availability, 3/8" standard nuts and Loctite may have been substituted for 3/8" self-locking nuts. If this substitution has been made, do not apply the anti-seize compound to the stainless steel bolts. Insert bolt thru hole before applying Loctite. Loctite will act as a thread lubricant.

Torque Requirements:

The idealized standard fastener torque values for galvanized and stainless steel fasteners are shown in the table below. These values may vary in actual practice. Note that the values shown for stainless steel fasteners are based on the fasteners being lubricated with anti-seize compound.

FASTENER TORQUE		
Bolt Diameter	Fastener Torque foot-lbs.(newton-meters)	
	Galvanized	* Stainless Steel
3/8"	20 (27.1)	20 (27.1)
1/2"	45 (61)	27 (37)
3/4"	150 (203)	74 (100)

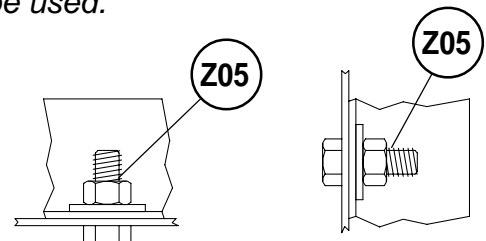
** Values based on fasteners lubricated with anti-seize compound. (Stainless steel only)*

Loctite®:

Critical structural and mechanical attachments require extra protection against the nuts vibrating loose during tower operation. This is accomplished on galvanized fasteners by applying Loctite **Z05** thread locking compound to the exposed threads of a bolt after the nut has been installed and tightened. Bolts should be installed with the threaded end up or horizontally. *On stainless steel fasteners the use of anti-seize compound makes the use of Loctite ineffective. Therefore in these critical areas with stainless steel fasteners self-locking nuts have been substituted for the standard nuts and the Loctite will not be used.*



This symbol is used throughout the manual to indicate the locations where Loctite **Z05** is required. Reference details at the right.



Typical bolted attachment with threaded end of bolt up or bolt installed horizontally.

GENERAL DECAL INSTRUCTIONS

Note: Decals are an important part of the tower assembly. Decals and nameplates provide instructions, identifications, cautions and warnings deemed necessary for proper maintenance.

Surface Preparation

Surface must be clean and dry. Oil and dirt may be removed with solvent (such as acetone) or commercial detergent. Finally wash the area with warm water and dry with a lint-free cloth. Ultimate adhesion will occur 24-48 hours after application. Application should not be undertaken if temperature is below 35° F (2° C) or humidity is greater than 95%.

General application instructions

Peel off backing paper, taking care to avoid dirt contamination of the exposed adhesive. On larger decals with slit back removal of half of the backing paper before and the other half during installation is beneficial for ease of alignment and installation.

Carefully apply the decal to the desired location with light pressure to avoid any distortion of vinyl. This is the time to remove the other half of backing paper on larger decals. Once positioned, smooth out with the aid of a squeegee or toweling.

If air bubbles occur, puncture with a pin or needle and smooth down with the squeegee. The finished decal should be completely flat.

Notes

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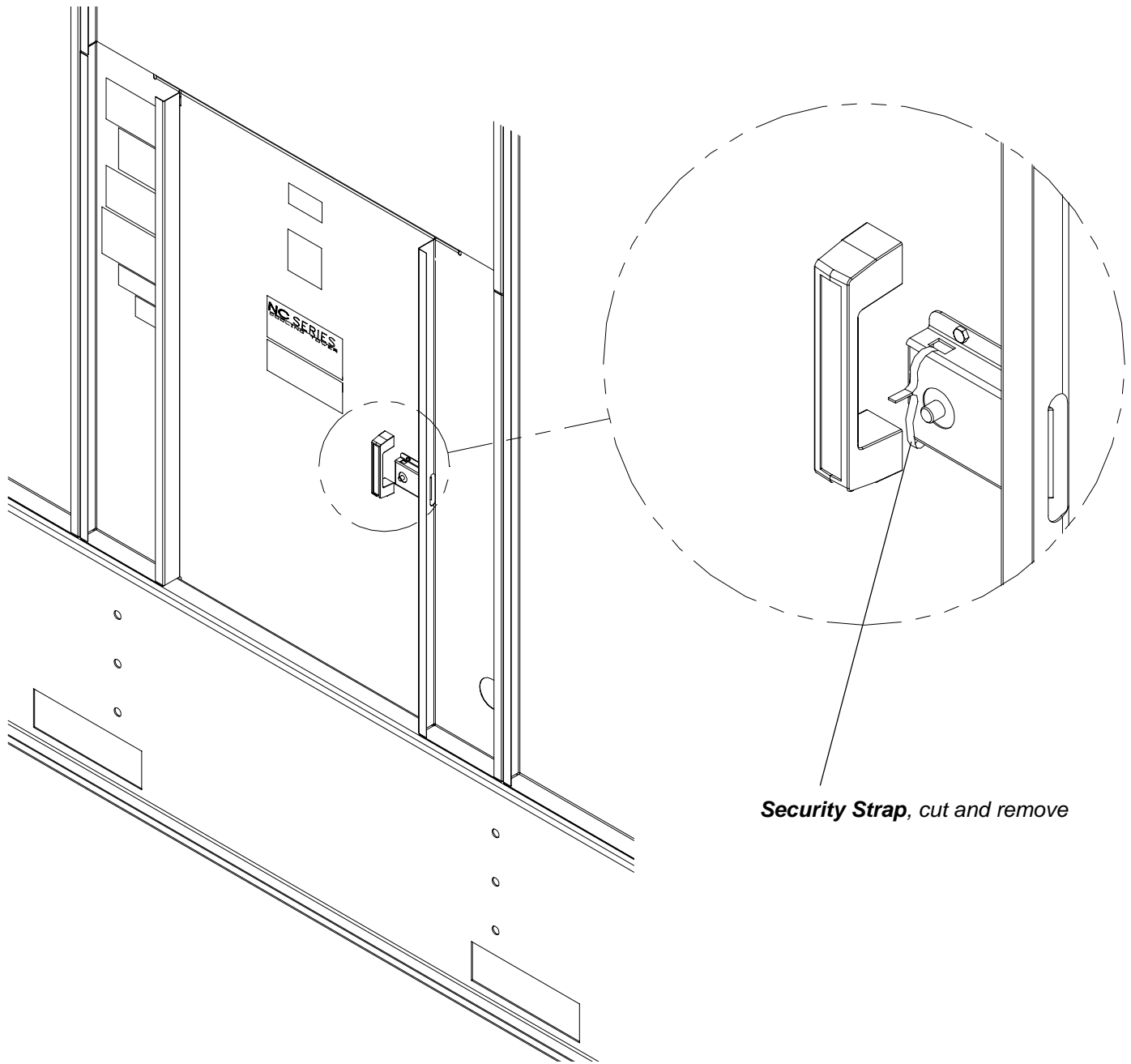


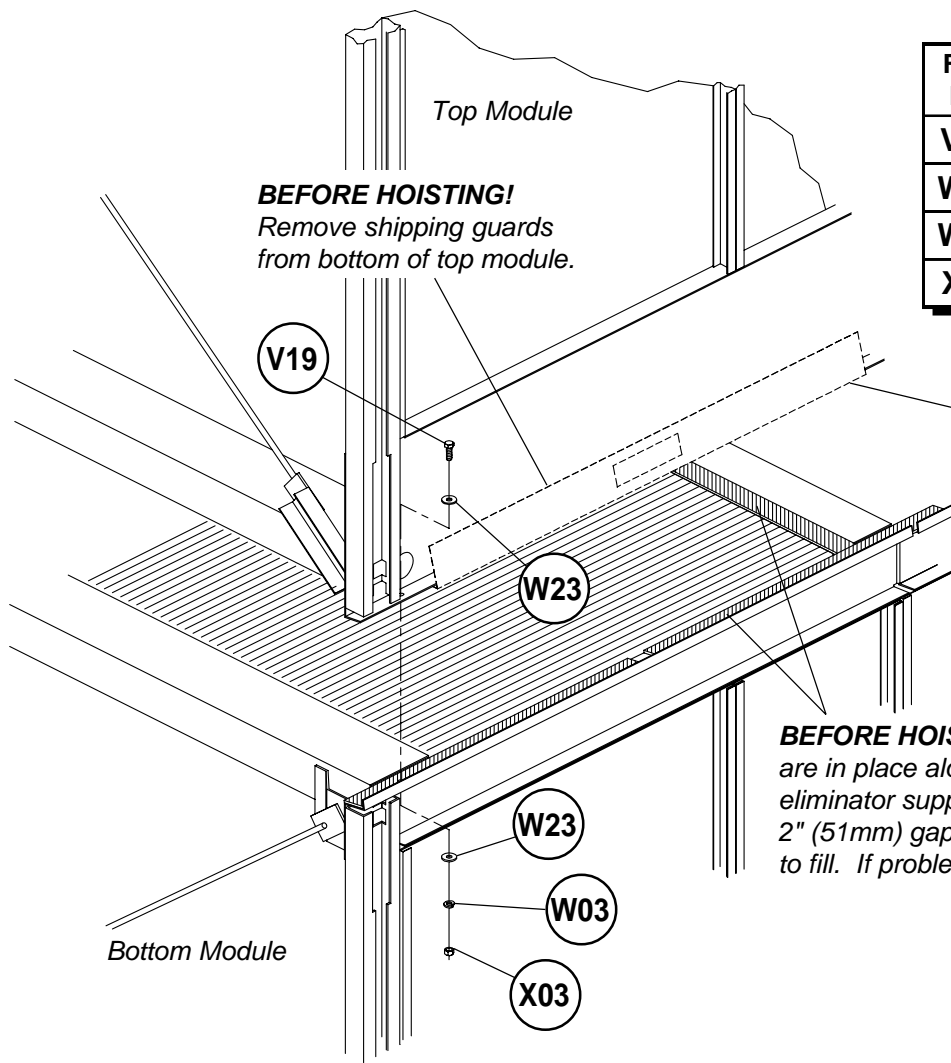
Figure 1-1

ACCESS DOOR

A security strap is installed thru holes in the latch of the access door at the factory. Cut and remove the security strap shown in *Figure 1-1*.

Note that most of the field installed items are shipped inside the tower.

Find No.	Description
V19	1/2"x1 1/2" Bolt
W03	1/2" Lock Washer
W23	1/2" Flat Washer
X03	1/2" Nut

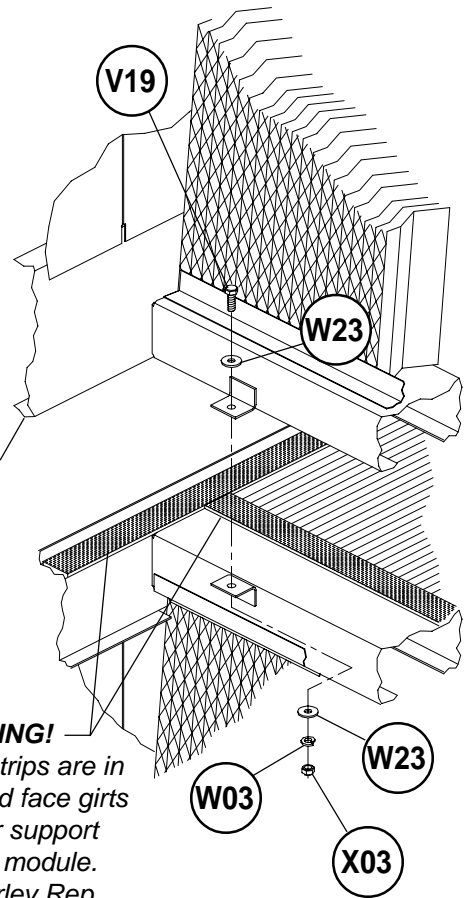


BEFORE HOISTING!
Remove shipping guards from bottom of top module.

Clean any dirt and debris from the underside of the top module skid & beams before hoisting into place.

BEFORE HOISTING! Make sure seal strips are in place along cased face girts and on eliminator support beams of bottom module. A 2" (51mm) gap will exist in seal strip adjacent to fill. If problems exist, contact Marley Rep.

Figure 1-2A



Clean any dirt and debris from the underside of the top module skid & beams before hoisting into place.

BEFORE HOISTING! Make sure seal strips are in place along cased face girts and on eliminator support beams of bottom module. If not contact Marley Rep.

Figure 1-2B

MODULE CONNECTION DETAILS

NC8310 thru NC8312 only

Before top module is hoisted into place on bottom module, clean any dirt and debris from the underside of the top module skid sides and beams. Remove shipping guards from bottom of top module. After top module is in place the modules may be connected near louver columns as shown in Figure 1-2A, or inside tower on eliminator face per Figure 1-2B.

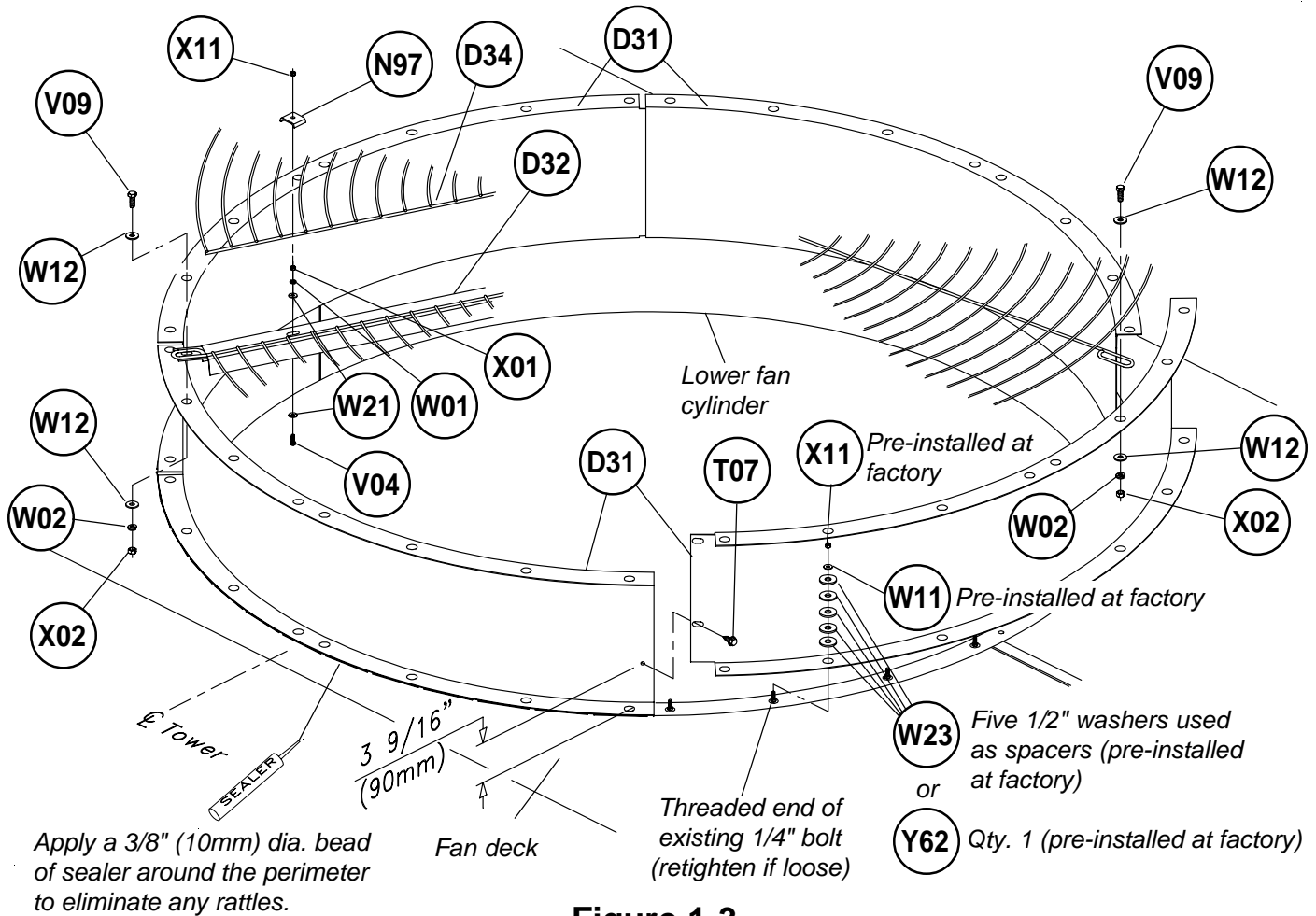


Figure 1-3
All towers without a velocity recovery stack

UPPER FAN CYLINDER & FAN GUARD

For all models without a velocity recovery stack, fan cylinder segments **D31** are installed on top of the lower cylinder that extends down from fan deck. Segments are to straddle tower centerline and be orientated as shown in *Figure 1-3*. Installation hardware for the cylinder segments has been pre-installed at the factory and must be removed prior to cylinder installation.

A single piece fan guard is provided on models NC8301 thru NC8303. Models NC8304 thru NC8312 use a two piece fan guard and require guard splice hardware. On models with a single piece fan guard, position guard **D34** over cylinder and raise center to align with holes in fan cylinder. On models with a two piece fan guard, guard **D32** is installed first and a splice clip **N97** is used to retain guard **D34**.

See the next page for velocity recovery stack installation details.

Find No.	Description
T07	3/8"x1" Tap Screw
V04	1/4"x1 1/2" Bolt (all thrd.)
V09	3/8"x1 1/2" Bolt
W01	1/4" Lock Washer
W02	3/8" Lock Washer
W11	1/4" Oversize Washer
W12	3/8" Oversize Washer
W21	1/4" Flat Washer
W23	1/2" Flat Washer
X01	1/4" Nut
X02	3/8" Nut
X11	1/4" Self-locking Nut

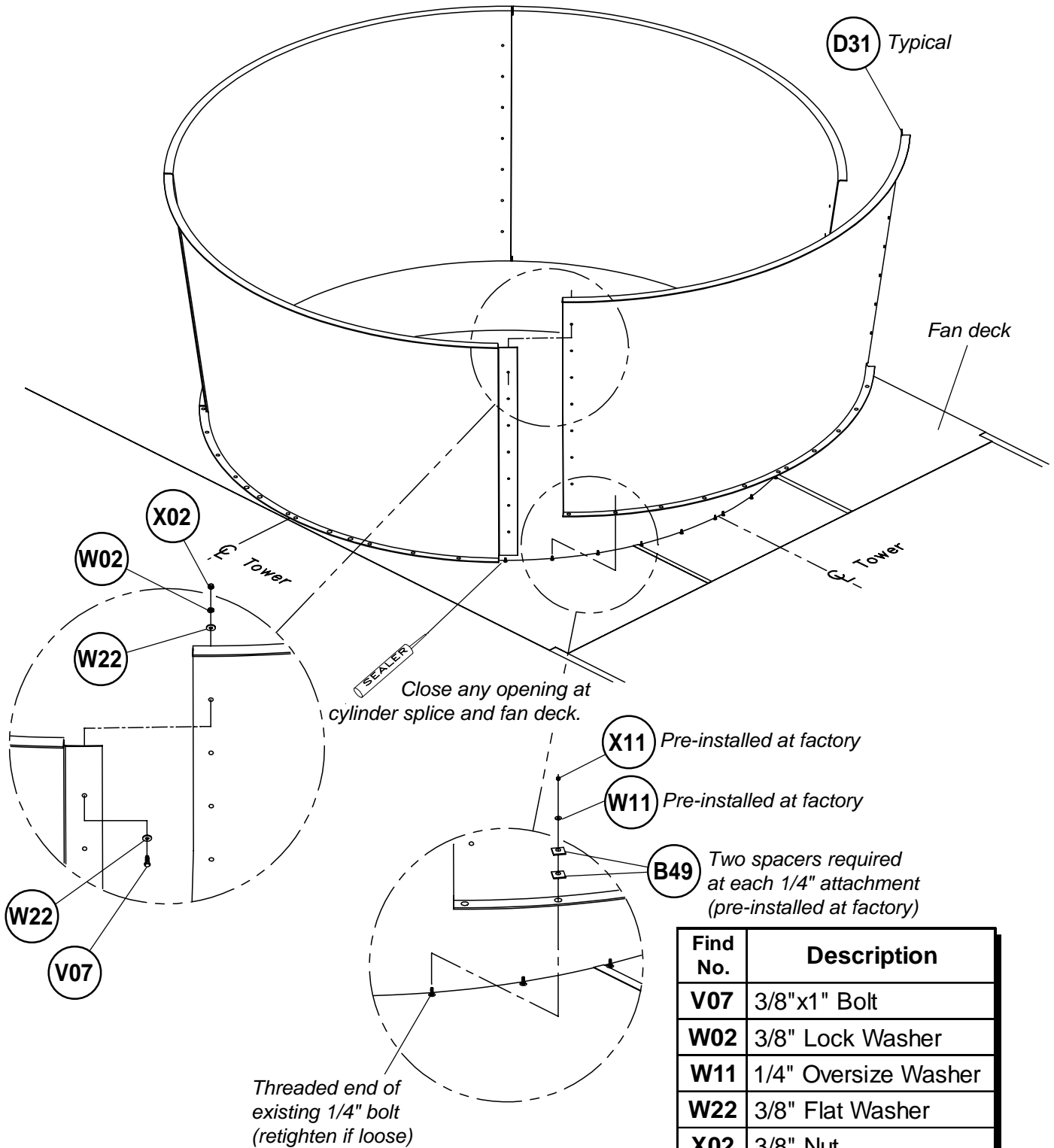


Figure 1-4

Find No.	Description
V07	3/8"x1" Bolt
W02	3/8" Lock Washer
W11	1/4" Oversize Washer
W22	3/8" Flat Washer
X02	3/8" Nut
X11	1/4" Self-locking Nut

VELOCITY RECOVERY STACK

On models with a velocity recovery stack, install fiberglass fan cylinder segments **D31** per *Figure 1-4* on top of lower cylinder that extends down from fan deck. Segments are to straddle

tower centerline. Installation hardware for the cylinder segments has been pre-installed at the factory and must be removed prior to cylinder installation. Fan guard is not required on these models.

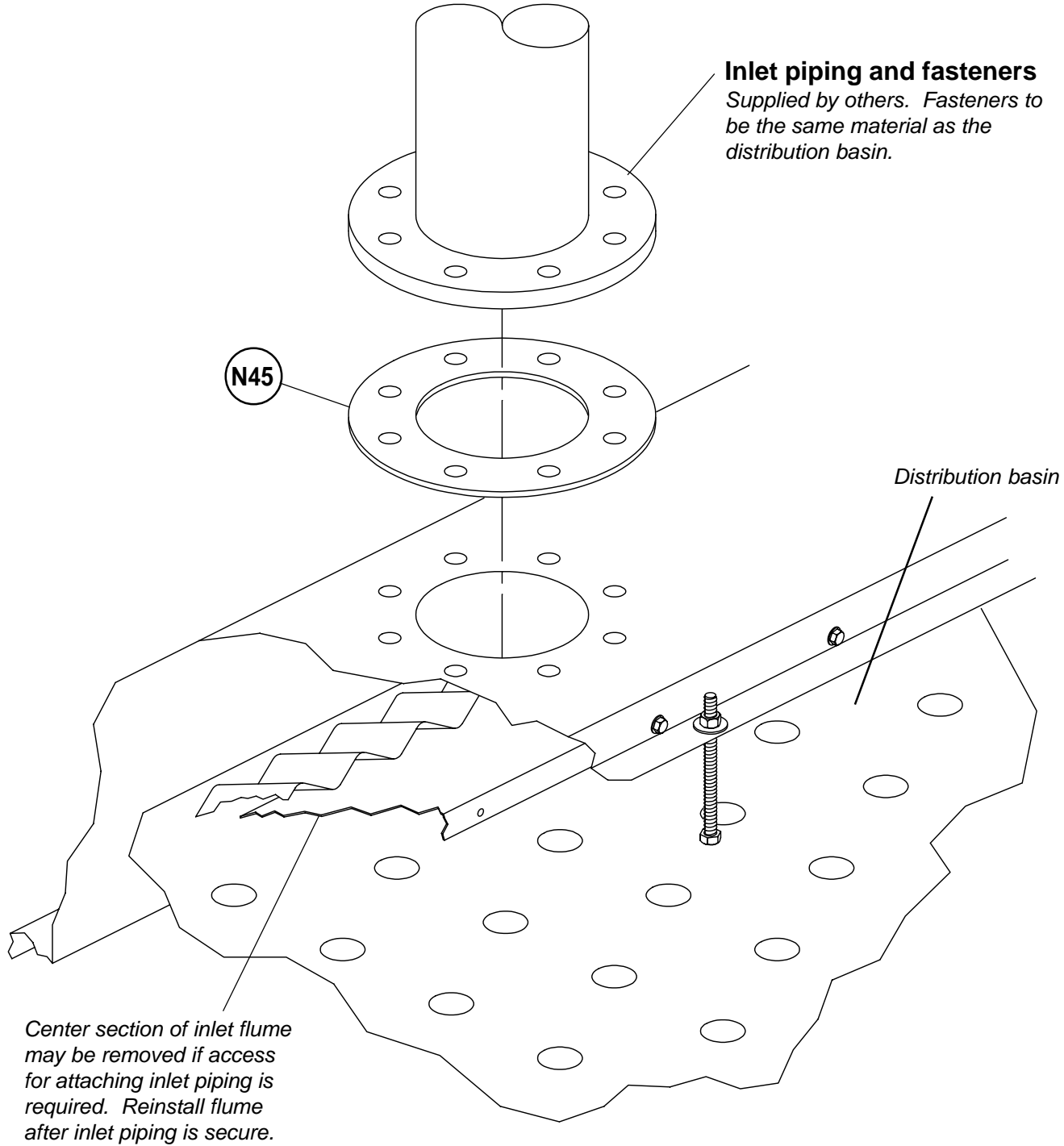



Figure 1-5

BASIC INLET PIPING

If tower is *not* using the optional HC valves, inlet piping is attached directly to the distribution basin, see *Figure 1-5A*. Note that inlet piping and fasteners are supplied by others. If HC valves are to be installed, see next page.

Piping, supports, design of piping and supports, and restraint of lateral piping loads is the responsibility of others. 

INLET PIPING WITH OPTIONAL HC VALVES

If HC valves **N40** are to be installed, attach as shown in *Figure 1-6*. A full face gasket **N45** is used between valve and distribution basin and a ring gasket **N39** is used between valve and inlet piping. Valve may be rotated 90° or 180° if desired.

Inlet piping
supplied by others

6" & 8" dia. valves **X04**
or

10" dia. valve **X06**


6" & 8" dia. valves **V35**
or

10" dia. valve **V42**

Half of these bolts are threaded into tapped holes in valve body, the other half require nuts.

Stainless fasteners are provided with stainless basins

Center section of inlet flume may be removed if access for attaching valve is required. Reinstall flume after valve is secure.

Piping, supports, design of piping and supports, and restraint of lateral piping loads is the responsibility of others. 

N39
Ring gasket without bolt circle

N40

N45
Full face gasket with bolt circle

6" & 8" dia. valves **W35**
or

10" dia. valve **W36**

6" & 8" dia. valves **W30**
or

10" dia. valve **W20**

Figure 1-6


6" & 8" dia. valves **V32** or **V46** 10" dia. valve

Find No.	Description
V32	3/4"x2" Bolt
V35	3/4"x3" Bolt (all thrd.)
V42	7/8"x5" Bolt (all thrd.)
V46	7/8"x2" Bolt
W20	7/8" Flat Washer
W30	3/4" Flat Washer
W35	3/4" Sealing Washer
W36	7/8" Sealing Washer
X04	3/4" Nut
X06	7/8" Nut

SINGLE INLET PIPING OPTION

If the tower has been supplied with a single inlet option, see installation details on pages 1-7 thru 1-9.

