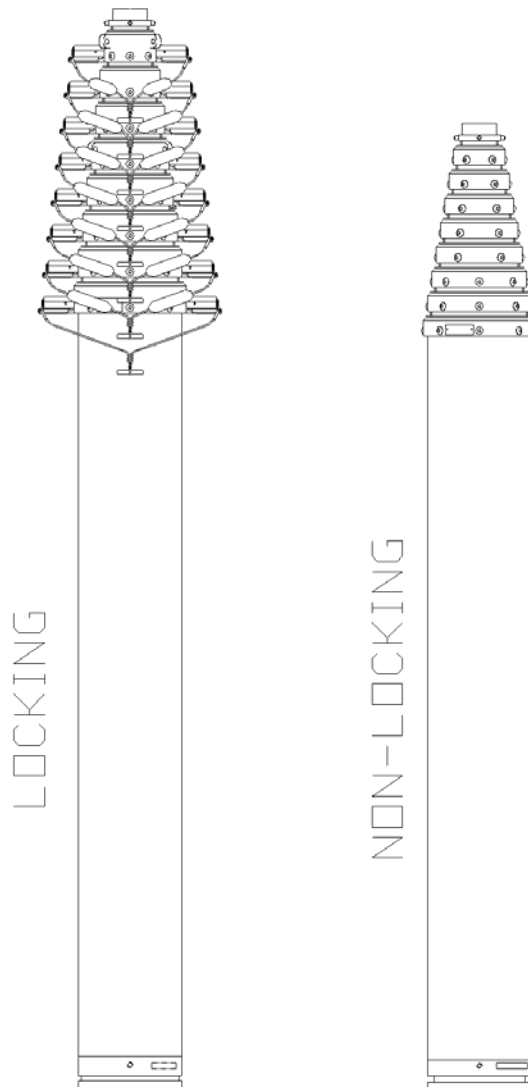




WILL-BURT

PNEUMATIC MAST OPERATOR'S MANUAL



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Document History

Manual	Version	Date	Remarks
Pneumatic Mast Op. Man.	Rev. 13	October 2012	Revised Tables, Reference Data 1.4
	Rev. 14	November 2013	Updated warranty page.
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SAFETY SUMMARY

SIGNAL WORD DEFINITION

Per the ANSI Z535.4 standard, the following signal words and definitions are used to indicate hazardous situations:



DANGER indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.



WARNING indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.



CAUTION indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It is also used to alert against unsafe practices.

GENERAL SAFETY PRECAUTIONS

The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.



Electrocution Hazard! Contact with high voltage will result in death or serious injury. Observe general safety precautions for handling equipment using high voltage. Do not locate or operate mast near electrical lines, cables or other unwanted sources of electricity. Do not operate mast in lightning. Be certain electrical cables are undamaged and properly terminated. Always disconnect power before performing service, repair or test operations.



Safety Instruction - Read Manual! Failure to follow operating instructions could result in death or serious injury. Read and understand the operator's manual before using the mast.



Tip Over Hazard! Mast tip over could result in death or serious injury. Do not operate in high winds. Operate on level ground only. Stand clear of mast and mast payload during operation. Be certain mast is level and secure before and during installation, operation and maintenance.



Safety Instruction - Trained Personnel Only! Death or serious injury could result if proper inspection, installation, operation and maintenance procedures are not observed. Installation, operation and maintenance to be performed by trained and authorized personnel only. Proper eye protection should be worn when servicing the mast.



Health and Safety Hazard! Solvent used to clean parts is potentially dangerous. Avoid inhalation of fumes and also prolonged contact to skin.



Safety Instruction – Resuscitation Alert! Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery.

SPECIFIC SAFETY PRECAUTIONS

The following are safety precautions that are related to specific procedures and therefore appear elsewhere in this publication for emphasis. These are recommended precautions that personnel must understand and apply during specific phases of installation, operation and maintenance.

WARNING

Pinch Point Hazard! Moving parts can crush and cut resulting in death or serious injury. Keep clear of moving parts while operating mast.

WARNING

Crush Hazard! Death or serious injury could result if mast fails suddenly. Do not stand directly beneath the mast or its payload. Be certain payload is properly installed and secured.