Piping, supports, design of piping and supports, and restraint of lateral piping loads is the responsibility of others.



REMOVE SHIPPING FASTENERS

EXTERNAL INLET PIPING BY OTHERS. FASTENERS ARE SIZED ASSUMING THE FLANGE THICKNESS IS PER ANSI B16.1

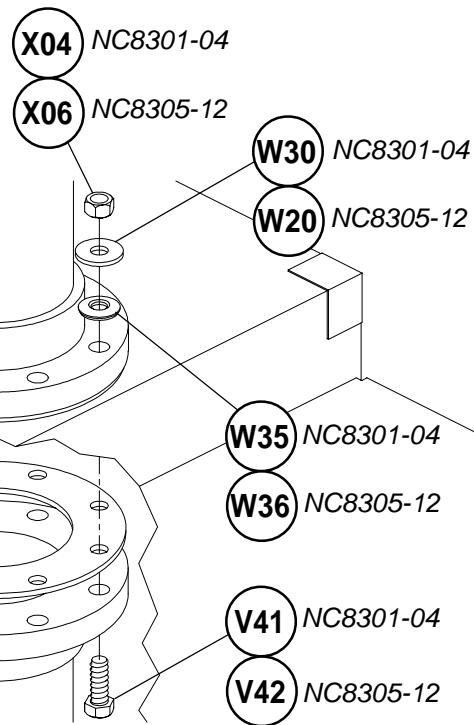


Figure 1-7A
SINGLE BOTTOM INLET

Stainless fasteners are provided with stainless basins, or casing

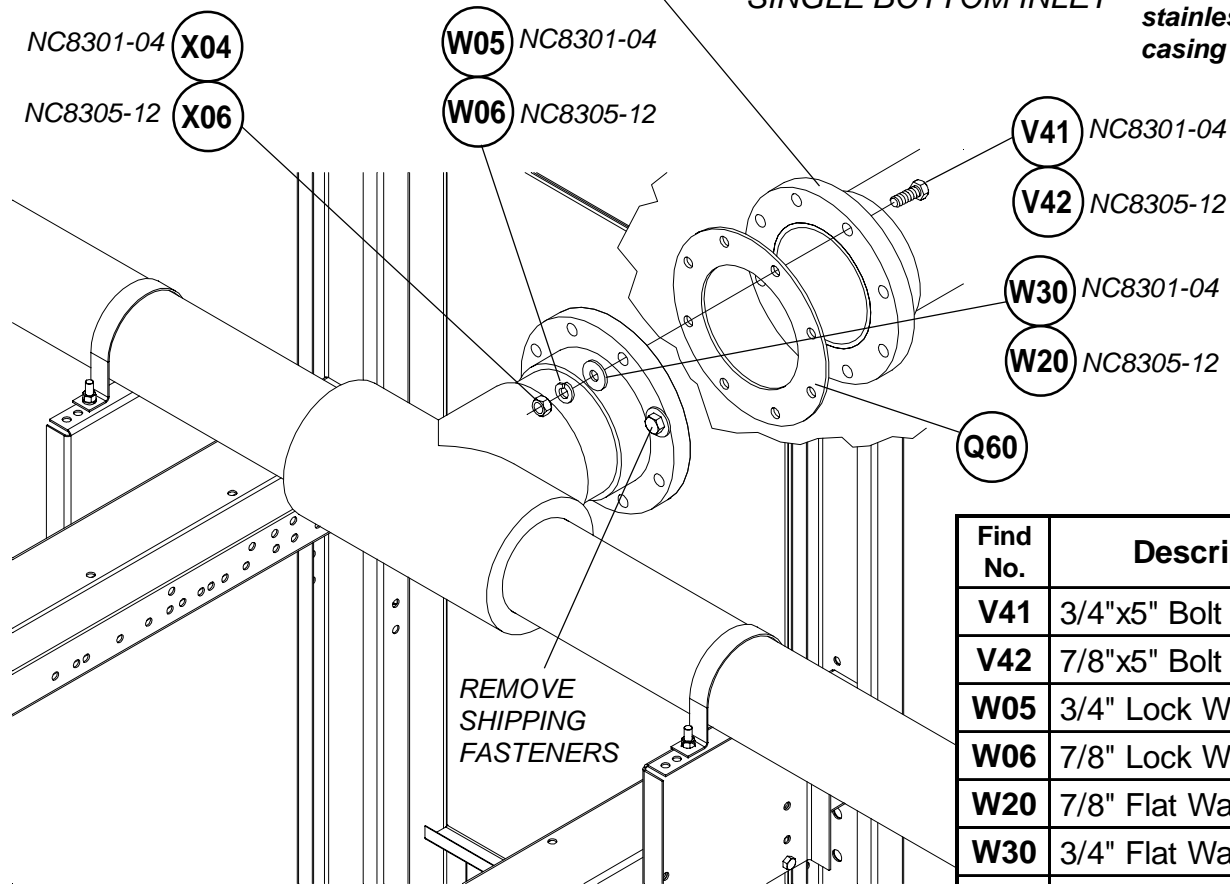


Figure 1-7B
SINGLE SIDE INLET

Find No.	Description
V41	3/4"x5" Bolt (all thrd.)
V42	7/8"x5" Bolt (all thrd.)
W05	3/4" Lock Washer
W06	7/8" Lock Washer
W20	7/8" Flat Washer
W30	3/4" Flat Washer
X04	3/4" Nut
X06	7/8" Nut

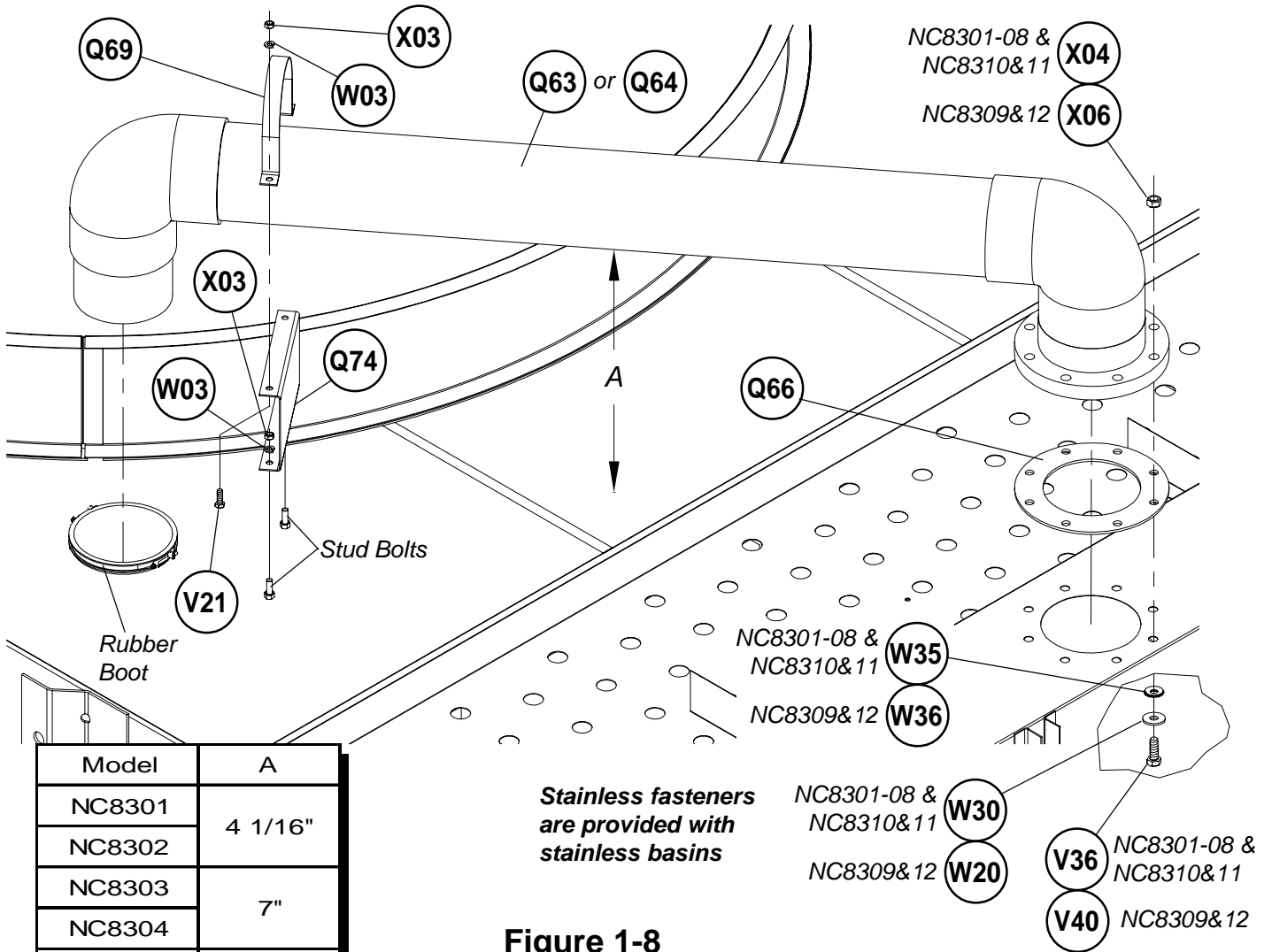


Figure 1-8
Single Inlet Fan Deck Piping

Model	A
NC8301	4 1/16"
NC8302	
NC8303	7"
NC8304	
NC8305	5"
NC8306	10 7/16"
NC8307	9 3/16"
NC8309	11 7/16"
NC8310	5"
NC8311	
NC8312	5 3/8"

Install pipe support **Q74** on to the stud bolts protruding from the fan deck as shown in *Figure 1-8A*. Prior to installation of Single Inlet fan deck piping **Q63** or **Q64**, clean outside of pipe and inside rubber boot protruding from the fan deck. Then apply a thin layer of sealer **Z11** to inside of rubber boot. Install the fan deck pipe into boot so that it butts with the interior pipe and align the flanged end with the hot water basin inlet along with gasket **Q66**. When installed, the fan deck piping should be level in relation to the fan deck. Finally, attach pipe support strap **Q69** to pipe support as shown.

Find No.	Description
V21	1/2"x2" Bolt (all thrd.)
V36	3/4"x3" Bolt
V40	7/8"x3" Bolt
W03	1/2" Lock Washer
W20	7/8" Flat Washer
W30	3/4" Flat Washer
W35	3/4" Sealing Washer
W36	7/8" Sealing Washer
X03	1/2" Nut
X04	3/4" Nut
X06	7/8" Nut

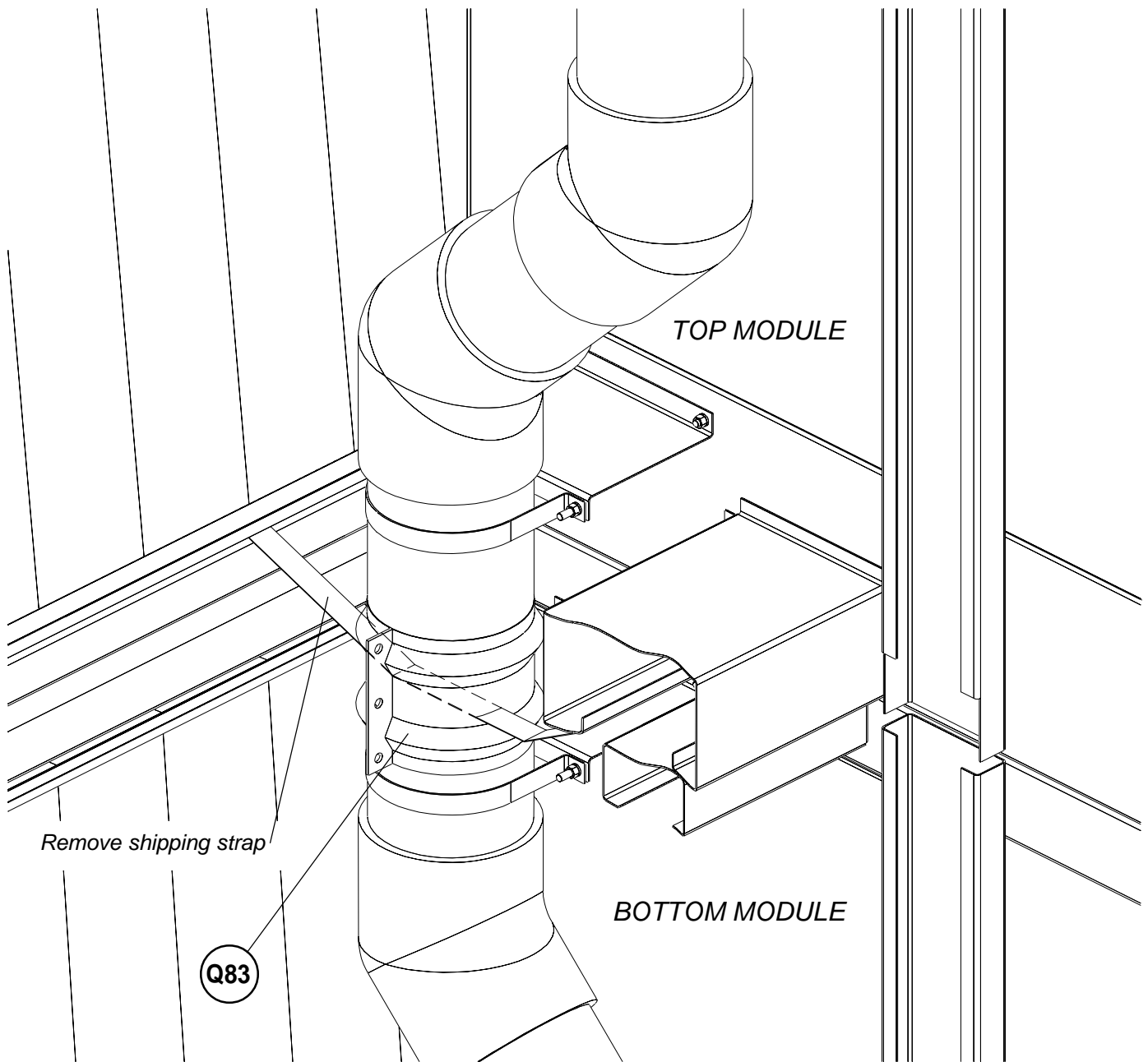


Figure 1-9
Single Bottom Inlet
 NC8310 thru NC8312 Only

Models NC8310 thru NC8312 with the Single Bottom Inlet Option require the installation of a Depend-O-Lok pipe coupling **Q83** between the piping of the top and bottom tower modules. The Depend-O-Lok includes fasteners, gaskets,

manual closure tool, and detailed instructions for installation. "C" clamp, ratchet, and adjustable wrench are optional tools for installation and are **not** included.

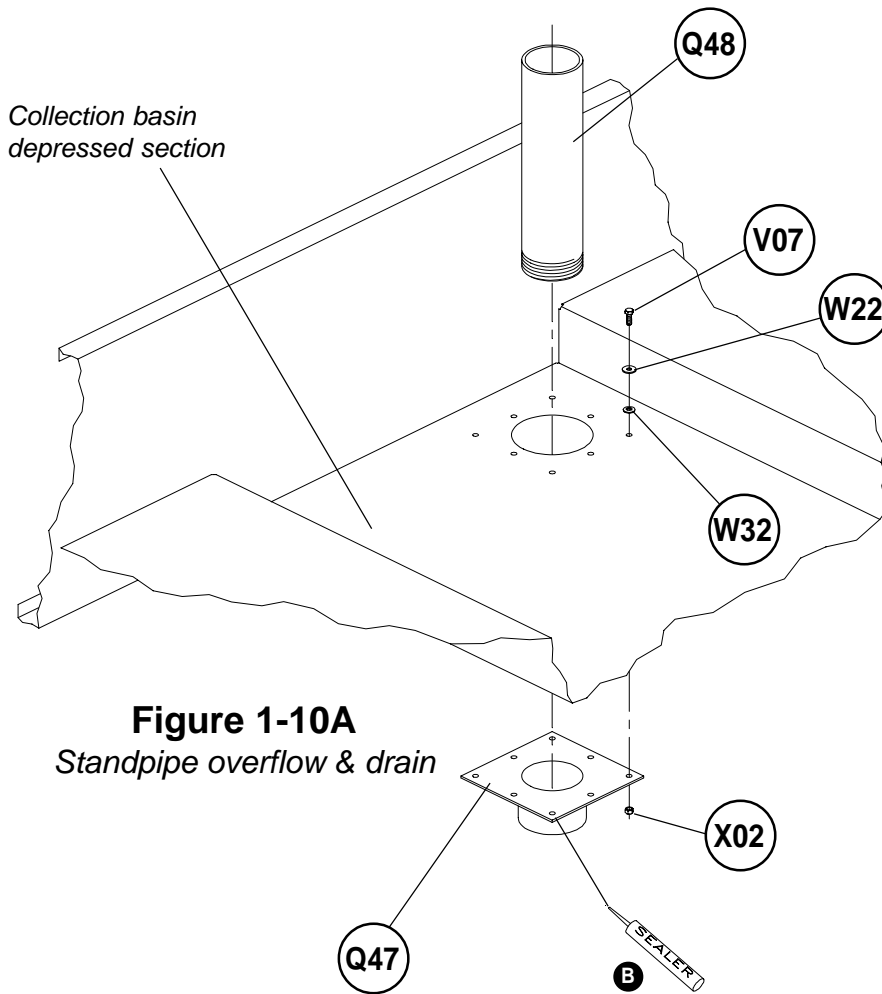


Figure 1-10A
Standpipe overflow & drain

Take care not to cross thread the PVC standpipe when threading into the steel coupling assembly.

Find No.	Description
V07	3/8"x1" Bolt
W22	3/8" Flat Washer
W32	3/8" Sealing Washer
X02	3/8" Nut

Stainless fasteners are provided with stainless basins

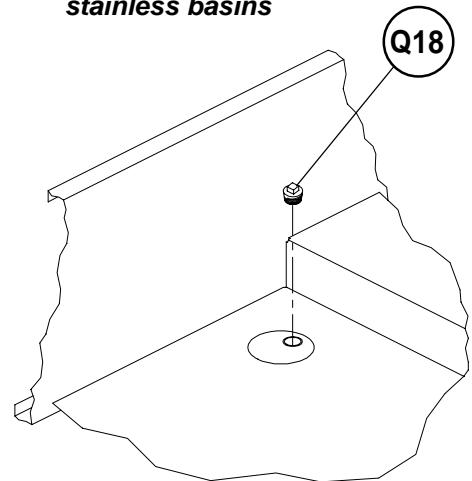


Figure 1-10B
Floor drain plug

OVERFLOW & DRAIN

All towers must have an overflow and drain, either as the standard standpipe in the collection basin floor or at the optional coverplate location. The standpipe overflow and drain is installed per *Figure 1-10A*. Bolt coupling assembly **Q47** to bottom of the collection basin floor at the 6" (152mm) diameter hole and bolt pattern. Install standpipe **Q48**. The standpipe is PVC unless an optional heater element is close by, then a steel standpipe will be installed with teflon tape (*supplied by others*) to protect the threads.

If the optional coverplate drain and overflow is being used, the cutout in the depressed section for the standpipe has been covered with a drain plate that must have plug **Q18** installed per *Figure 1-10B*. If coverplate drain is not being plumbed, install pipe plug **Q18** per *Figure 1-10C*.

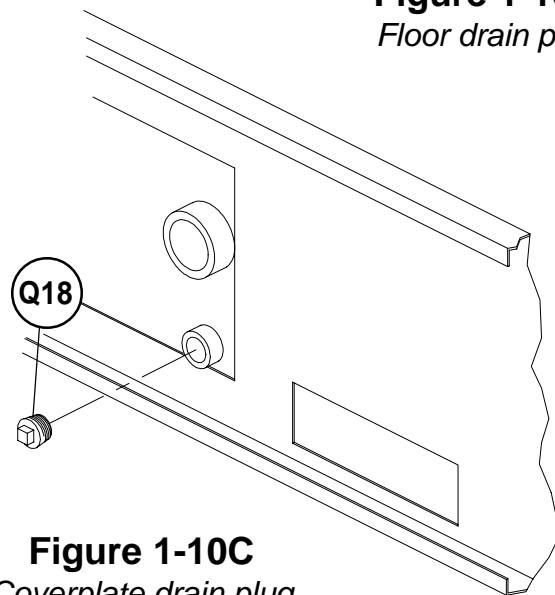


Figure 1-10C
Coverplate drain plug

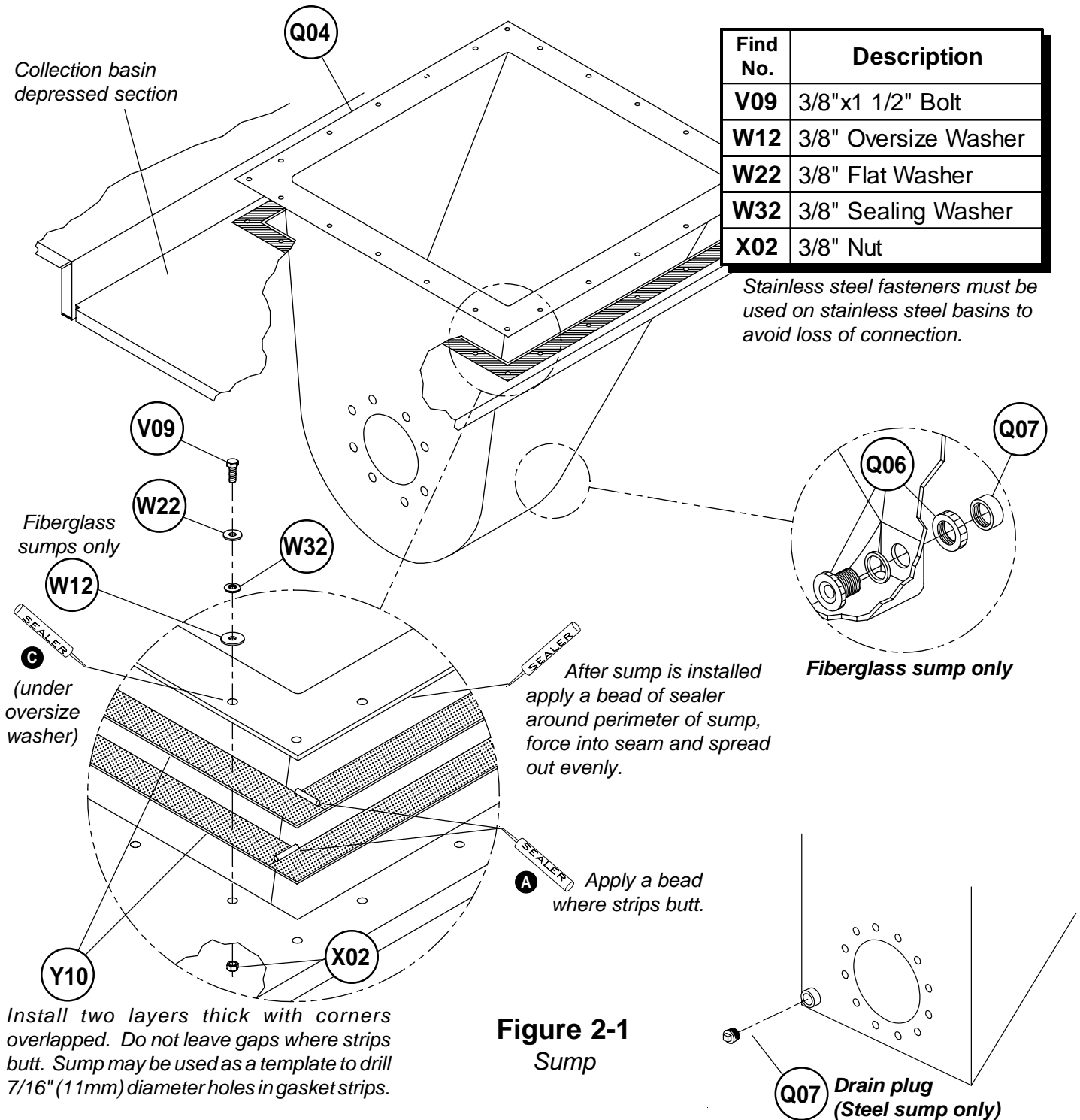


Figure 2-1
Sump

SUMP

Sump installation is per *Figure 2-1*. Sump may be rotated 90° or 180° provided outlet piping will clear supporting steel. Lay strips of gasket **Y10** around sump opening in depressed section floor. Set sump **Q04** in place and use as a template to drill 7/16" (11mm) dia. holes thru

gasket. Attach sump to floor and seal around perimeter. On fiberglass sumps, install plastic tank adapter **Q06** and pipe cap **Q07** in the bottom of the sump as a drain (on steel sumps, pipe plug **Q07** is installed in the coupling in the front of the sump).

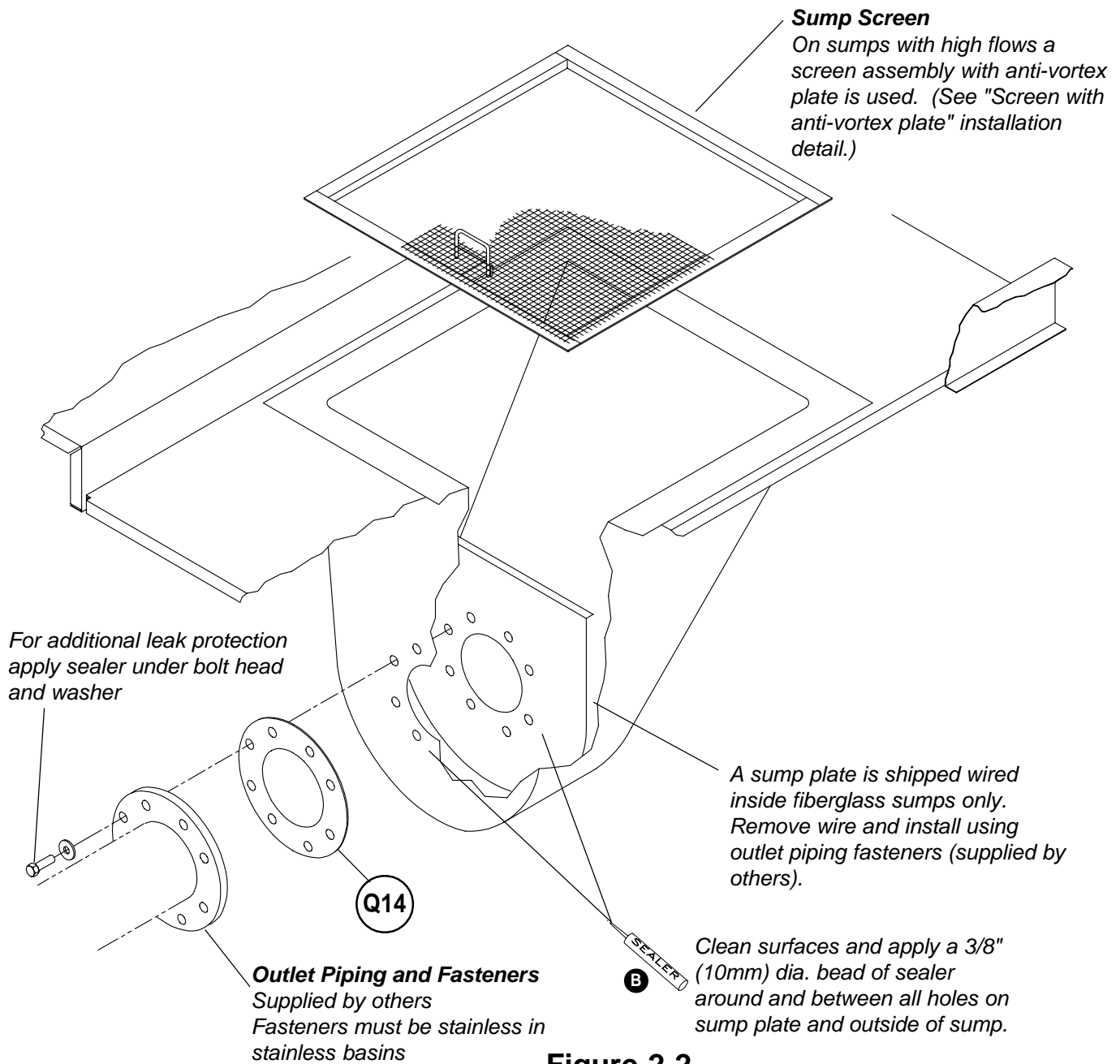



Figure 2-2

See Figure 2-2 for the typical attachment of customer piping using gasket **Q14**. A sump plate is used on the inside of fiberglass sumps only. After piping has been installed set sump screen (if required) in place over the sump opening. On sumps with a higher flows, a screen assembly with anti-vortex plate is used instead of the sump screen shown. See "Screen with anti-vortex plate" installation detail. **The tower is not designed to support additional piping loads. DO NOT SUPPORT PIPING FROM THE TOWER.**

 Piping, supports, design of piping and supports, and restraint of lateral piping loads is the responsibility of others.

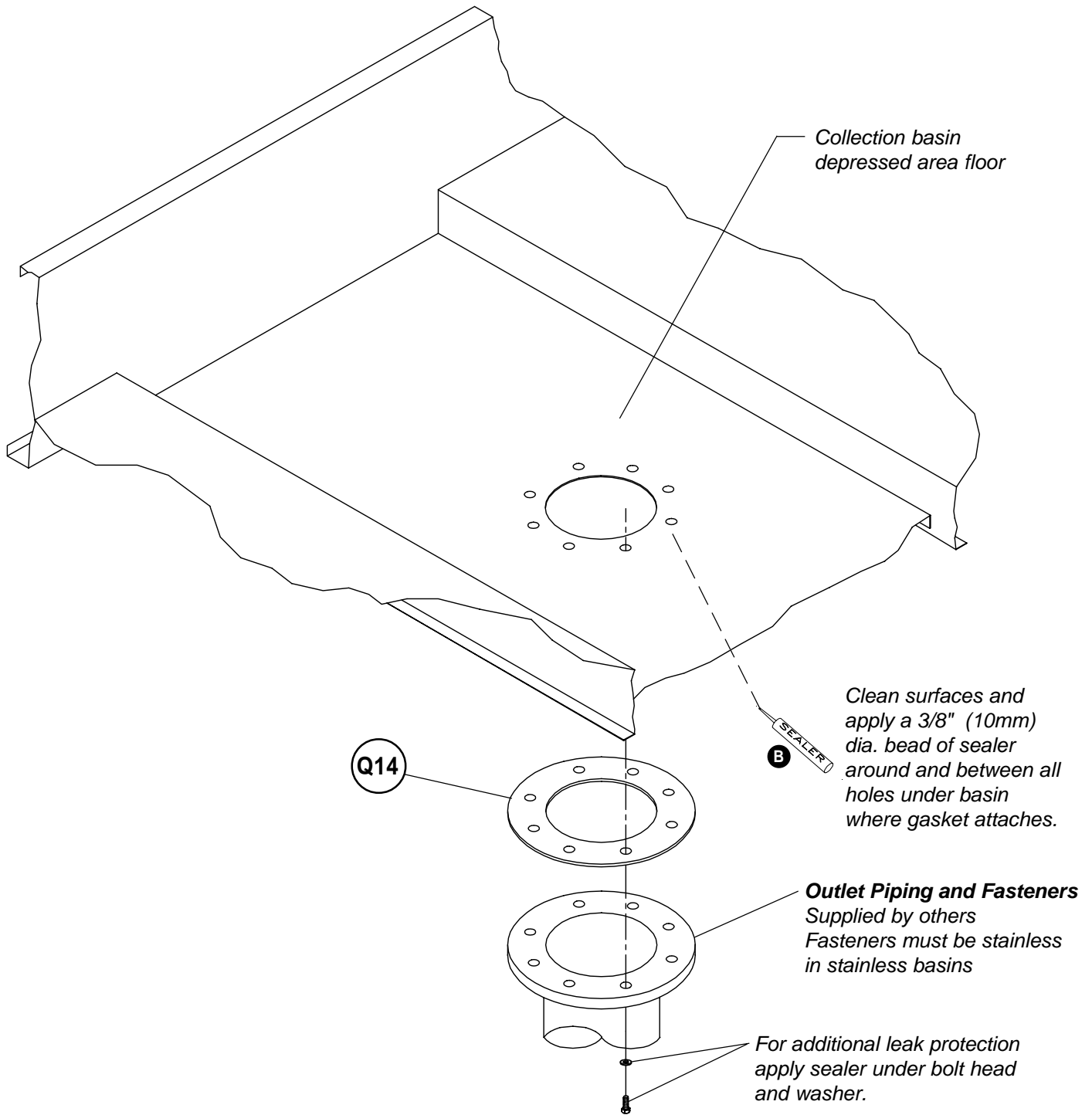



Figure 2-3

BOTTOM OUTLET

The typical attachment of customer piping for bottom outlet or equalizer connection using gasket **Q14** is shown in *Figure 2-3*. **The tower is not designed to support additional piping loads. DO NOT SUPPORT PIPING FROM THE TOWER.**

 Piping, supports, design of piping and supports, and restraint of lateral piping loads is the responsibility of others.

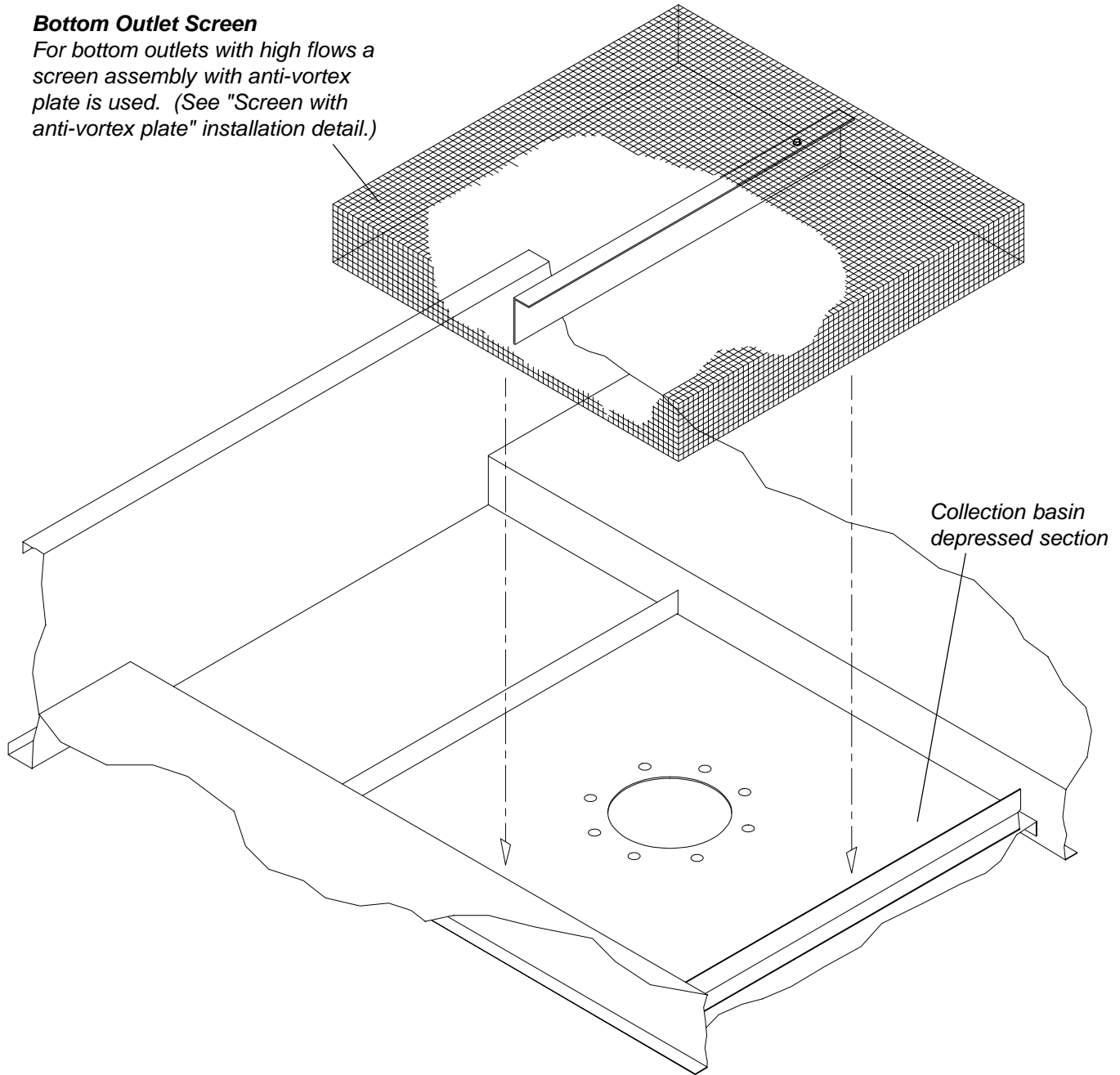


Figure 2-4

BOTTOM OUTLET SCREEN

When a screen is needed with the bottom outlet, it is installed as shown in *Figure 2-4*. On bottom outlets with higher flows a screen assembly with anti-vortex plate is used. See "Screen with anti-vortex plate" installation detail.

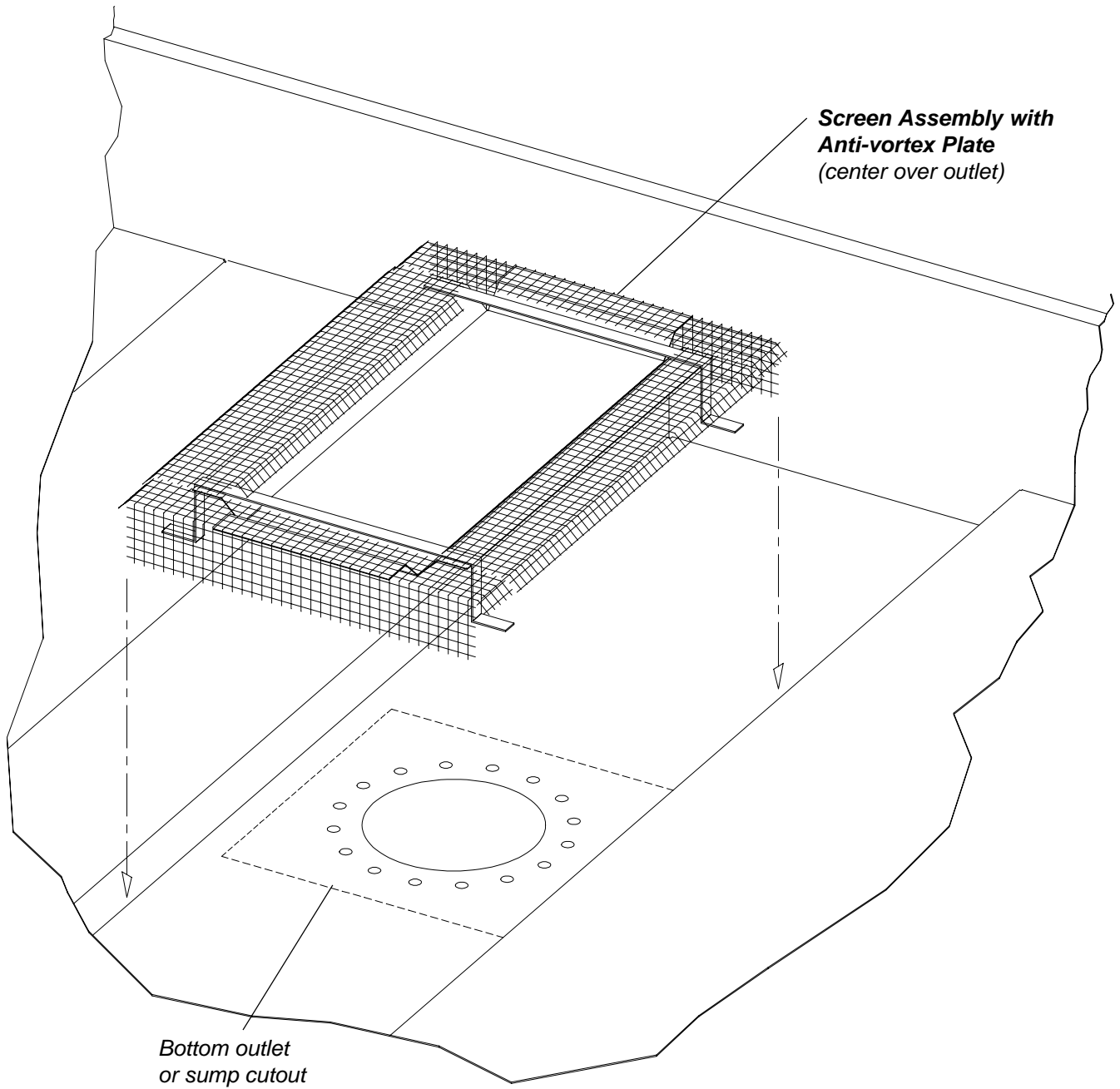


Figure 2-5

SCREEN WITH ANTI-VORTEX PLATE

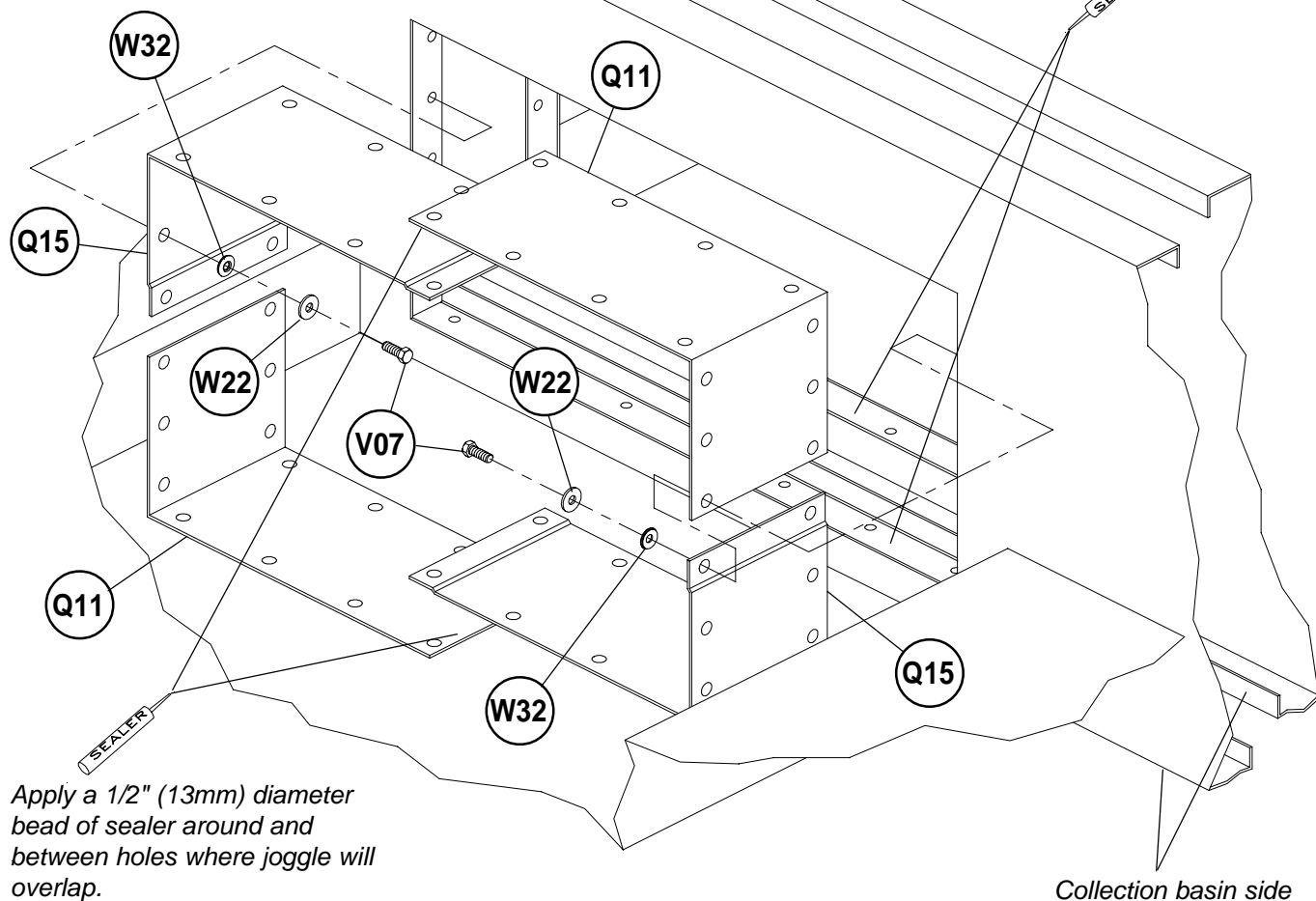
On towers with higher outlet flows, a screen assembly with an anti-vortex plate is used as shown in *Figure 2-5*. Anti-vortex plate is pre-assembled with screens and retainers. Position anti-vortex assembly in depressed area of collection basin centered over outlet.

IMPORTANT! Flumes are not a walking surface. Flumes that are 18" (457mm) long and longer have a caution decal which should be orientated on top.

Find No.	Description
V07	3/8"x1" Bolt
W22	3/8" Flat Washer
W32	3/8" Sealing Washer

Fasteners are stainless steel

Apply a 1/2" (13mm) diameter bead of sealer around and between holes on flume collars.



Apply a 1/2" (13mm) diameter bead of sealer around and between holes where joggle will overlap.

Figure 2-6

FLUME

If collection basins of multiple towers are to be connected together, a flume is installed per Figure 2-6.

Flume collars are shop installed in each tower along with temporary coverplates for shipment. Remove coverplates before continuing. Note that if a weir gate option (a removable plate used to isolate adjacent towers) has been purchased, the weir gate is shop installed, in one tower, for shipment. The weir gate will be reinstalled, in either tower, after installation of flume per Figure 2-7.

Note that towers must be aligned before attempting to install flume in place. **Sealing of the flume connections is critical to prevent leaks.** Apply a 1/2" (13mm) bead of sealer Z11 as indicated, around and between all holes on both flume collars. Install non-joggled flume corners Q11 first. Apply another bead of sealer around and between holes where joggle will overlap on flume. Complete flume installation by installing joggled flume corners Q15. If weir gate option is purchased, ends of flume corners must be flush to ensure a proper seal.

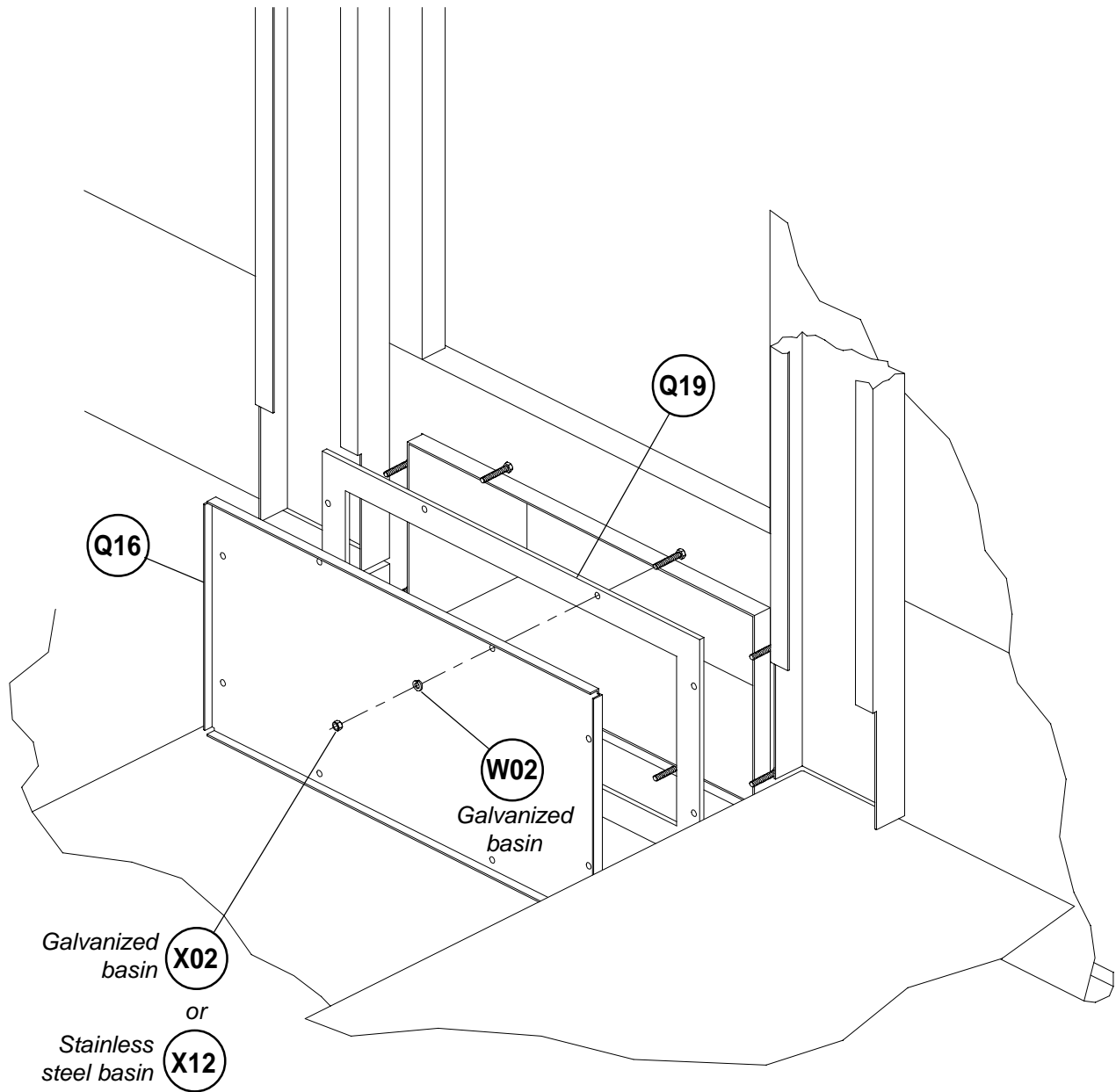


Figure 2-7

WEIR GATE

If the weir gate option is being used refer to *Figure 2-7* for installation details. Slide weir gate **Q16** and gasket **Q19** (removed from tower before flume installation) over eight longer bolts. Tighten all bolts, beginning at the top, compressing gasket against end of flume insert.

Find No.	Description
W02	3/8" Lock Washer
X02	3/8" Nut
X12	3/8" Self-locking Nut

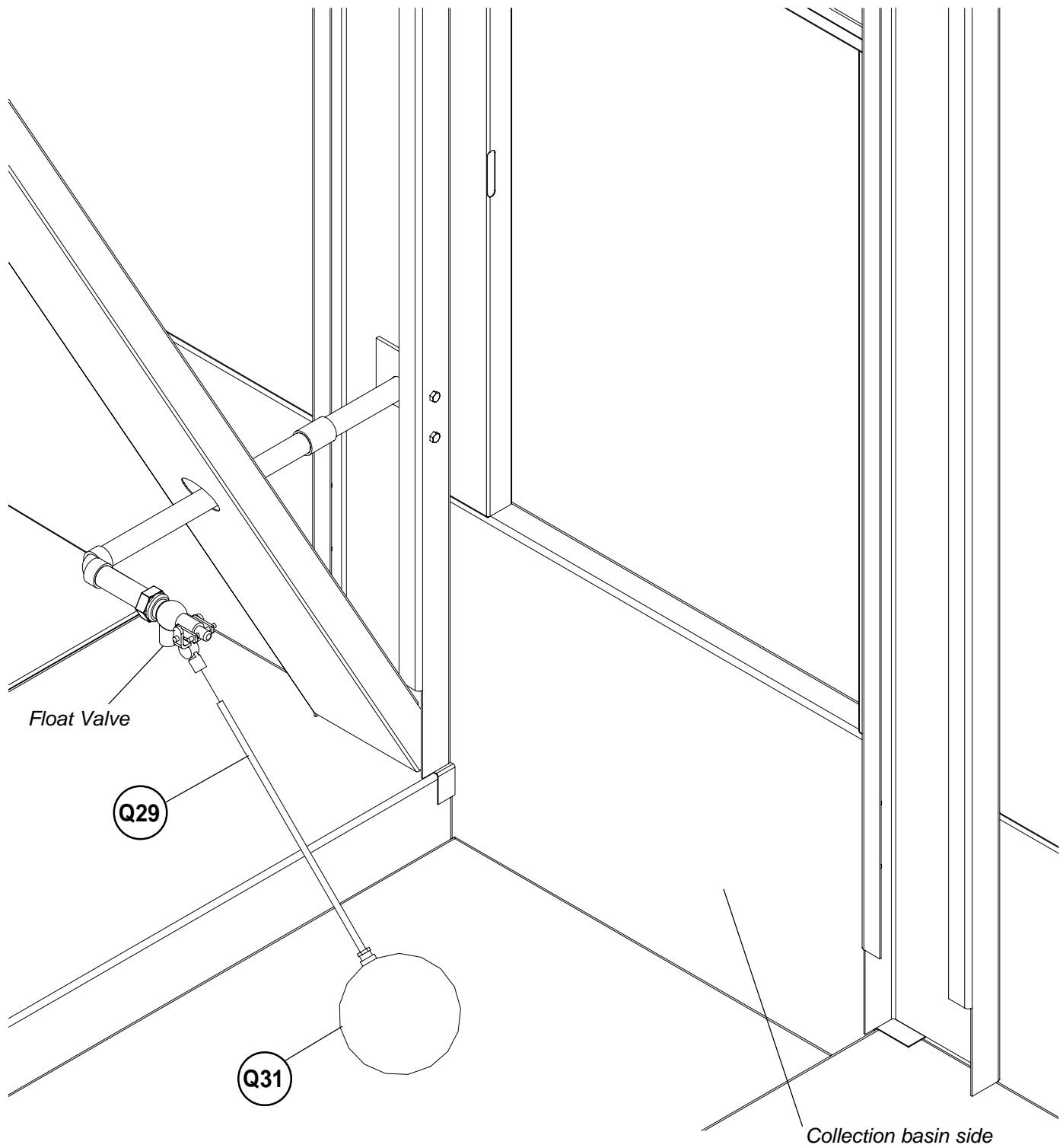


Figure 2-8

FLOAT VALVE FLOAT

Attach stem **Q29** to float **Q31**. Install float and stem assembly into end of float valve lever arm as shown in Figure 2-8. See your *NC Owners Manual* for adjustment of float valve.