WARNING

Burst Hazard! Over pressurizing mast will trip safety valve and could result in death or serious injury. Do not exceed maximum operating pressure of 35 psi (241 kPa) for Heavy and Super Heavy Duty masts. Do not exceed maximum operating pressure of 20 psi (138 kPa) for Standard Duty masts. Keep personnel clear of safety valve exhaust direction.

WARNING

Fire Hazard! Cleaning solvent, used for maintenance, is flammable and can be explosive resulting in death or serious injury. Do not smoke. Use cleaning solvent in a well-ventilated area. Keep cleaning solvent away from ignition sources. Always store cleaning solvent in the proper marked container.

WARNING

Relocation Hazard! Relocating the mast during operation or after extension could result in death or serious injury. Do not relocate the mast during operation or while extended. This applies especially to masts mounted to vehicles. Operate the mast only if the vehicle is stationary and the vehicle engine is off.

WARNING

Lifting Hazard! The mast is intended to lift a specific payload for lighting, surveillance or communication use only. Any other use without written consent is prohibited and could cause death or serious injury. Do not use mast to lift personnel. Do not exceed specified payload capacity.

WARNING

Mast Extension Hazard! Extending mast into obstructions could result in death or serious injury and could render the mast inoperable and partially extended. Before applying power and operating the mast, be certain there is sufficient clearance above and to all sides of the expected location of the fully extended mast and payload. Keep all persons clear of mast and mast extension. Do not lean directly over the mast.

WARNING

Mounting Structure Hazard! Mounting mast into a structure unable to resist the forces generated from customer-specific loading scenario could result in death or serious injury and could damage the mast. Before operation, be certain mounting structure is capable of resisting forces generated from all loading and environmental conditions, including, but not limited to, mast size and weight, payload size and weight, sail size, wind speed, guy line arrangement, support bracket or roof line location and base plate assembly.

⚠ WARNING

Safety Instruction – Operation! At all times prior to mast operation, insure that:

- 1.) The mast area is free of personnel and mechanical obstruction;
- 2.) All electrical cables are undamaged and properly terminated;
- 3.) The operator must have full view of the mast during use;
- 4.) Any transit tie-downs on the payload have been removed;
- 5.) The vehicle is not moving;
- 6.) The area above the mast is free of mechanical obstructions.

⚠ CAUTION

Pressurized Device Hazard! Mast disassembly prior to depressurization may release pressurized air jet. Completely lower the mast, depressurize and shut down power before disassembly.

⚠ CAUTION

Safety Instruction – Roof Access! If mast will be mounted to a vehicle, user must provide safe means to access the roof of the vehicle during installation and maintenance.

⚠ CAUTION

Entanglement Hazard! Tangled cables can cause equipment damage. Ensure control cables are not tangled and are free to pay out as mast is extended.

⚠ CAUTION

Safety Instruction – Installation! At all times while using pipe and hose during installation, recognize that:

- 1.) Pipe and hose should be routed, mounted and restrained to protect from damage;
- 2.) Do not use second hand piping for installation;
- 3.) Do not bend air pipe and hose at a radius less than specified by the manufacturer;
- 4.) Pipes should be marked to avoid hazards from incorrect connection;
- 5.) The exhaust should be fitted with a silencer and be directed away from personnel;
- 6.) When routing piping, install in such a way as to minimize torsion on the joints;
- 7.) Mounting air pipe and hose shall be accomplished only by the use of tools to prevent readily disconnecting air pipe and hose from mast.

⚠ CAUTION

Safety Instruction – Control Valve! Improper positioning and operation of Control Valve can result in moderate injury or equipment damage. Control valve must be mounted in a location such that the operator has full view of the mast, but does not make contact with the mast during operation. Use only a Hold-To-Run type control valve.

⚠ CAUTION

Lifting Hazard! Manually lifting over 55 lb (25kg) is prohibited. In the UK, all lifting equipment must be thoroughly examined annually by a competent person according to the Lifting Operations and Lift Equipment Regulations 1998. Equivalent regulations exist in other EU states.

⚠ CAUTION

Safety Instruction – Follow Procedure! Failure to follow drain kit installation instructions could damage the mast and render the mast inoperable. Read and understand the installation instructions before installing the drain kit.