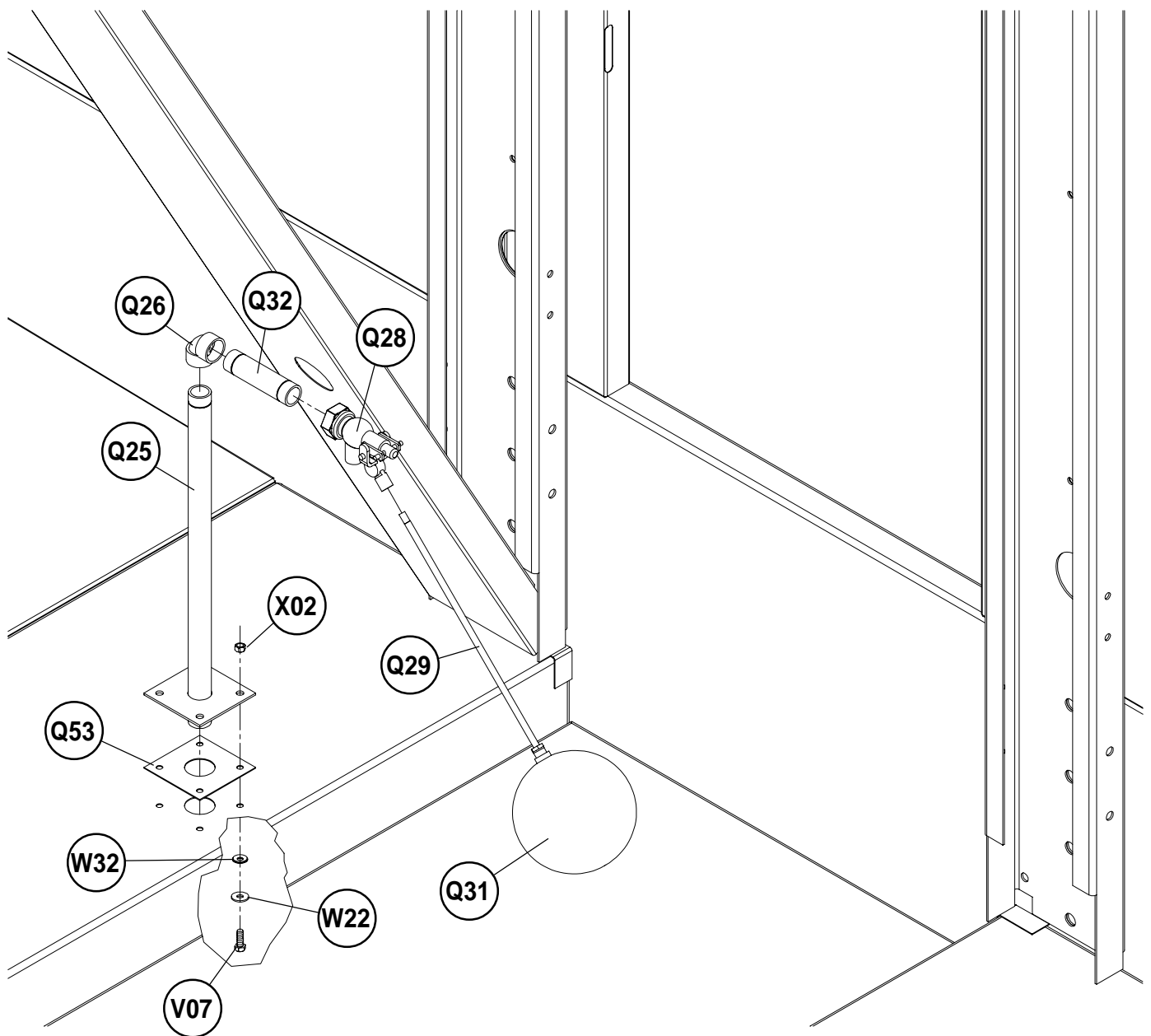


Figure 2-9

STANDPIPE FLOAT VALVE

Figure 2-9 shows the standpipe float valve installation. Start by attaching standpipe assembly **Q25** and gasket **Q53** to the collection basin floor. Using pipe joint compound **Z04** on all pipe connections, connect 90° elbow **Q26**, pipe **Q32**, and float valve **Q28** (*make sure valve opening is pointing down*). Install float **Q31** and valve stem **Q29**. Coat exposed pipe threads with rust inhibiting paint. See your *NC Owners Manual* for adjustment of float valve.

Find No.	Description
V07	3/8"x1" Bolt
W22	3/8" Flat Washer
W32	3/8" Sealing Washer
X02	3/8" Nut

ELECTRIC BASIN HEATERS

The collection basin modifications for the heater components for single cell towers are typically located on a cased face for a single heater element and thru the depressed section floor for multiple heater elements. The collection basin modifications for the heater components for multi-cell towers are typically located thru the collection basin depressed floor. See *Figure 2-10A*. Depending on heater package selected, multiple holes for heater elements may be in basin.

The installation must meet requirements of latest National Electric Code and local codes. Heater package components consist of an enclosure, magnetic contactor, circuit board, transformer, heater elements, and control probe. One heater package can control the heaters for a maximum of a two cell multi-cell tower. Multi-cell towers with more than two cells must have a heater package for every two cells, or for every cell. See Pages 2-11 thru 2-12 for installation details.

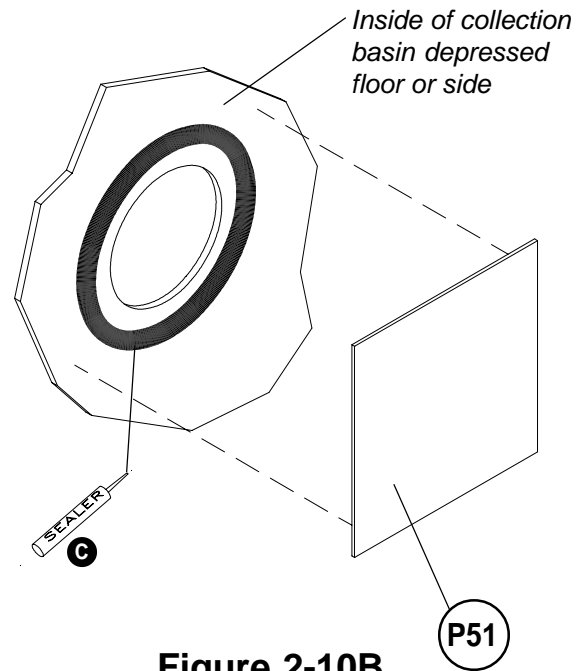


Figure 2-10B

*If the heater is unavailable and it is necessary to run the tower, temporary cover plates **P51** are provided for installation per *Figure 2-10B*.*

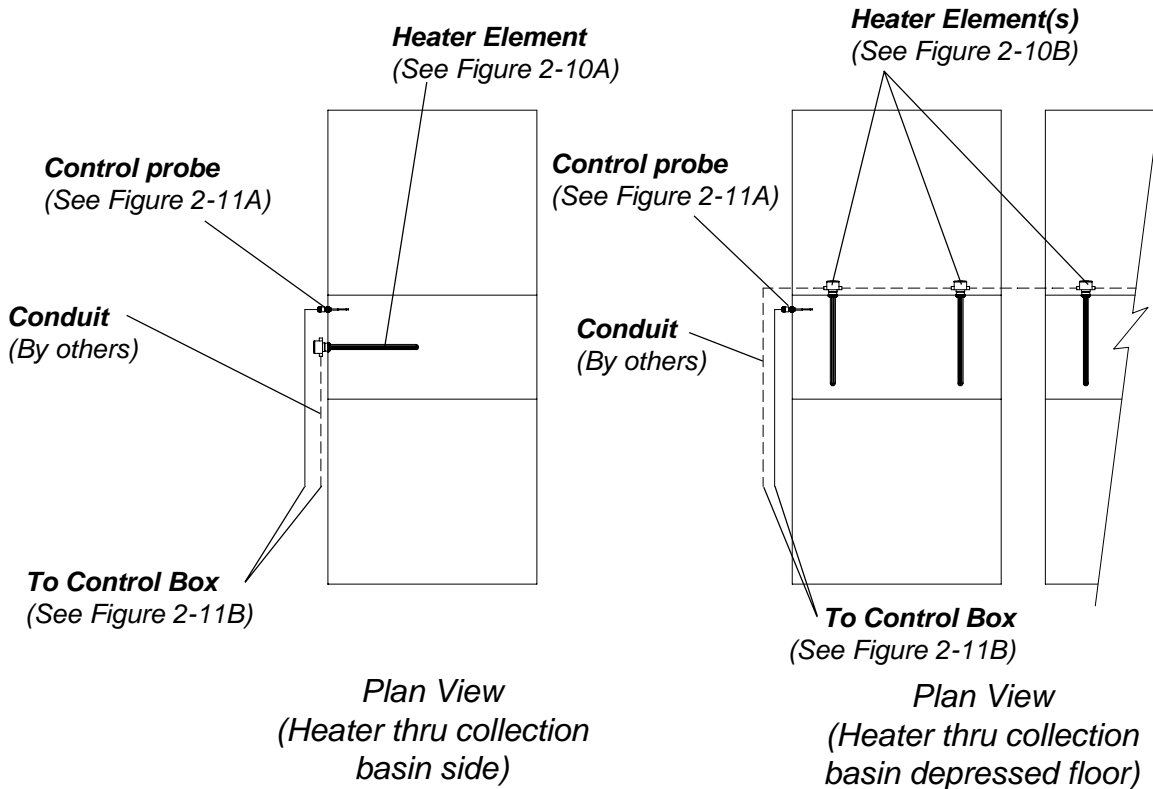


Figure 2-10A

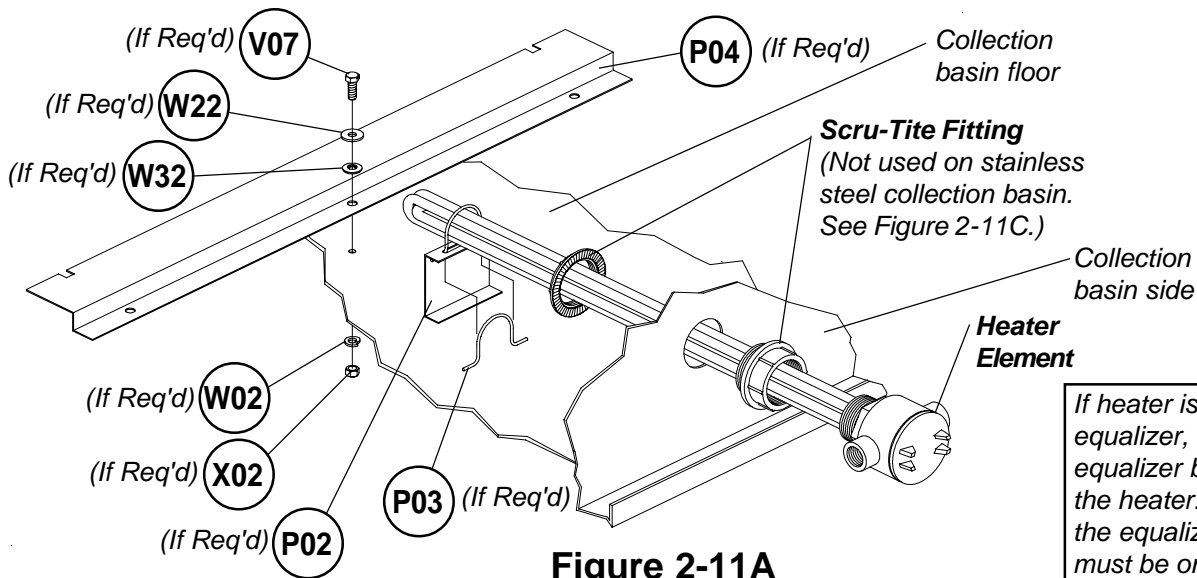


Figure 2-11A
(Heater thru collection basin side)

If heater is located over an equalizer, install the equalizer before installing the heater. Bolt heads of the equalizer fasteners must be on the inside of the basin.

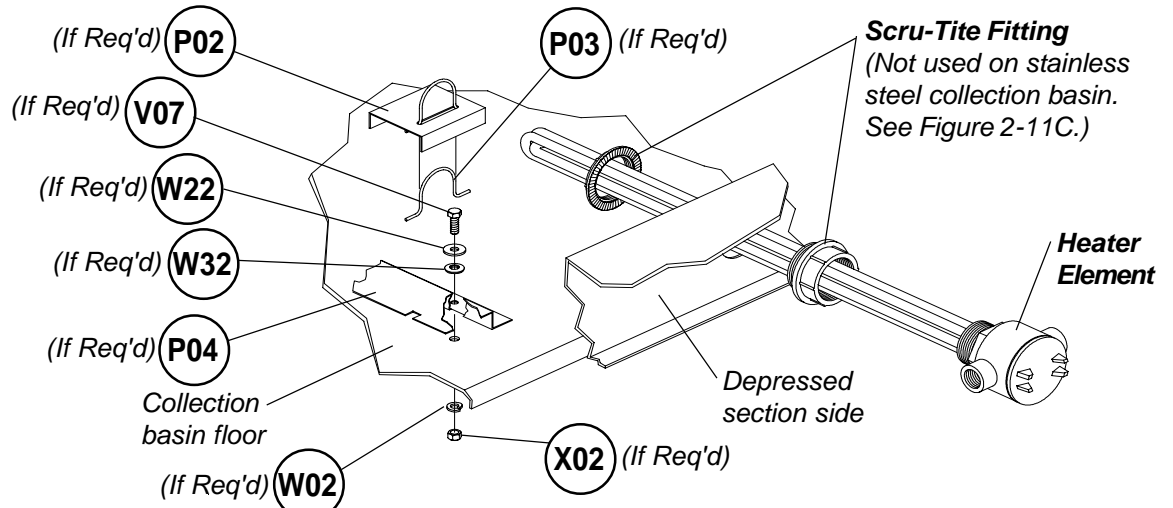


Figure 2-11B
(Heater thru collection basin depressed section)

3"x3" (7.62cm x 7.62cm) Plates
(install on inside of basin)

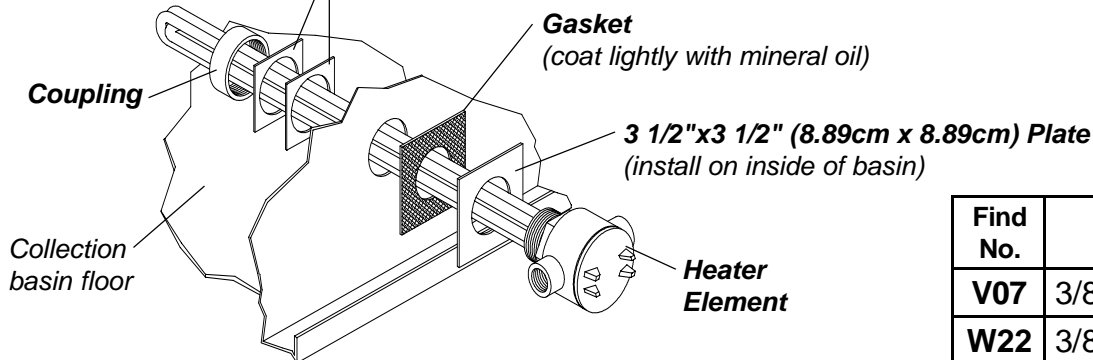


Figure 2-11C
(Required on towers with stainless steel collection basin)

Find No.	Description
V07	3/8"x1" Bolt
W22	3/8" Flat Washer
W32	3/8" Sealing Washer
X02	3/8" Nut

The heater element(s) are installed in the 2 7/16" (6.19 cm) diameter hole(s) in the collection basin. On galvanized basins install scru-tite fitting as shown in *Figures 2-11A and 2-11B*. On stainless steel basins install gasket, plates and coupling as indicated in *Figure 2-11C*. Use pipe joint compound on threads for a watertight connection and screw heater element into fitting or coupling. Plugs are provided in conduit openings of heater element. Install single conduit to opening with temporary plastic plug. *Do not remove pipe plug unless conduit is installed.*

If heater is within ten inches of a grp sump, a heat shield has been provided. Clean area and apply a 3/8" diameter bead of sealer **Z11** around holes. Attach shield **P04** to floor as shown in *Figures 2-11A and 2-11B*.

If heater is located over an equalizer, install the equalizer before installing the heater. Bolt heads of the equalizer fasteners must be on the inside of the basin.

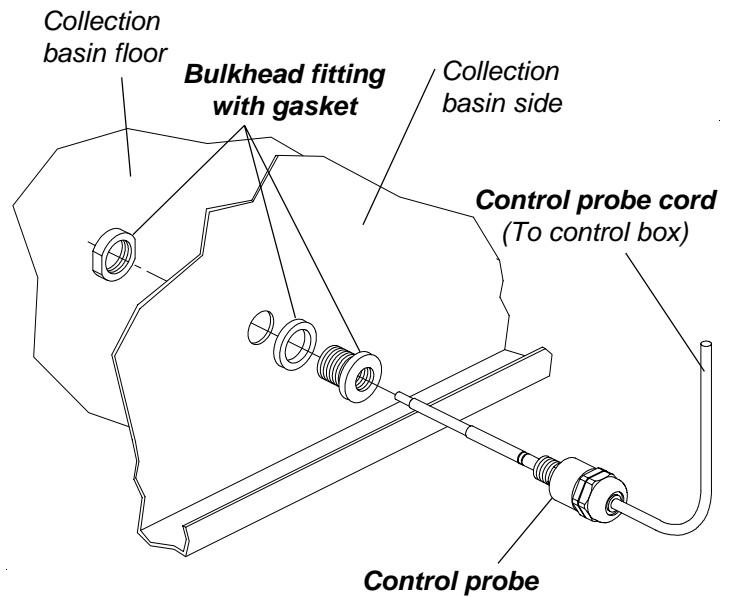


Figure 2-12A

Install the control probe in the bulkhead fitting as shown in *Figure 2-12A*. Use pipe joint compound on threads for a water tight connection. The bulkhead fitting is then installed in the 1 1/8" (2.86 cm) diameter hole in the collection basin.

The basin heater control box (*Figure 2-12B*) is to be located and installed by the customer, outside the cooling tower. Control probe cord length of 12'-0" (3.66 m) limits control box location.

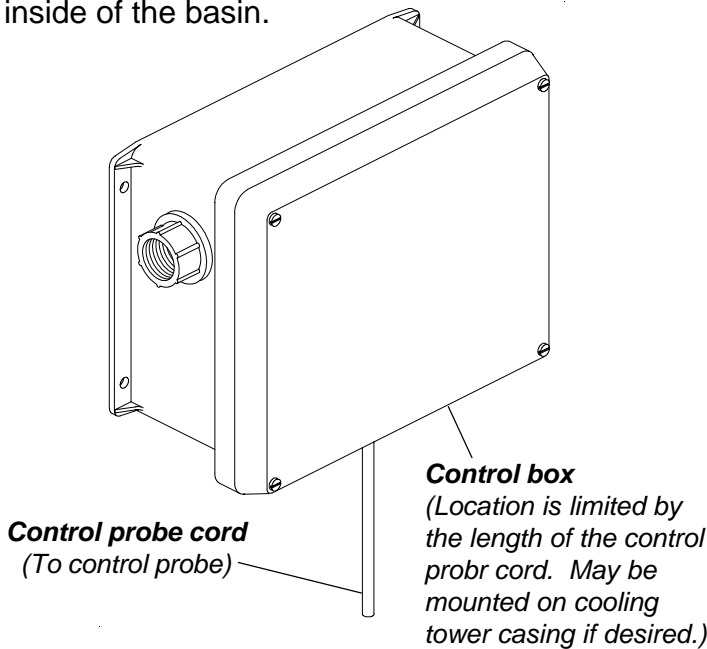


Figure 2-12B

If the heater element is over 10 kilowatts a heater support is required as shown in *Figure 2-12C*. Insert formed wire **P03** thru heater support **P02** and slide over the end of the heater element. Position support to keep the unsupported length of the heater element under 30 inches (76.2 cm). Clean area under support and "glue" to floor using sealer **Z11**.

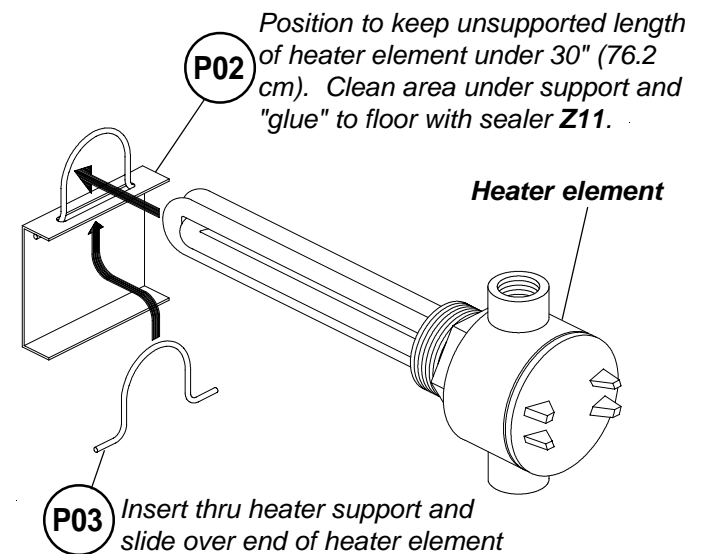


Figure 2-12C

(Required on heaters over 10 kilowatts)

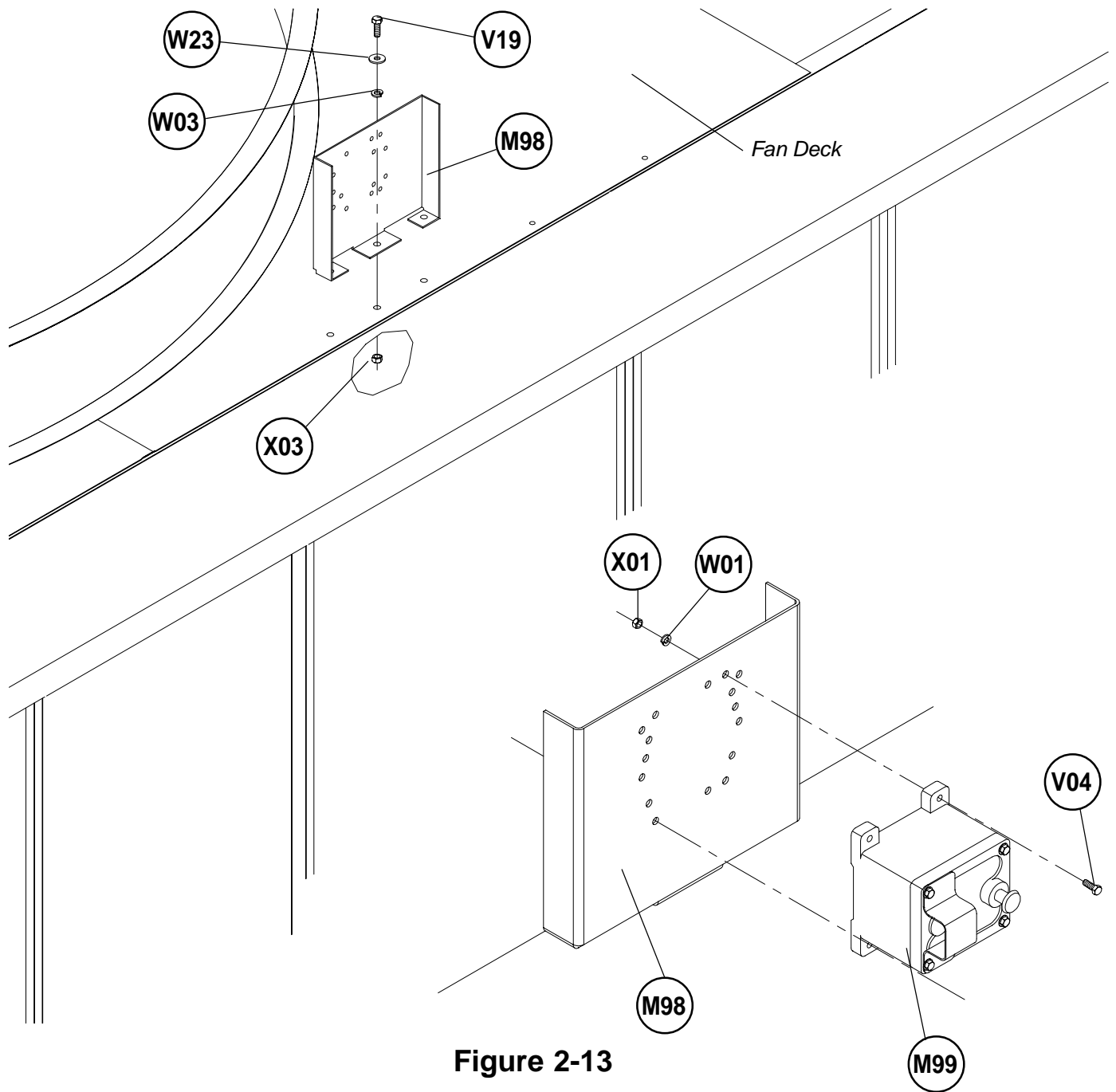


Figure 2-13

EXTERNAL VIBRATION SWITCH

If your tower is equipped with an external Metrix, Robertshaw, Murphy, or other vibration switch, Install bracket **M98** to the fan deck on the motor side of the tower as shown. The bracket may be rotated 180° from the position shown on towers without the ladder and handrail option. Install switch **M99** as shown. If a rainshield is required, it is provided for installation between the beam and the switch using the switch mounting hardware.

Find No.	Description
V04	1/4"x1 1/2" Bolt (all thrd.)
V19	1/2"x1 1/2" Bolt
W01	1/4" Lock Washer
W03	1/2" Lock Washer
W23	1/2" Flat Washer
X01	1/4" Nut
X03	1/2" Nut

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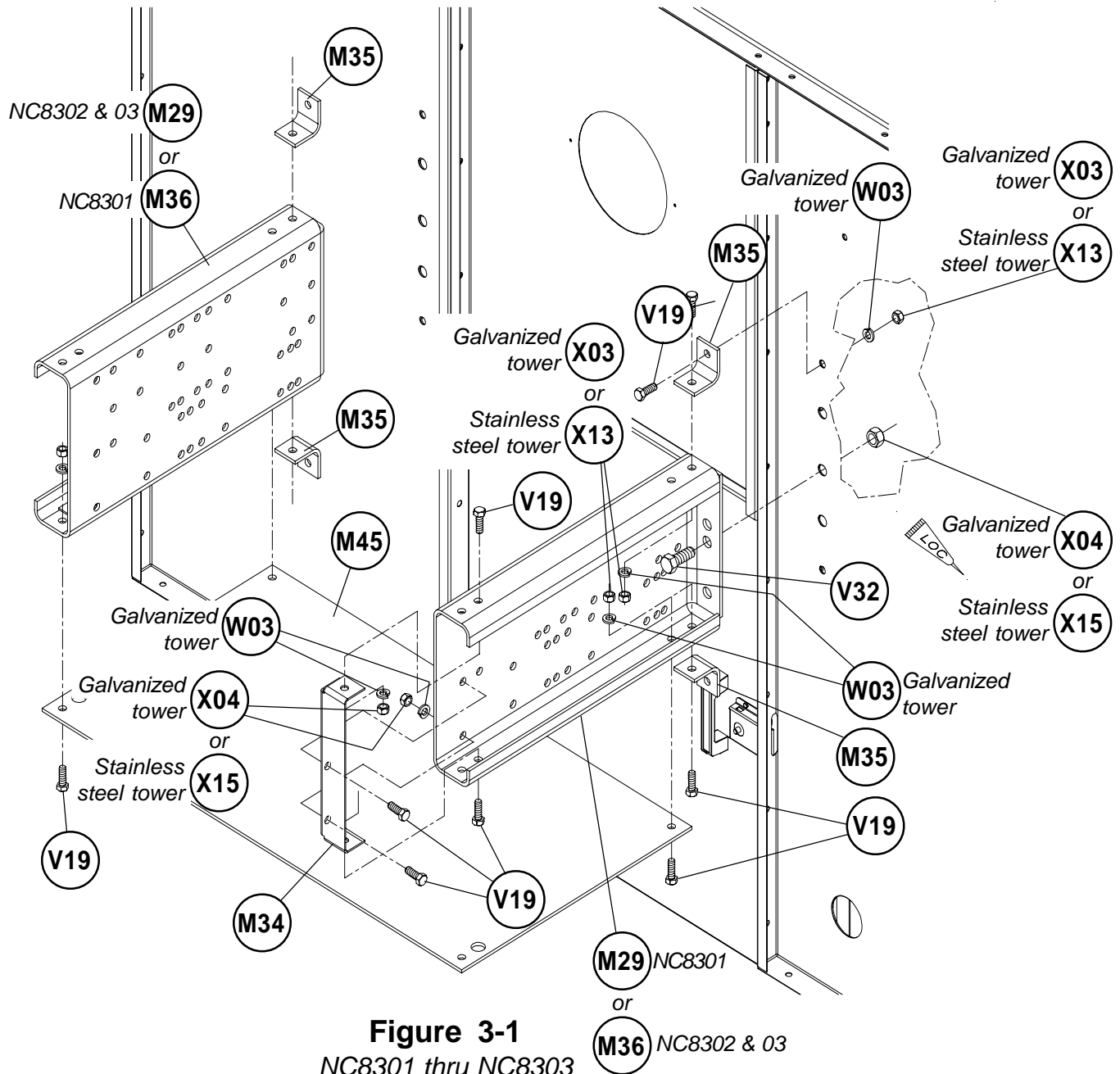


Figure 3-1
NC8301 thru NC8303

MOTOR OUTSIDE AIRSTREAM (MOA)

On towers with MOA option, the motor must be installed in the field on a special support outside the tower and a driveshaft is used as the drive line between motor and Geareducer.

For models NC8301 thru NC8303 refer to *Figure 3-1*. Attach support clips **M35** to support rails **M29** and **M36**. Insert end gusset **M34** into each support rail and attach with hardware as shown. Install bottom plate **M45** to the bottom of the support rails. Attach support assembly to the outside of tower as shown.

Find No.	Description
V19	1/2"x1 1/2" Bolt
V32	3/4"x2" Bolt
W03	1/2" Lock Washer
X03	1/2" Nut
X04	3/4" Nut
X13	1/2" Self-locking Nut
X15	3/4" Self-locking Nut

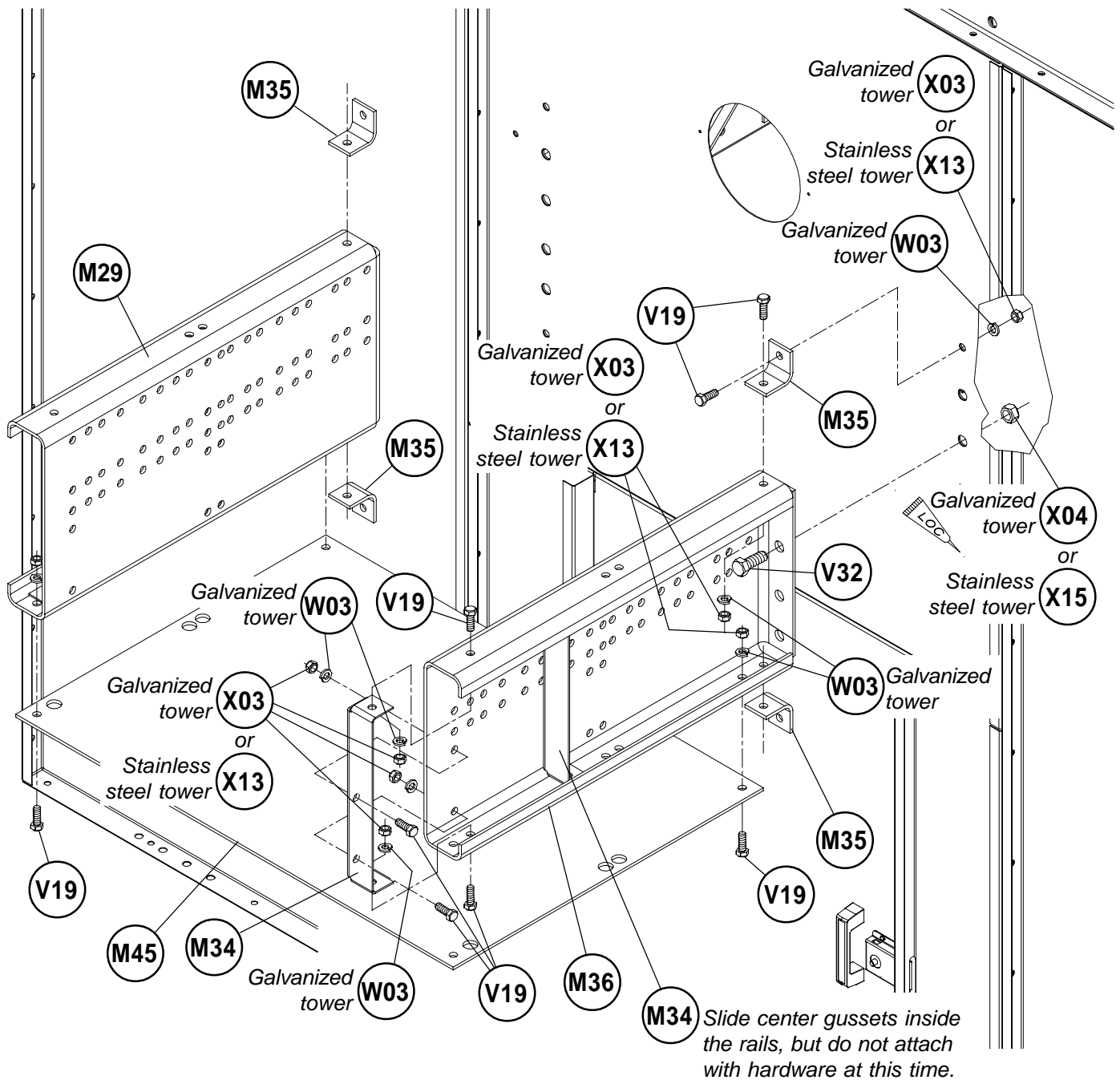


Figure 3-2
NC8304 thru NC8312

Find No.	Description
V19	1/2"x1 1/2" Bolt
V32	3/4"x2" Bolt
W03	1/2" Lock Washer
X03	1/2" Nut
X04	3/4" Nut
X13	1/2" Self-locking Nut
X15	3/4" Self-locking Nut

For models NC8304 thru NC8312 refer to *Figure 3-2*. Attach support clips **M35** to support rails **M29** and **M36**. Insert one rail gusset **M34** into the center of each support rail, but do not fasten with hardware at this time. Insert end gusset **M34** into each support rail and attach with hardware as shown. Install bottom plate **M45** to the bottom of the support rails. Attach support assembly to the outside of tower as shown.

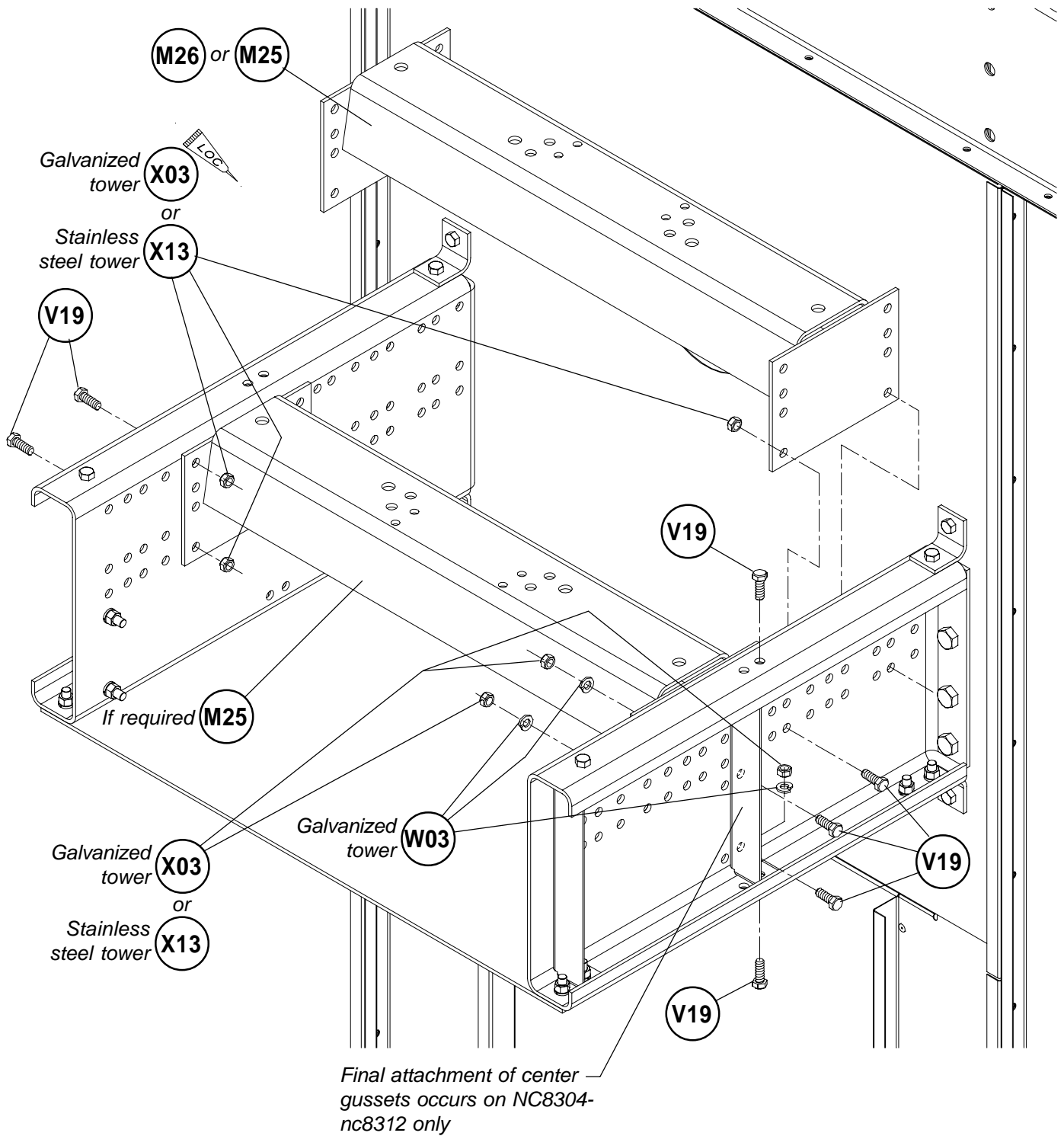


Figure 3-3

Install motor supports **M25** and/or **M26** as shown in Figure 3-3. For NC8304 thru NC8312 models attach center gussets fitted loose previously. In order to determine the motor support and gusset positions, you must determine your tower model and motor frame size. Then refer to the appropriate figures in this section.

Find No.	Description
V19	1/2"x1 1/2" Bolt
W03	1/2" Lock Washer
W23	1/2" Flat Washer
X03	1/2" Nut
X13	1/2" Self-locking Nut

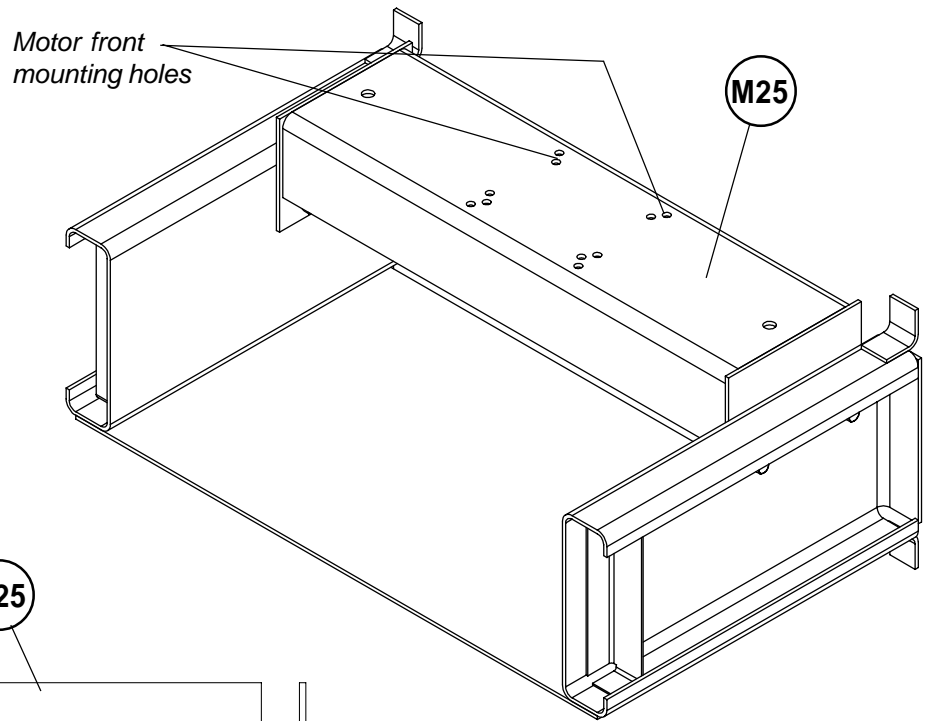


Figure 3-4A

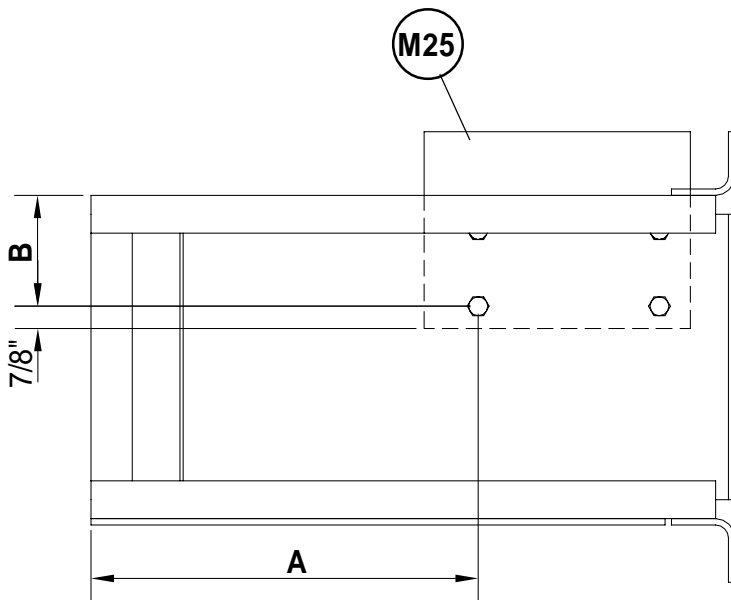


Figure 3-4B

If your tower model and motor frame size are listed in the table below, orient motor support **M25** as shown in *Figure 3-4A*. Install motor support at the dimensions shown in *Figure 3-4B*.

Tower Model	Motor Frame	A	B
NC8301	184T	15 1/4" (387mm)	4 3/8" (111mm)
NC8301	213T & 215T	11 13/16" (300mm)	4 3/8" (111mm)

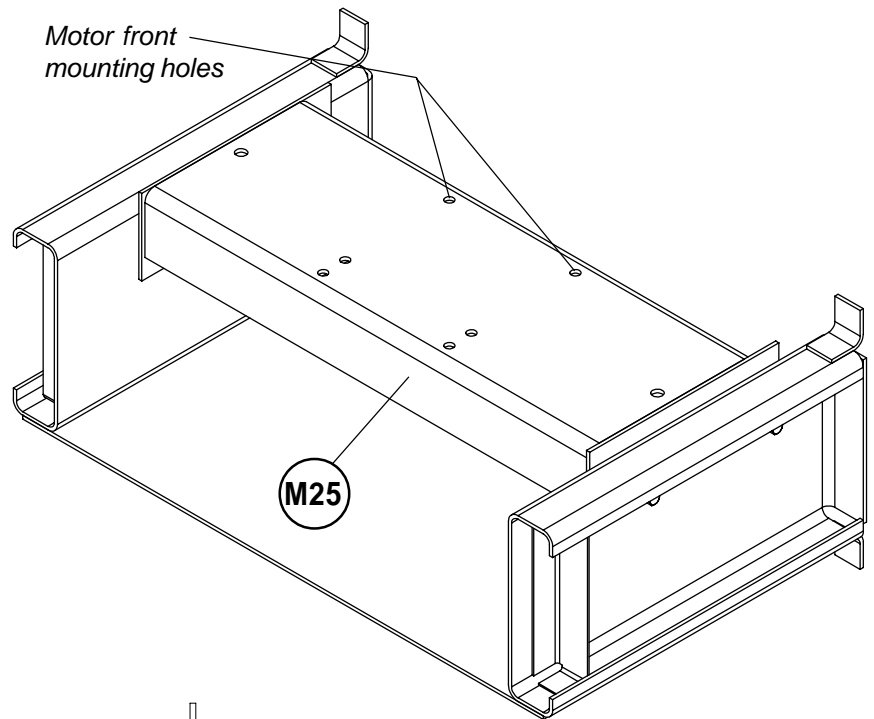


Figure 3-5A

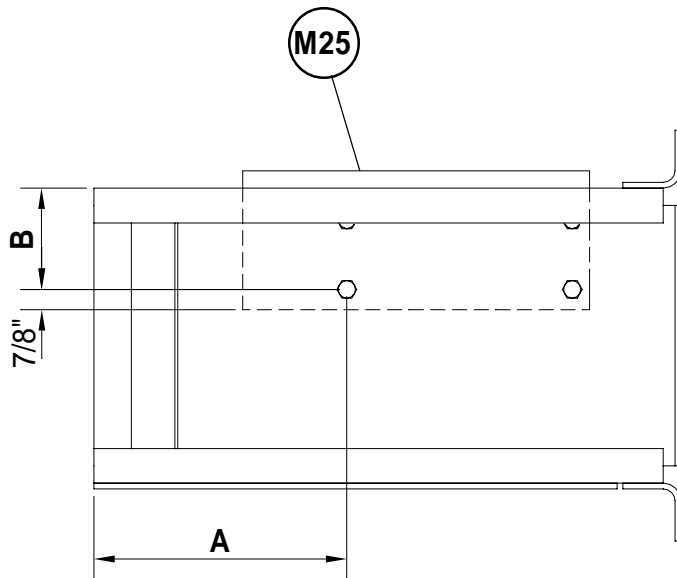


Figure 3-5B

If your tower model and motor frame size are listed in the table below, orient motor support **M25** as shown in *Figure 3-5A*. Install motor support at the dimensions shown in *Figure 3-5B*.

Tower Model	Motor Frame	A	B
NC8301	254T & 256T	10 15/16" (278mm)	4 3/8" (111mm)
	284TS & 286TS	7 9/16" (192mm)	4 3/8" (111mm)

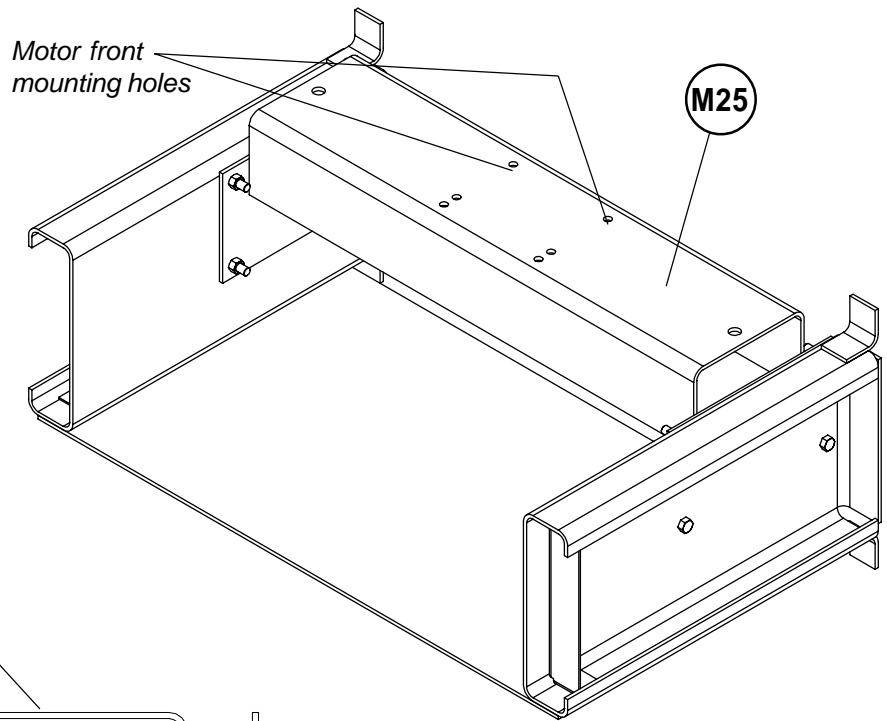


Figure 3-6A

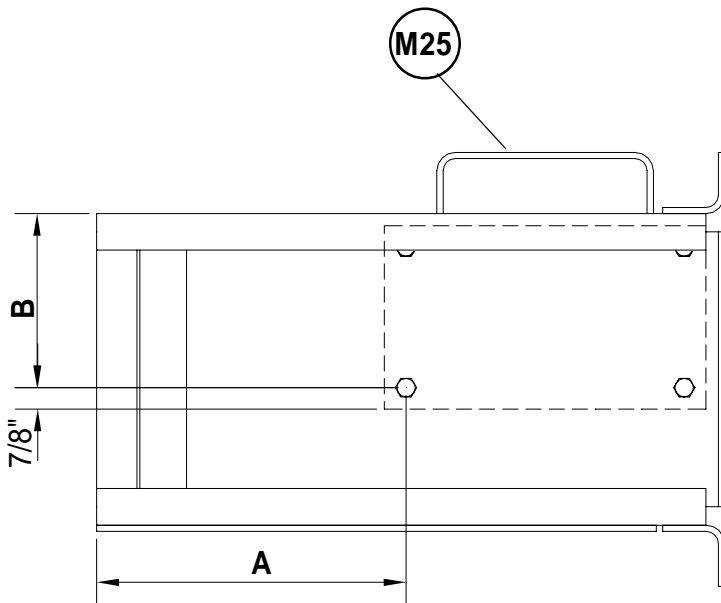


Figure 3-6B

If your tower model and motor frame size are listed in the table below, orient motor support **M25** as shown in *Figure 3-6A*. Install motor support at the dimensions shown in *Figure 3-6B*.

Tower Model	Motor Frame	A	B
NC8302 & NC8303	184T	12 1/2" (317mm)	7 1/8" (181mm)

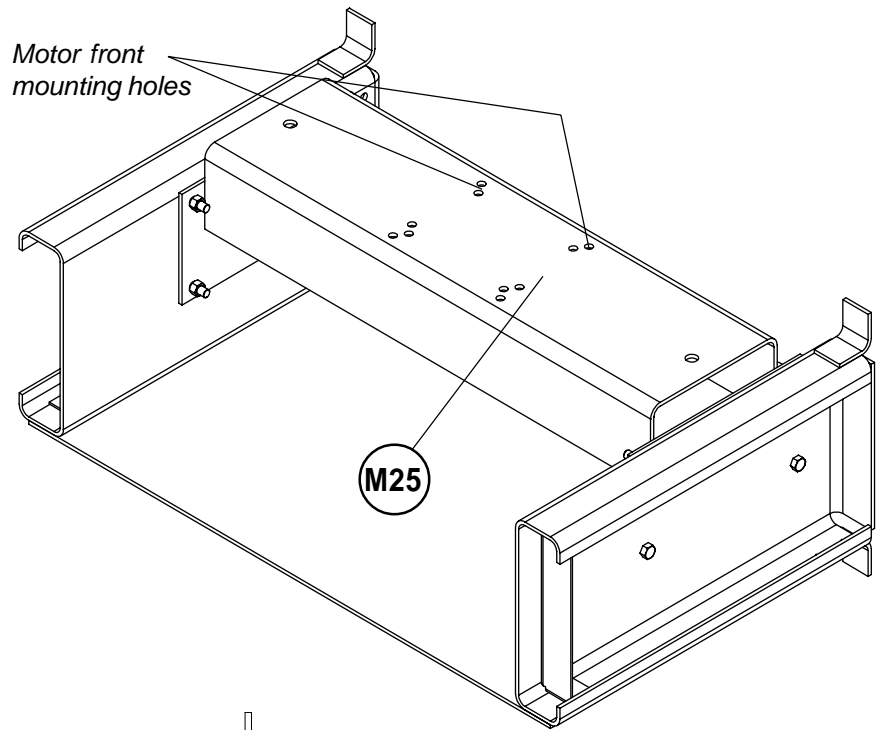


Figure 3-7A

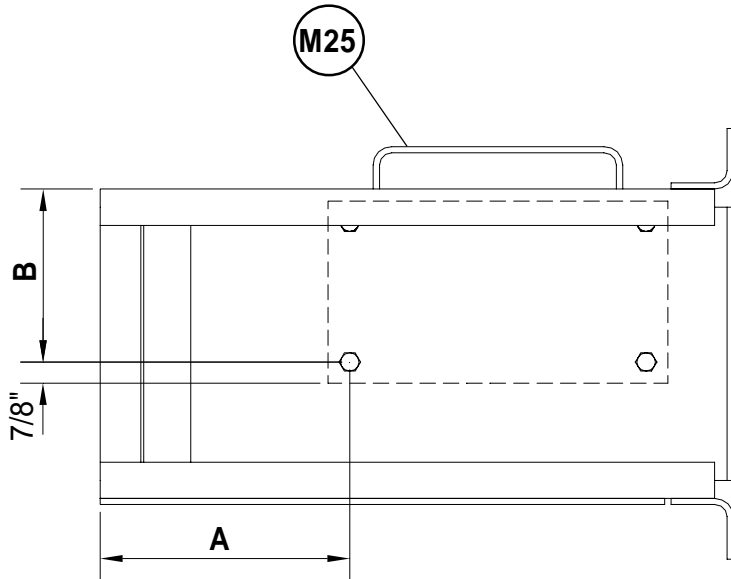


Figure 3-7B

If your tower model and motor frame size are listed in the table below, orient motor support **M25** as shown in *Figure 3-7A*. Install motor support at the dimensions shown in *Figure 3-7B*.

Tower Model	Motor Frame	A	B
NC8302 & NC8303	213T & 215T	10" (254mm)	7 1/8" (181mm)

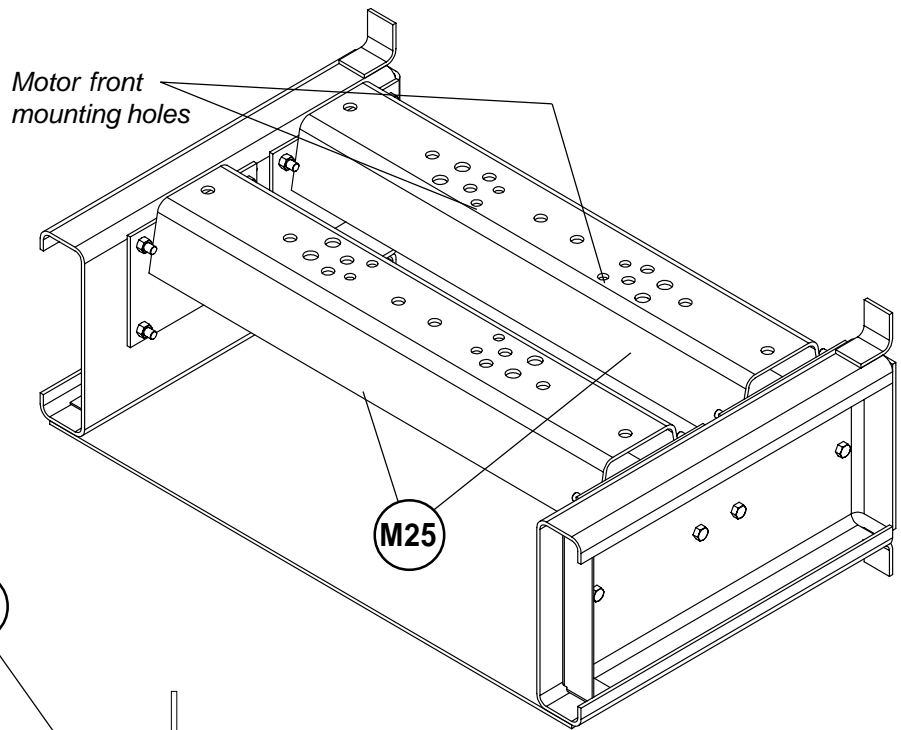


Figure 3-8A

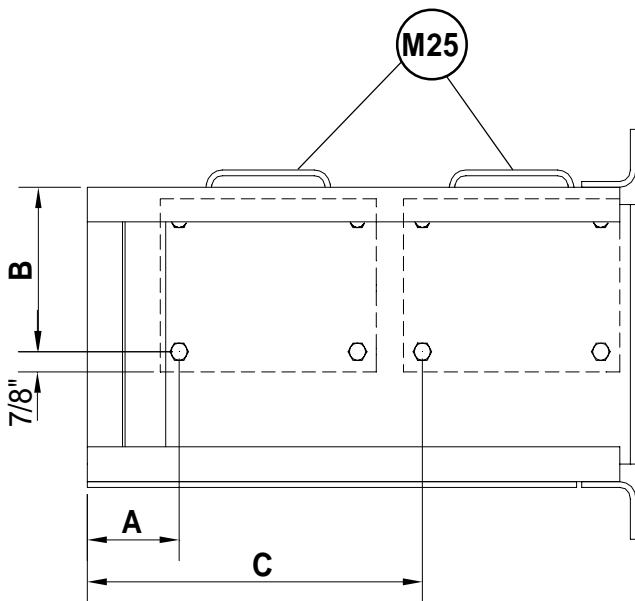


Figure 3-8B

If your tower model and motor frame size are listed in the table below, orient motor supports **M25** as shown in *Figure 3-8A*. **Notice that the back hat is turned 180 degrees from the front hat.** Install motor support at the dimensions shown in *Figure 3-8B*.

Tower Model	Motor Frame	A	B	C
NC8302 & NC8303	254T & 256T	4 1/4" (108mm)	7 1/8" (181mm)	15 1/2" (394mm)

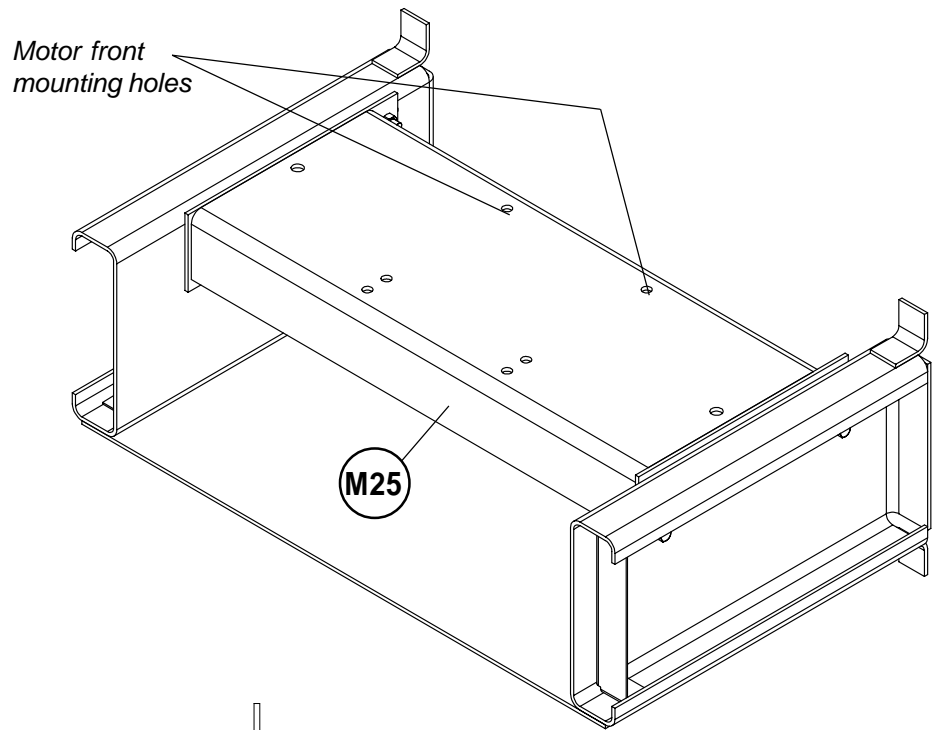


Figure 3-9A

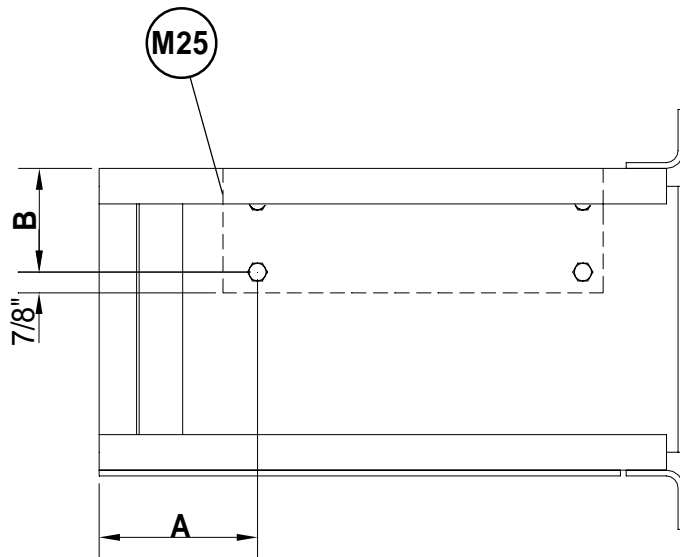


Figure 3-9B

If your tower model and motor frame size are listed in the table below, orient motor support **M25** as shown in *Figure 3-9A*. Install motor support at the dimensions shown in *Figure 3-9B*.

Tower Model	Motor Frame	A	B
NC8302 & NC8303	284TS & 286TS	6 7/8" (175mm)	4 3/8" (111mm)

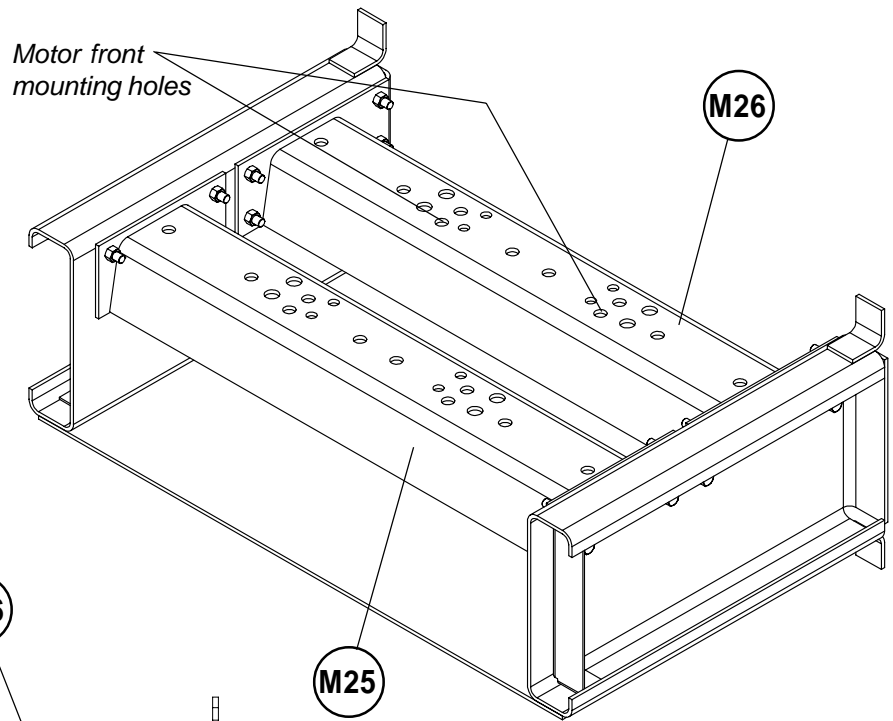


Figure 3-10A

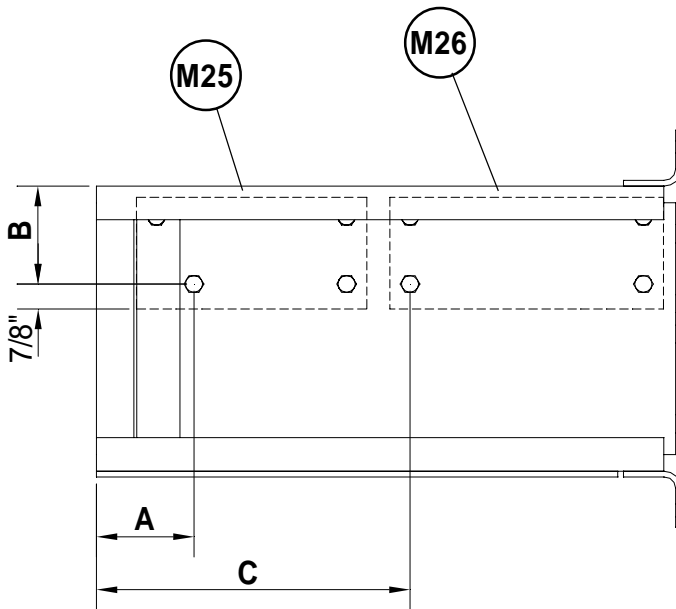


Figure 3-10B

If your tower model and motor frame size are listed in the table below, orient motor supports **M25** and **M26** as shown in *Figure 3-10A*. Install motor support at the dimensions shown in *Figure 3-10B*.

Tower Model	Motor Frame	A	B	C
NC8302 & NC8303	324TS & 326TS	4 1/4" (108mm)	4 3/8" (111mm)	13 5/8" (346mm)

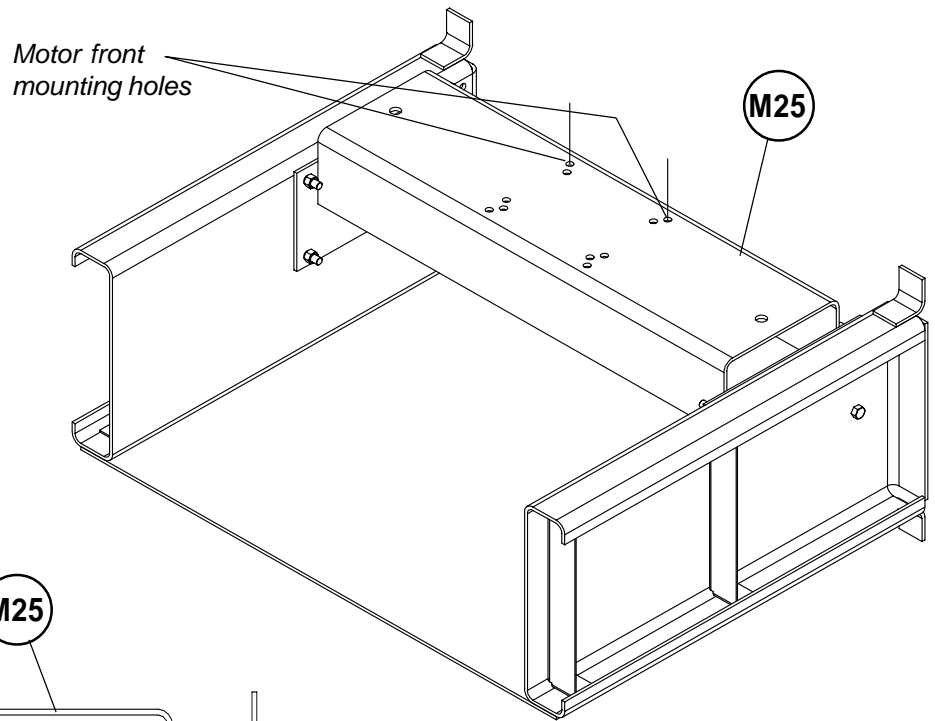


Figure 3-11A

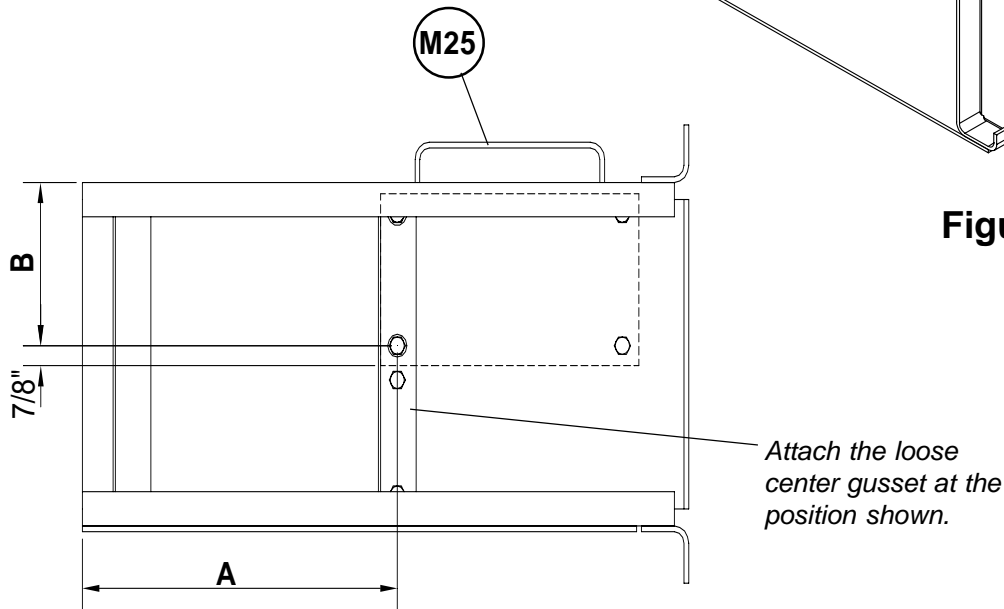


Figure 3-11B

If your tower model and motor frame size are listed in the table below, orient motor supports **M25** as shown in *Figure 3-11A*. Install motor support at the dimensions shown in *Figure 3-11B*.

Tower Model	Motor Frame	A	B
NC8304 & NC8305	213T & 215T	16 5/8" (422mm)	5 7/16" (138mm)
NC8306 & NC8307			7 1/8" (181mm)

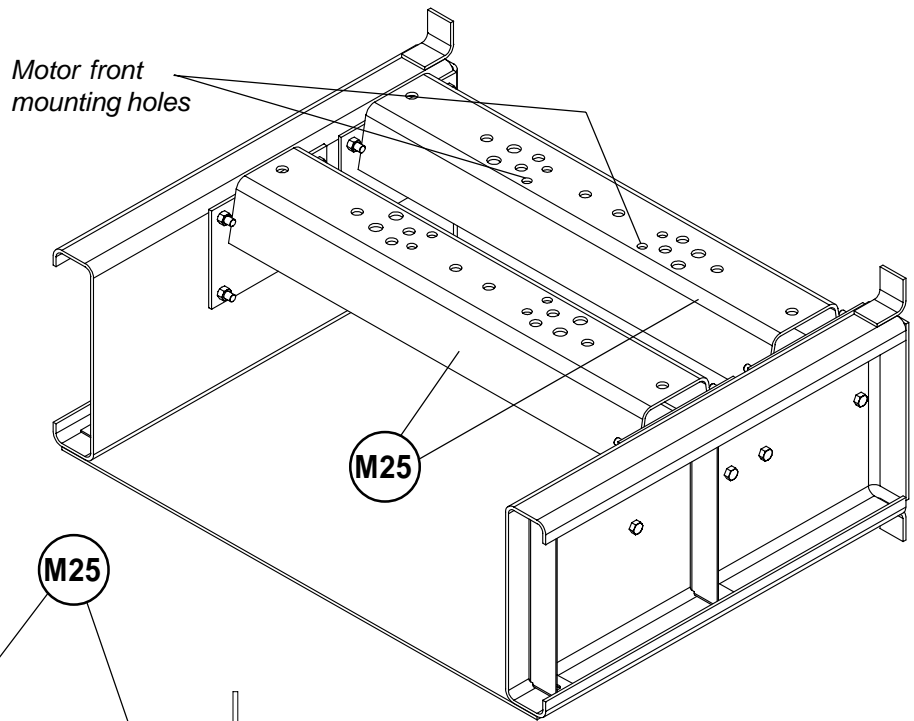


Figure 3-12A

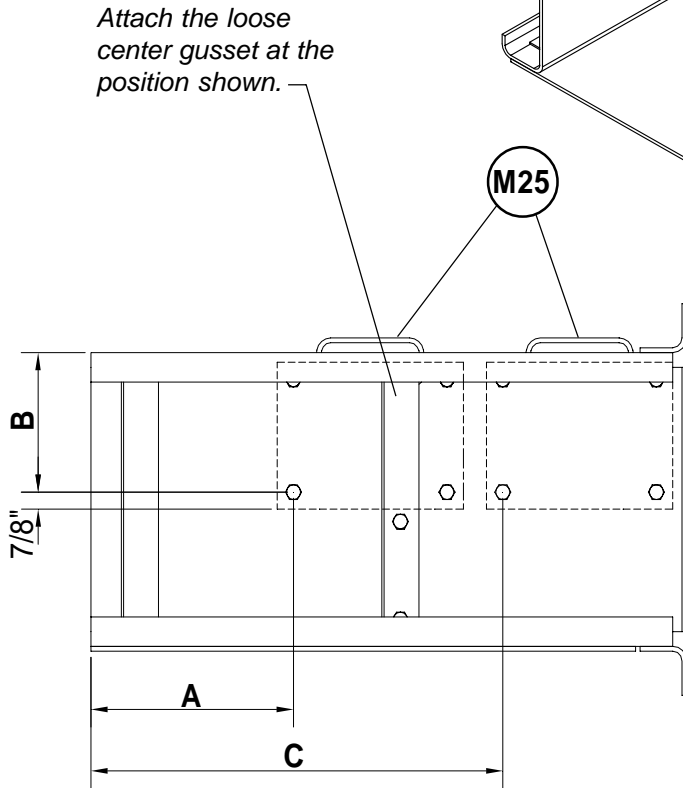


Figure 3-12B

If your tower model and motor frame size are listed in the table below, orient motor supports **M25** as shown in *Figure 3-12A*. **Notice that the back hat is turned 180 degrees from the front hat.** Install motor support at the dimensions shown in *Figure 3-12B*.

Tower Model	Motor Frame	A	B	C
NC8304 & NC8305	254T & 256T	10 7/8" (276mm)	5 7/16" (138mm)	22 1/8" (562mm)
NC8306 thru NC8312			7 1/8" (181mm)	

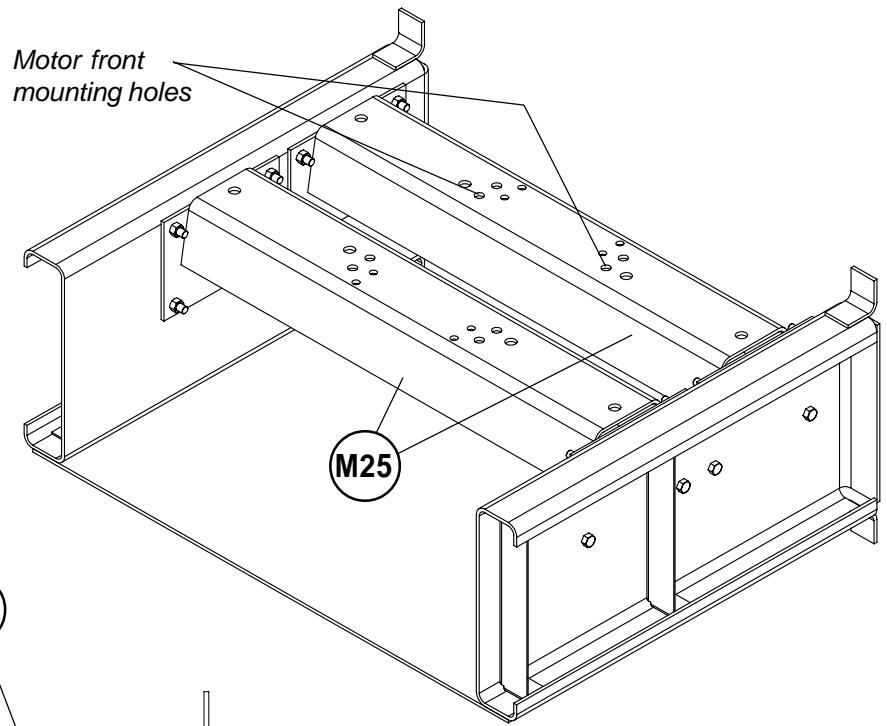


Figure 3-13A

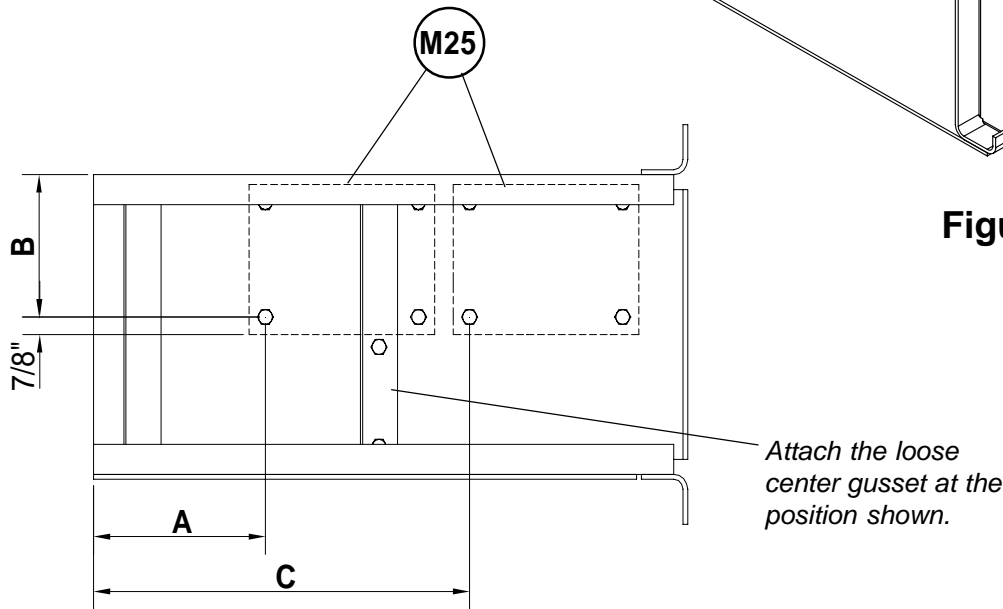


Figure 3-13B

If your tower model and motor frame size are listed in the table below, orient motor supports **M25** as shown in *Figure 3-13A*. **Notice that the back hat is turned 180 degrees from the front hat.** Install motor support at the dimensions shown in *Figure 3-13B*.

Tower Model	Motor Frame	A	B	C
NC8304 & NC8305	284T & 286T	9 1/4" (235mm)	5 7/16" (138mm)	20 1/4" (514mm)
NC8306 thru NC8312			7 1/8" (181mm)	

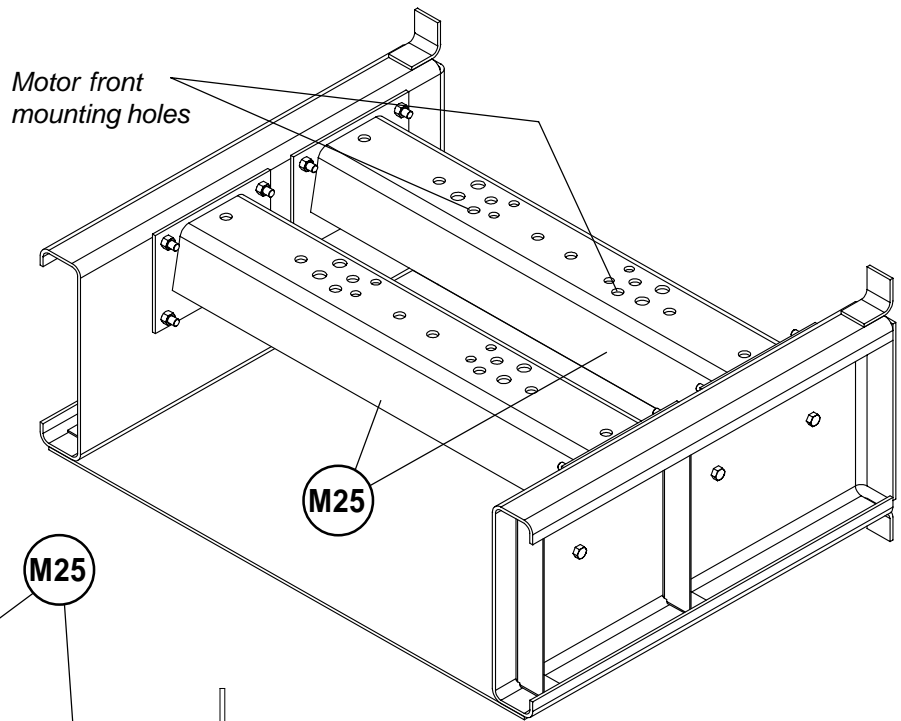


Figure 3-14A

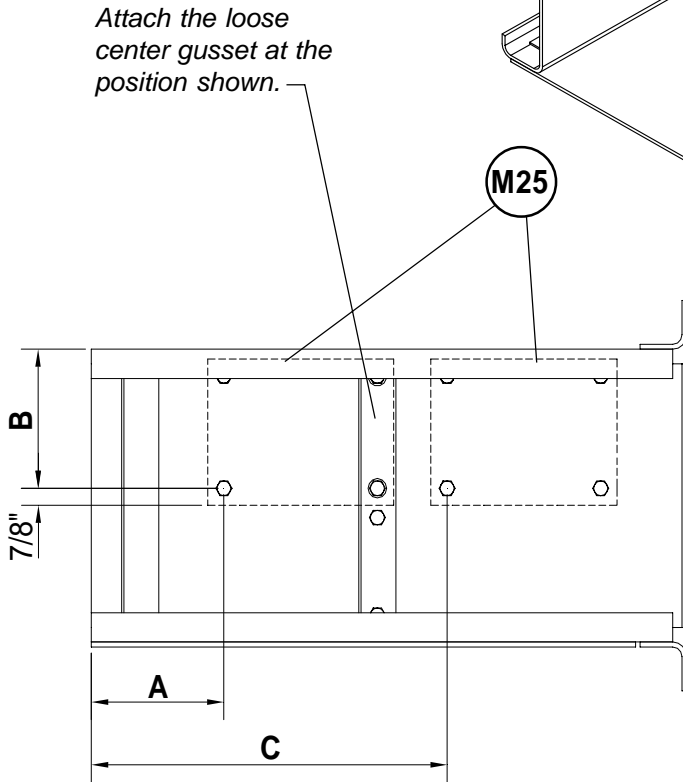


Figure 3-14B

If your tower model and motor frame size are listed in the table below, orient motor supports **M25** as shown in *Figure 3-14A*. Install motor support at the dimensions shown in *Figure 3-14B*.

Tower Model	Motor Frame	A	B	C
NC8304	324T & 326T	7 1/8" (181mm)	5 7/16" (138mm)	19 1/8" (486mm)
NC8305			5 7/16" (138mm)	
NC8306 thru NC8312			7 1/8" (181mm)	

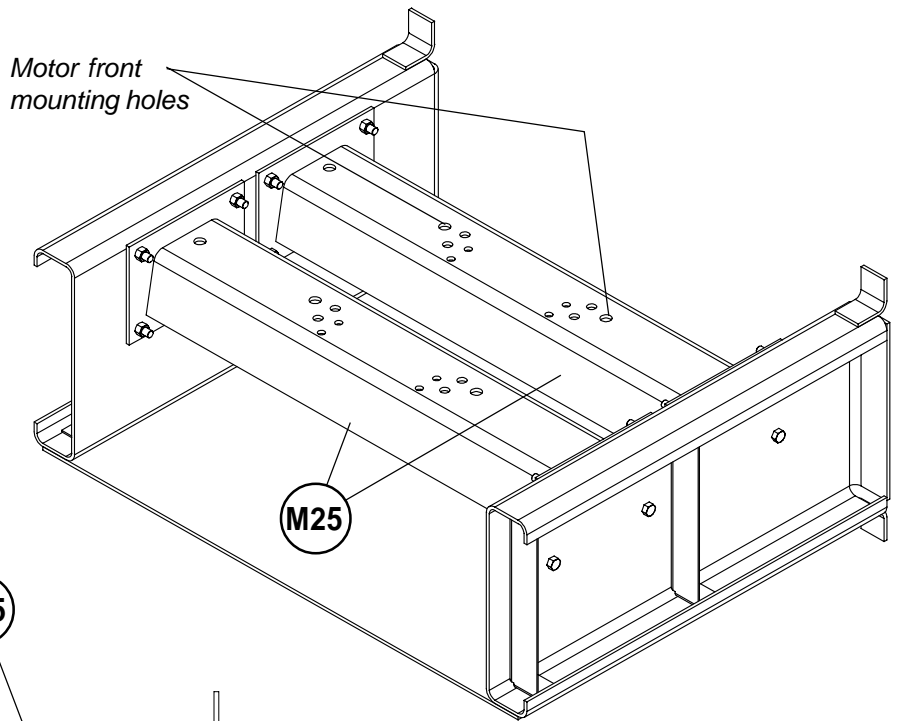


Figure 3-15A

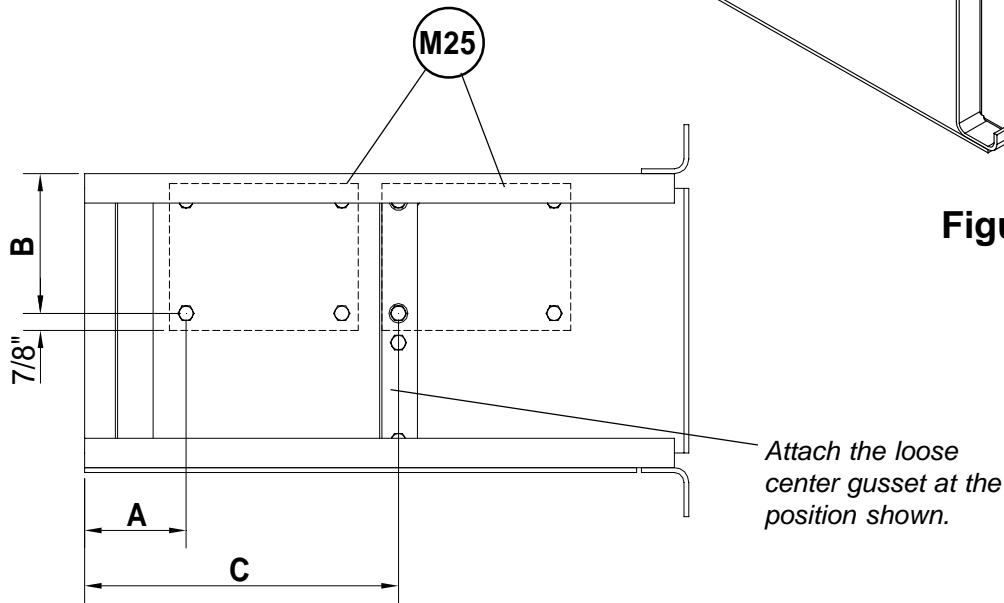


Figure 3-15B

If your tower model and motor frame size are listed in the table below, orient motor supports **M25** as shown in *Figure 3-15A*. Install motor support at the dimensions shown in *Figure 3-15B*.

Tower Model	Motor Frame	A	B	C
NC8304	364T & 365T	5 3/8" (137mm)	5 7/16" (138mm)	16 5/8" (422mm)
NC8305			5 7/16" (138mm)	
NC8306 thru NC8312			7 1/8" (181mm)	

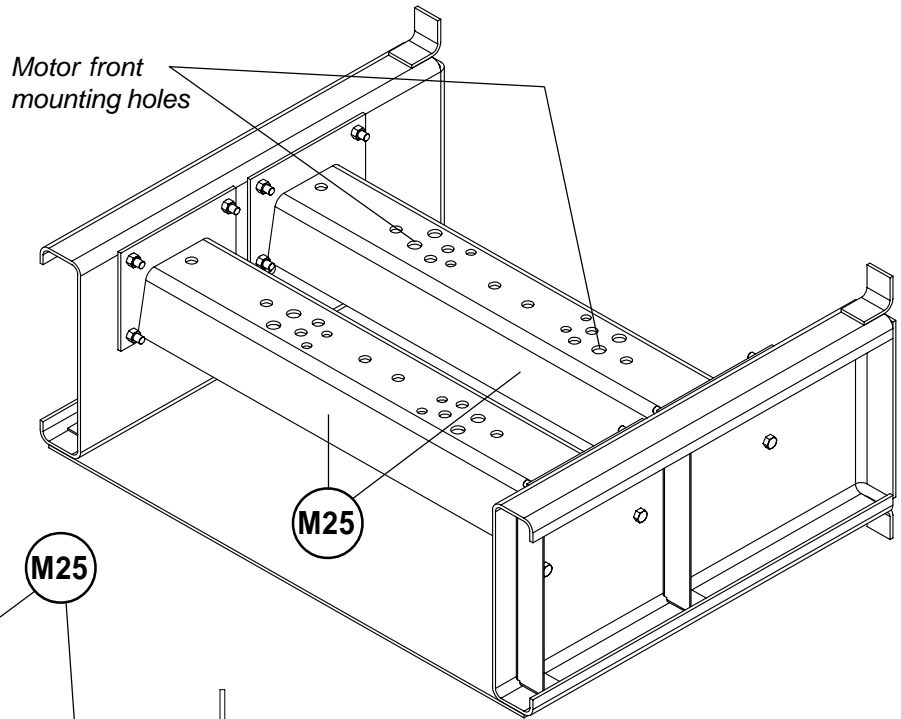


Figure 3-16A

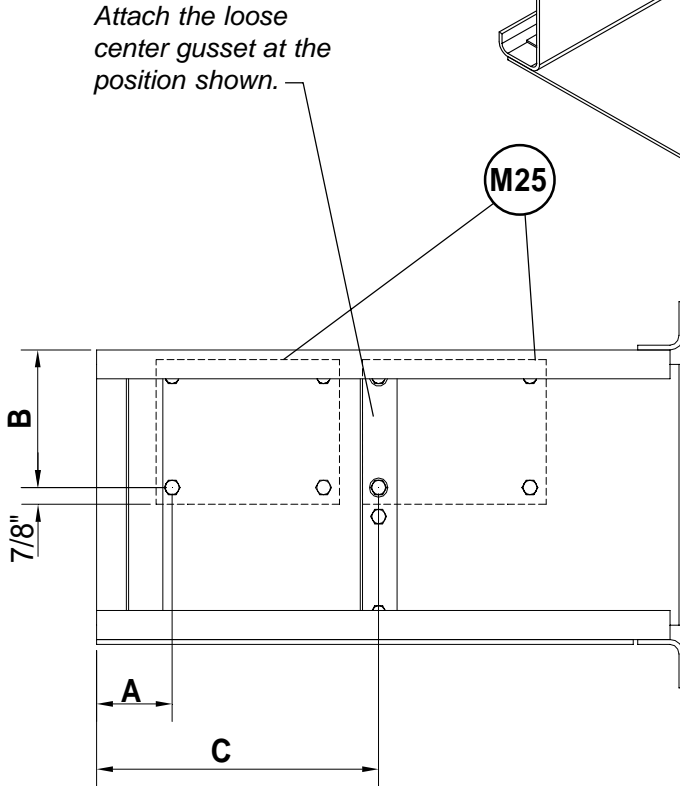


Figure 3-16B

If your tower model and motor frame size are listed in the table below, orient motor supports **M25** as shown in *Figure 3-16A*. **Notice that the back hat is turned 180 degrees from the front hat.** Install motor support at the dimensions shown in *Figure 3-16B*.

Tower Model	Motor Frame	A	B	C
NC8306 thru NC8312 2200 & 2400 Geareducer only	404T	4 1/8" (105mm)	7 1/8" (181mm)	15 3/8" (391mm)
	405T	2 5/8 (67mm)		

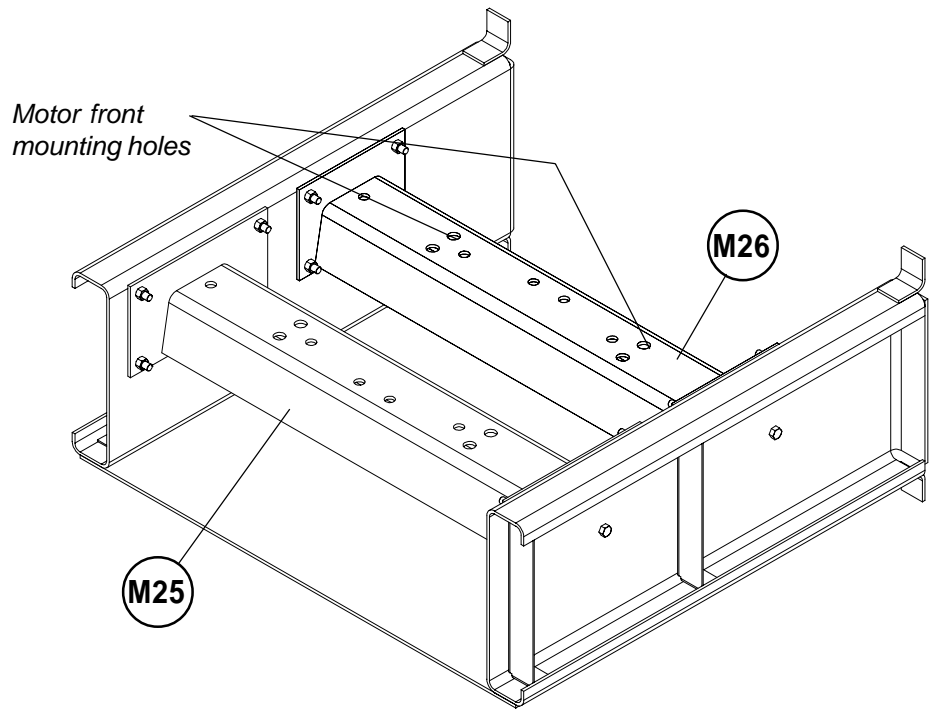


Figure 3-17A

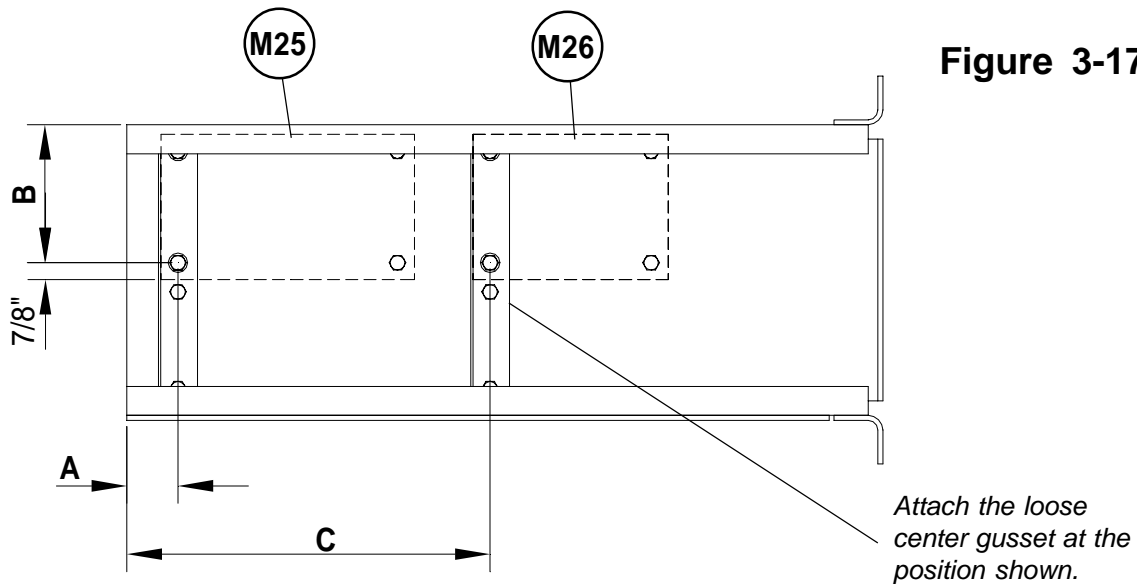


Figure 3-17B

If your tower model and motor frame size are listed in the table below, orient motor supports **M25** and **M26** as shown in *Figure 3-17A*. Install motor support at the dimensions shown in *Figure 3-17B*.

Tower Model	Motor Frame	A	B	C
NC8306 thru NC8312 2200 & 2400 Geareducers only	444T	4 1/8" (105mm)	7 1/8" (181mm)	15 3/8" (391mm)
	445T	2 5/8" (67mm)		

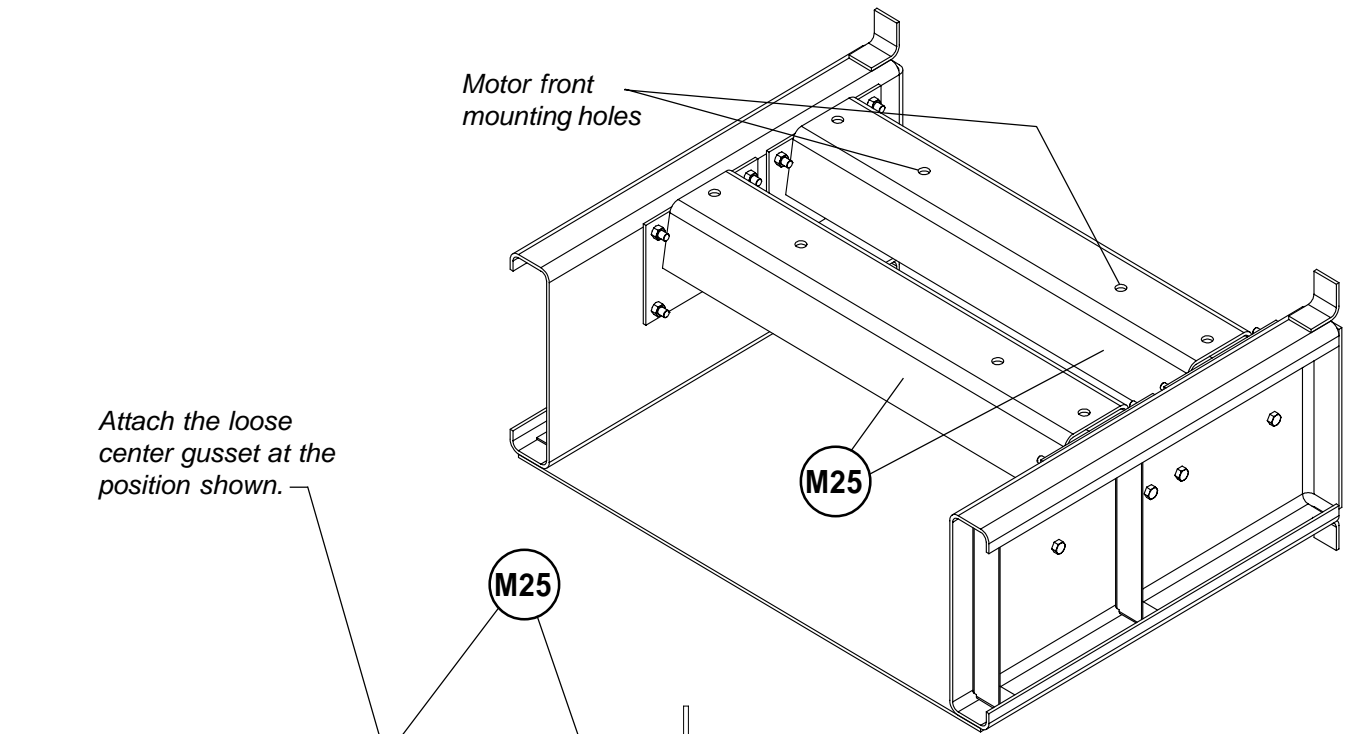


Figure 3-18A

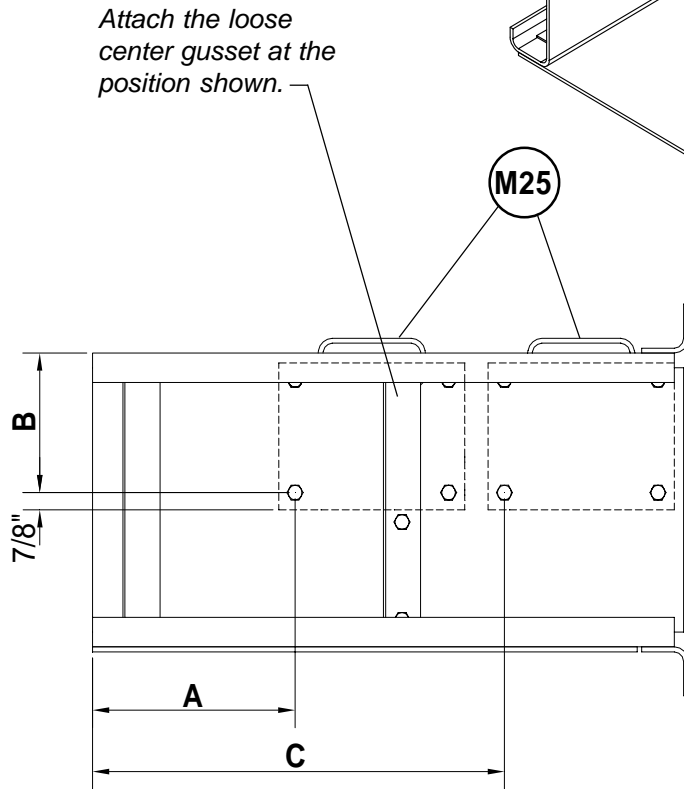


Figure 3-18B

If your tower model and motor frame size are listed in the table below, orient motor supports **M25** as shown in *Figure 3-18A*. **Notice that the back hat is turned 180 degrees from the front hat.** Install motor support at the dimensions shown in *Figure 3-18B*.

Tower Model	Motor Frame	A	B	C
NC8312 with Series 3000 Geareducer	405T	16 1/8" (410mm)	7 1/8" (181mm)	29 1/8" (740mm)
	445T	11 3/8" (289mm)		24 3/8" (619mm)
	447T	7 7/8" (200mm)		27 7/8" (708mm)

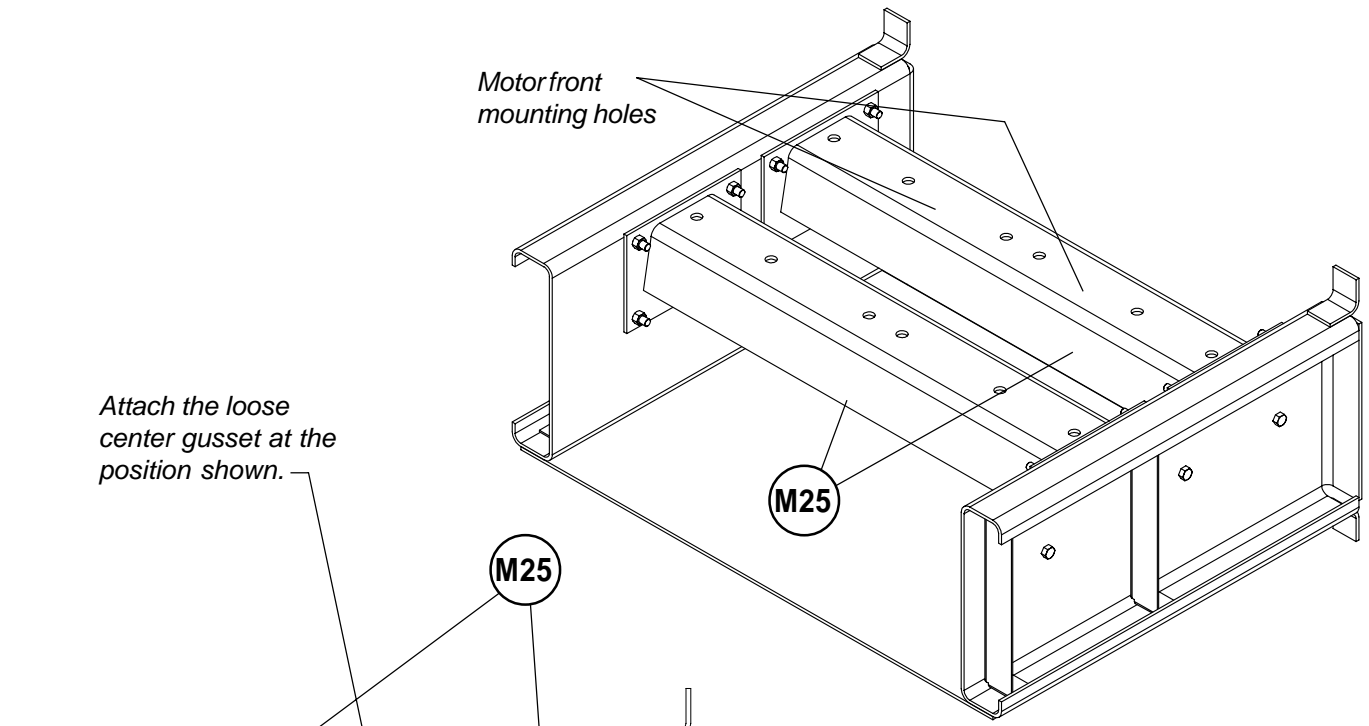


Figure 3-19A

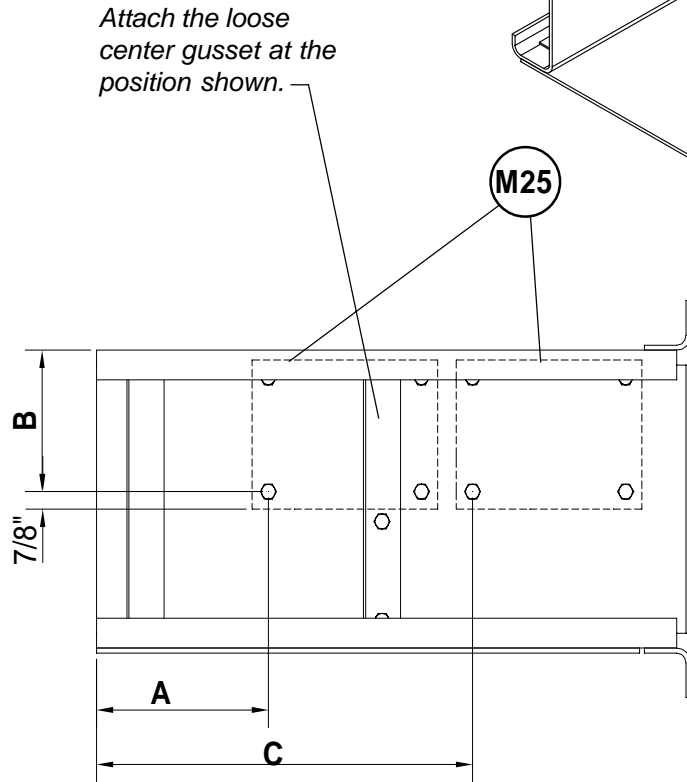


Figure 3-19B

If your tower model and motor frame size are listed in the table below, orient motor supports **M25** as shown in *Figure 3-19A*. Install motor support at the dimensions shown in *Figure 3-19B*.

Tower Model	Motor Frame	A	B	C
NC8312 with Series 3000 Geareducer	444T	13 3/8" (340mm)	7 1/8" (181mm)	27 7/8" (759mm)

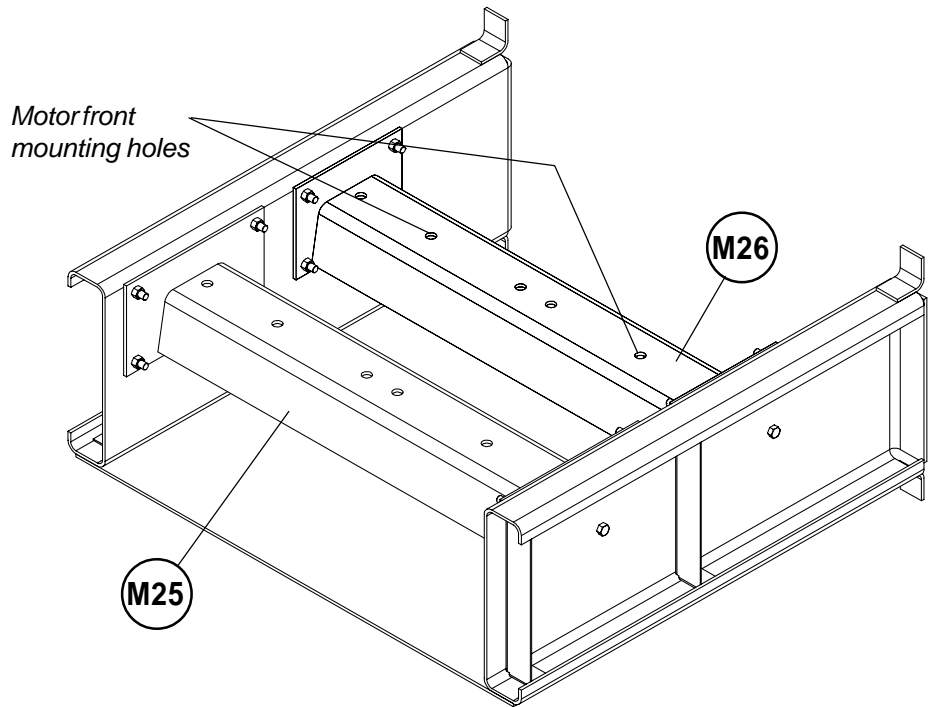


Figure 3-20A

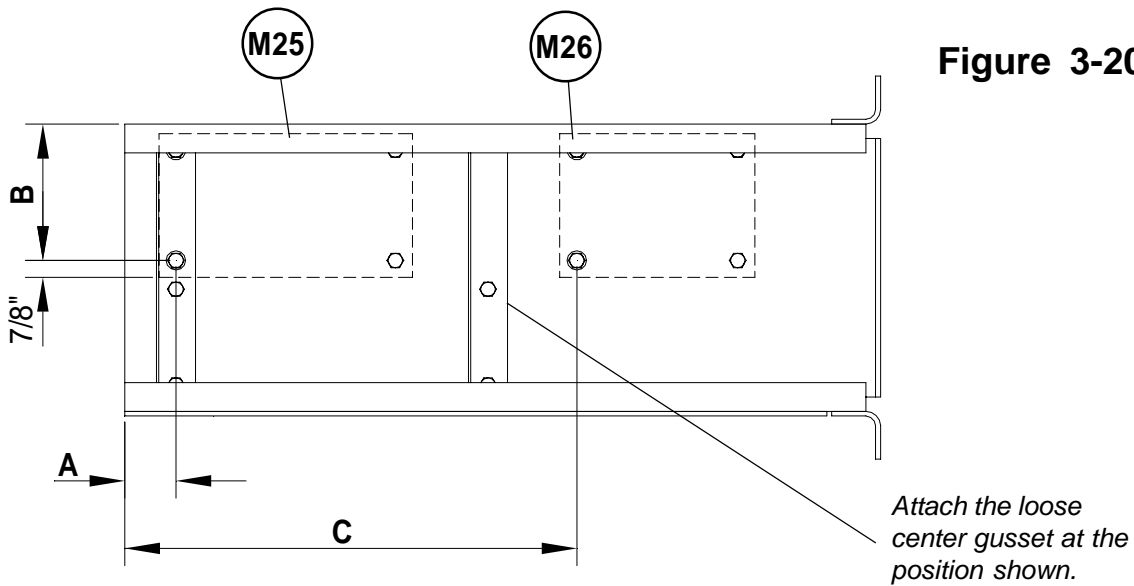


Figure 3-20B

If your tower model and motor frame size are listed in the table below, orient motor supports **M25** and **M26** as shown in *Figure 3-20A*. Install motor support at the dimensions shown in *Figure 3-20B*.

Tower Model	Motor Frame	A	B	C
NC8312 with Series 3000 Geareducer	449T	2 7/8" (73mm)	7 1/8" (181mm)	27 7/8" (708mm)

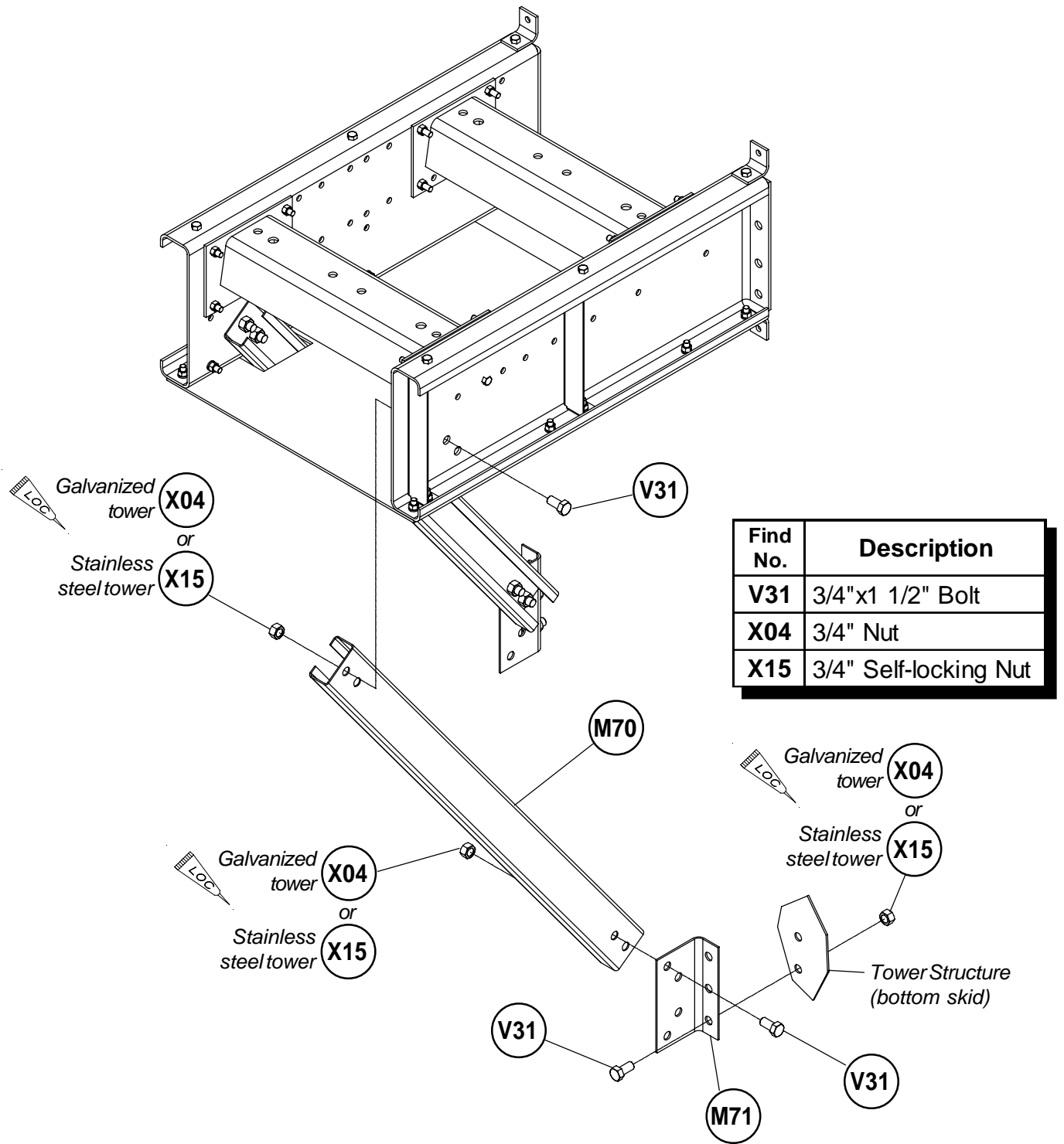


Figure 3-21

For towers with 100 hp and larger motors. Add the support brackets **M70** and clips **M71**. *The clips attach to the bottom skid of the upper module.*

CAUTION: Excessive force when installing the driveshaft could damage Geareducer seal. See Service Manual for installation instructions

CAUTION: Before installing motor, on towers with 3000 geareducers, install support brackets per page 3-21.

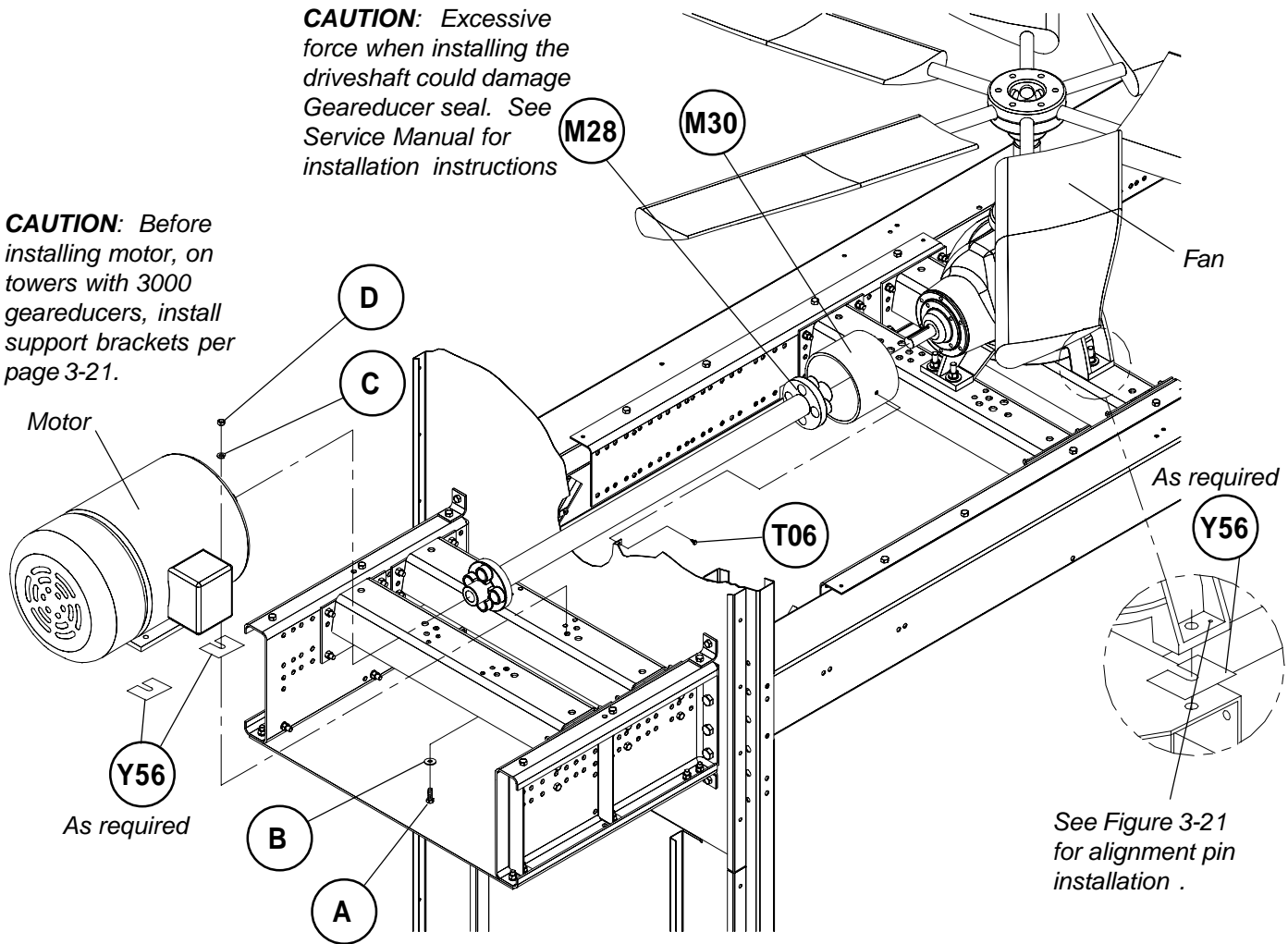



Figure 3-22
M.O.A. only

 Do not apply anti-seize compound to stainless steel motor hold down bolts. Loctite will be applied to these attachments later.

Find No.	Description
T06	1/4"x3/4" Tap Screw
See table on the next page for motor attachment hardware.	

For optional M.O.A. (Motor Outside Airstream) installation refer to Figure 3-22. Attach motor to motor supports. Coat motor shaft, Geareducer shaft and bores of driveshaft yokes with lubricant **Z21**. Slide driveshaft guard **M30** around driveshaft **M28** and install per Driveshaft Service Manual.

Use shims **Y56**, as required, to align driveshaft. After installing driveshaft, coat motor and Geareducer shafts with paint. Slide guard thru hole in casing against motor and use guard clips as templates to drill (2) 3/16" (5mm) dia. holes in guard and attach to clips.

CAUTION: Excessive force when installing the drive coupling could damage Geareducer seal. See Service Manual for installation instructions

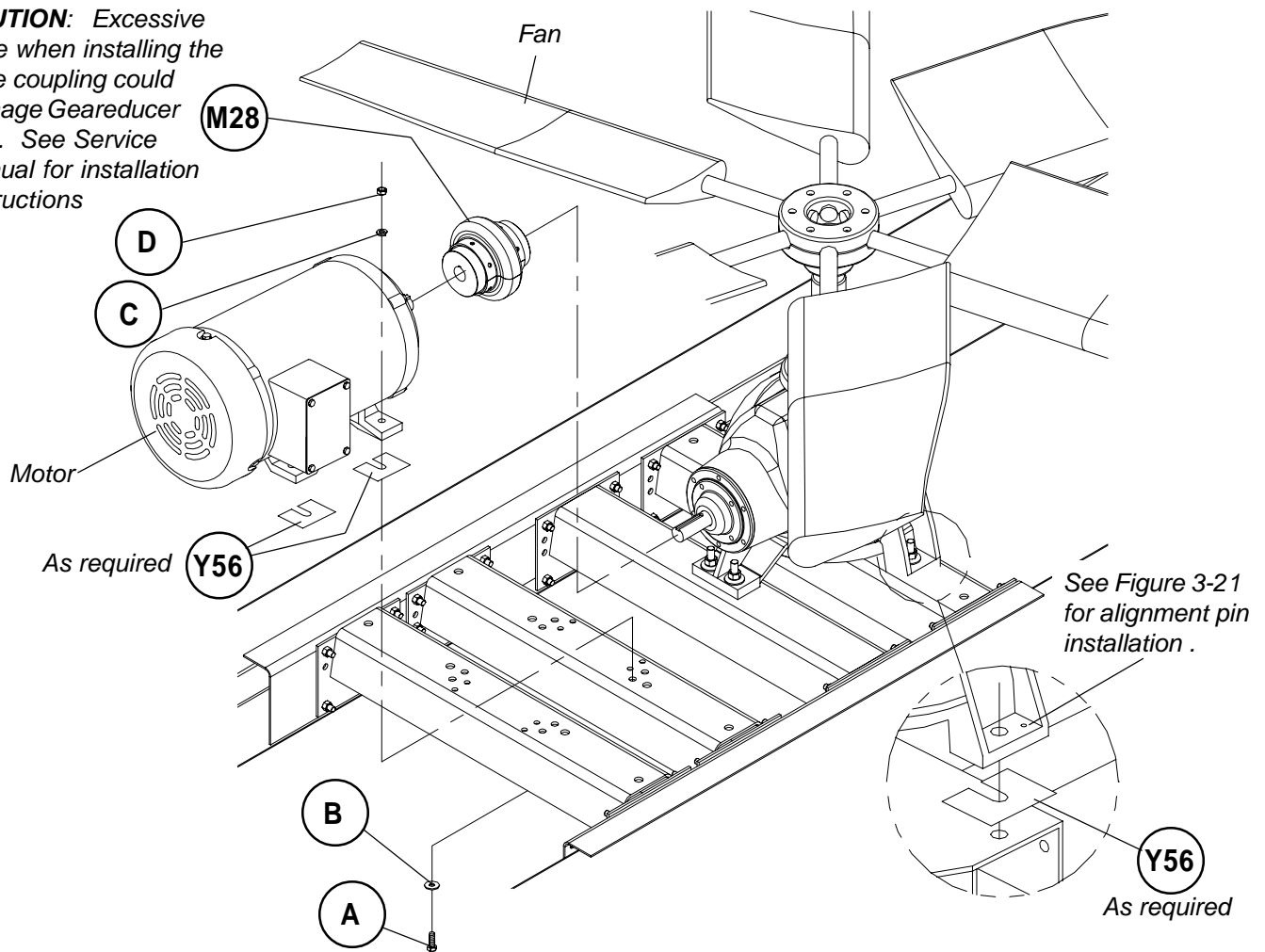



Figure 3-23

FIELD INSTALLED MOTOR

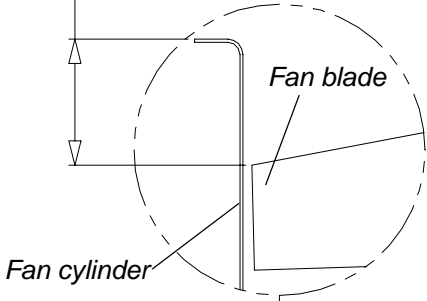
For field installation of motor inside the tower refer to *Figure 3-23*. Attach motor to motor supports and install drive coupling **M28**. Refer to *Close Coupling Service Manual* for installation instructions. Use shims **Y56**, as required, to align drive coupling. After installing drive coupling, coat motor and geareducer shafts with paint.

 Do not apply anti-seize compound to stainless steel motor hold down bolts. Loctite will be applied to these attachments later.

Motor Attachment Hardware					Description
Motor Frame	Find Numbers				
	A	B	C	D	
184T	V07	W22	W02	X02	3/8"x1" Bolt, Flat Washer, Lock Washer & Nut
213T & 215T	V09	W22	W02	X02	3/8"x1 1/2" Bolt, Flat Washer, Lock Washer & Nut
254T thru 286T, 284TS & 286TS	V22	W23	W03	X03	1/2"x2 1/2" Bolt, Flat Washer, Lock Washer & Nut
324T thru 365T & 324TS	V30	W29	W04	X05	5/8"x2 1/2" Bolt, Flat Washer, Lock Washer & Nut
404T thru 449T	V33	W30	W05	X04	3/4"x2 1/2" Bolt, Flat Washer, Lock Washer & Nut

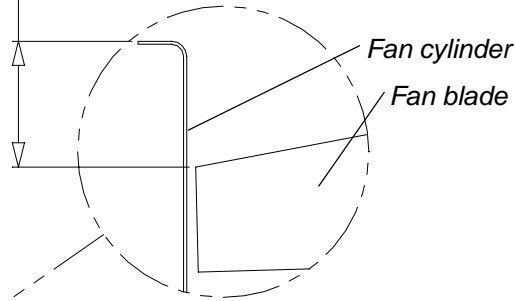
Any single blade must be same distance from fan deck to fan blade around perimeter of cylinder within a range of one inch (25mm).

All blades when rotated past the same location on cylinder must be same distance from fan deck within $\pm A$ ".



Fan Tilt Check

Adjust by shimming geareducer while maintaining alignment with motor.



Tip Track Check

If not within tolerance recheck blade, blade attachment and fan pitch.

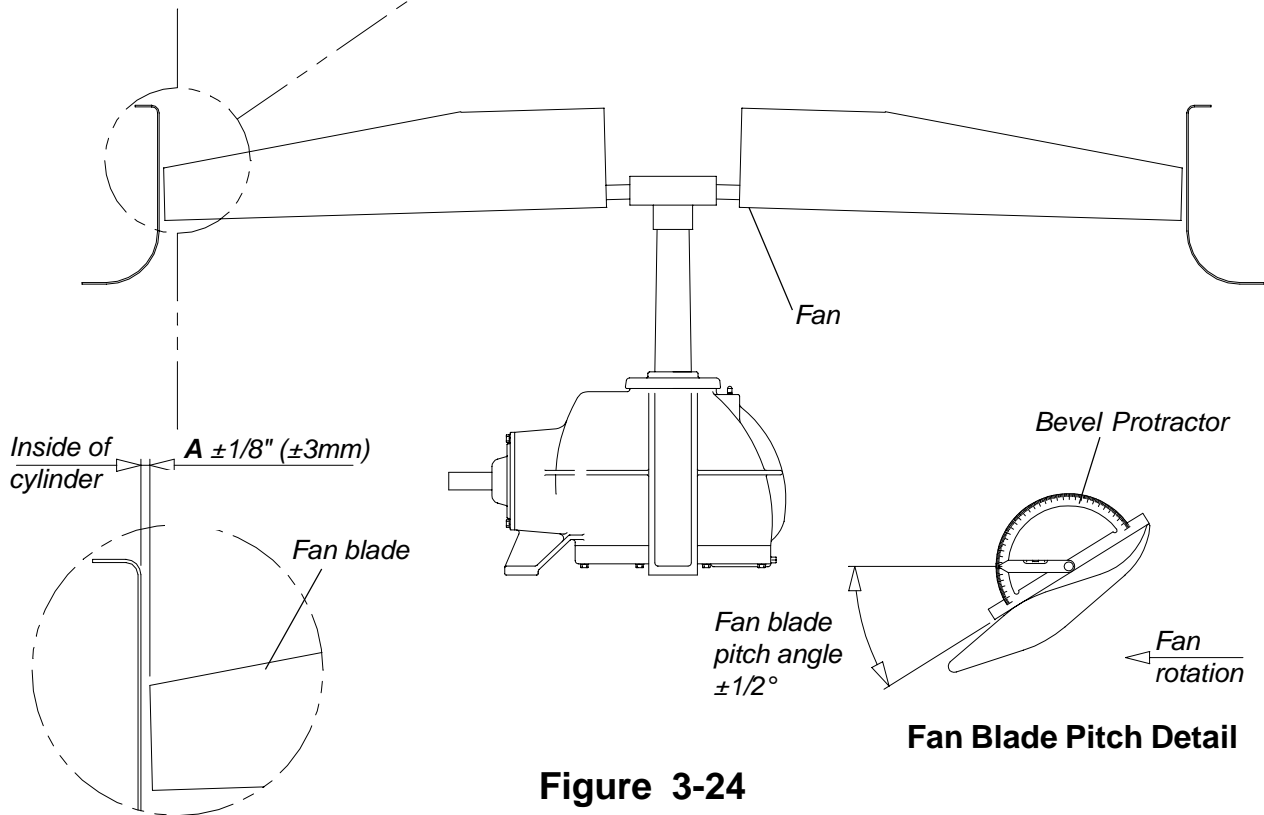


Figure 3-24

Blade Tip Clearance Check

Adjust by repositioning Geareducer within cylinder or by adjusting fan cylinder.

On towers with MOA option or field installed motor, final fan adjustments must be made after motor is in place. Fan blades are pitched to contract requirements in the plant. Fan blade tip clearance, tip track, and fan tilt must be adjusted, in the field, as indicated in *Figure 3-24*. Tower must be plumb and cylinder centered around fan to provide proper tip clearance. Use longest blade and check all around cylinder for tip clearance. Be certain each blade is in its' furthest out position.

Tower Model	A
NC8301	3/8" (10mm)
NC8302 & NC8303	7/16" (11mm)
NC8304 & NC8305	1/2" (13mm)
NC8306 & NC8307	5/8" (16mm)
NC8308 & NC8309	11/16" (17mm)
NC8310 & NC8311	5/8" (16mm)
NC8312	11/16" (17mm)

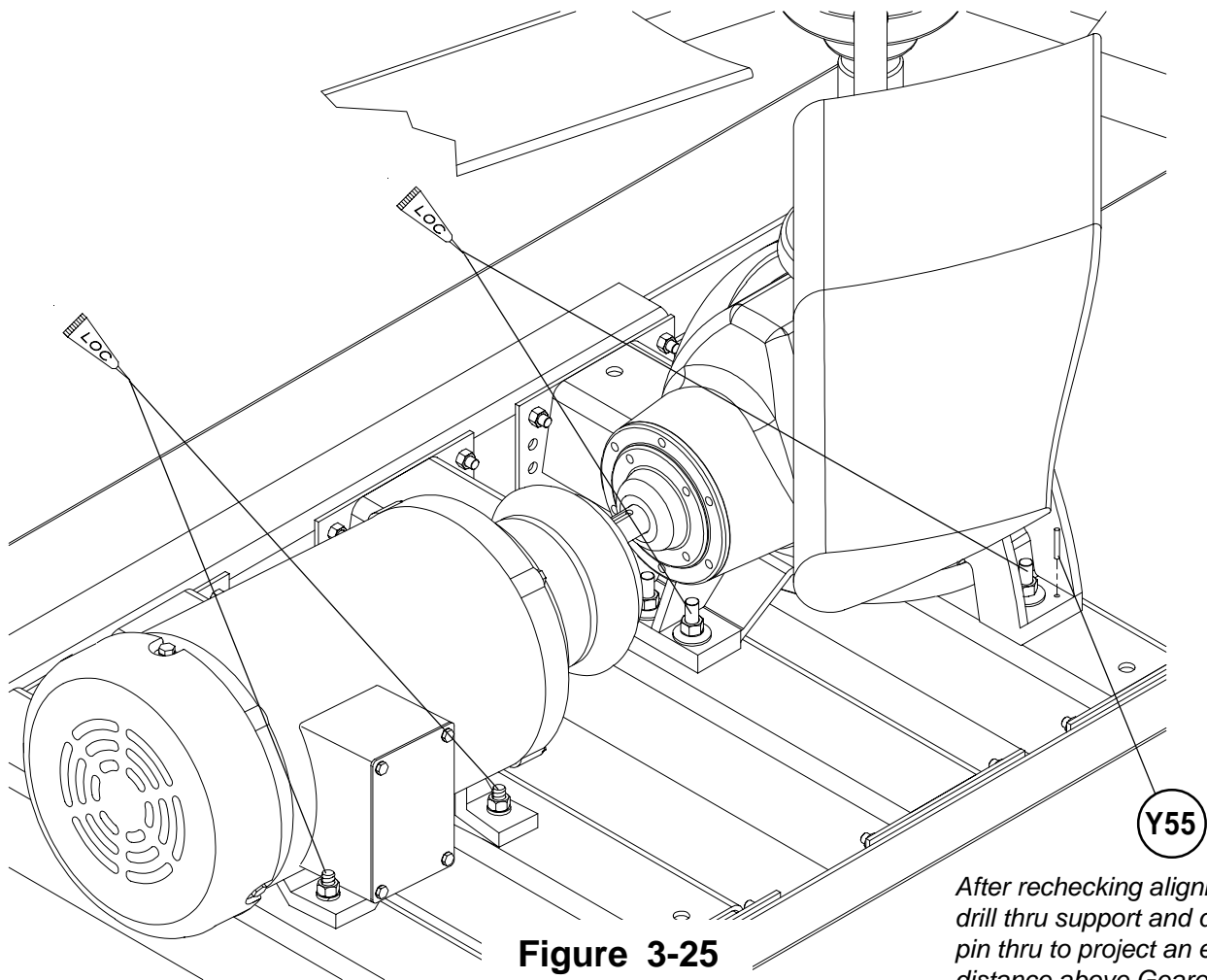


Figure 3-25

After rechecking alignment, drill thru support and drive pin thru to project an equal distance above Geareducer foot and below support.

FASTENER TORQUE @ MOTOR AND GEAREDUCER HOLD-DOWN FASTENERS ONLY		
Bolt Diameter	Fastener Torque foot-lbs. (Newton-meters)	
	Galvanized (Unlubricated)	Stainless Steel (Unlubricated)
3/8"	30-32 (42-43)	34-36 (46-48)
1/2"	64-66 (87-90)	85-90 (115-122)
5/8"	135-140 (183-190)	125-130 (169-176)
3/4"	220-230 (298-312)	195-205 (264-278)

After all drive coupling and fan adjustments have been made refer to *Figure 3-25*. Tighten each motor and Geareducer nut 5 to 10 ft-lbs (7 to 13 N-m) less than specified torque while holding bolt head. Retighten nuts to specified torque. Bolt heads may be tightened while holding nut if nut is not accessible with torque wrench. Now

apply thread locking compound **Z05** to all bolt threads. On towers with a Series 20 or 22 Geareducer two drive pins **Y55** are used to retain alignment. Using pilot holes in Geareducer feet, drill a 23/64" (9mm) diameter hole thru support and drive pin thru to project an equal distance above Geareducer foot and below support.

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