⚠ CAUTION

Frozen Water Hazard! Water freezing inside mast or air fittings may render mast inoperable and cause major equipment damage. Open drain, when mast is not in operation, in temperatures near or below freezing.

CHAPTER 1 INTRODUCTION

1.1 SAFETY PRECAUTIONS

Refer to the Safety Summary for precautions to be observed while installing, operating or maintaining this equipment.

1.2 INTRODUCTION

This manual covers the installation, operation, and maintenance for The Will-Burt Co. pneumatic masts. Mast models covered include standard duty non-locking, heavy duty non-locking, heavy duty locking, super heavy duty non-locking and super heavy duty locking models. The pneumatic mast comprises a non-locking or locking telescoping mast, a hardware bag, a drain kit, and a mast extension magnetic warning kit. A non-rotating base plate, a rotating hardware kit, a support bracket assembly, an internal mounting kit, an external shelf bracket assembly, a pneumatic system, a mast top cover or a guy line kit may also be included.

1.3 DESCRIPTION

1.3.1 TELESCOPING MAST

The telescoping mast is the structure used to raise the payload to an operational level. It consists of several concentric, nesting mast sections, fabricated from aluminum tube, that extend and retract pneumatically. The telescoping mast can be non-locking or locking. The non-locking telescoping mast must remain pressurized to support the payload at an extended height. The locking telescoping mast can be depressurized once the desired sections are raised and locked into position. The base mast section is constructed from the tube with the largest diameter and the top mast section is constructed from the tube with the smallest diameter. The intermediate mast sections are any mast section in between the base and top mast sections. Aluminum collars are fitted to the top end of each mast section, except for the top mast section that is fitted with a top tube stop. When the telescoping mast is completely retracted, the collars nest on top of each other. The collars on a locking mast are fitted with a locking mechanism including a yoke assembly. There are two types of yoke assemblies, a T-handle and a trip line. Refer to Figure 3-1 for illustrations of the two yoke assembly types. Where guying is required, lugs or holes used to attach the guy lines are integral to the locking mast's fabricated collar. Each mast section, except the base mast section, has two rectangular keys along the length of the tube. The keys match with keyways on the larger, adjacent mast section's collar. The keys and keyways are used to establish azimuth (rotational) integrity between the sections. Identification plates are secured to the collar on the base mast section. Standard duty masts use both the 902852 and 914098 identification plates. Heavy and super heavy duty masts use the 902851 identification plate. The plates are engraved with information pertaining to the mast. Refer to Table 6-1 and Figure 6-1 for identification plate abbreviation explanation and illustration. Refer to CHAPTER 5 for a mast drawing and bill of materials.

1.3.2 HARDWARE BAG

The hardware bag is a 4 x 6" plain cloth bag that includes screws for fastening a non-rotating base plate to the base mast section, and bolts, washers and nuts that may be used for securing the mast to a mounting structure. The hardware bag also contains a safety valve, for protection from over pressurization, and brass fittings for water drainage and connecting the mast to the air supply line. Do not operate the mast until the safety valve has been properly installed. Refer to Table 6-2 for a hardware bag parts list and to Figure 6-2 for an illustration of the hardware bag contents and installation schematic.

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1.3.3 WEEP HOLE DRAIN KIT

The drain kit, sealed in a clear plastic bag, includes installation instructions, a length of clear plastic tube and fittings to outfit the telescoping mast with a means to drain water that has entered the top and intermediate mast sections and may cause damage. Use the drain cock from the hardware bag to drain water from the base mast section. The fittings are used to attach one end of the plastic tube to the weep hole in the base mast section and to route the other end of the tube outside the mounting structure or vehicle to drain water. Refer to 2.4.2.1 for installation instructions and Figure 6-3 for an illustration of the fittings.

1.3.4 MAST EXTENSION MAGNETIC WARNING KIT

The warning kit, packaged in a brown cardboard box, includes items to install a system for warning against moving a vehicle while the telescoping mast is partially or completely extended. The clamp is a thin strip of coiled metal used to brace the switch assembly against the mast base tube. The magnet is cylindrical and covered with a wax-like coating. The switch assembly is attached to a small, rectangular aluminum casing. The labels are gray. The flasher has a cylindrical metal casing and is packaged in a rectangular box. The (2) plastic lights are red. The relay (not included or necessary in kits for the 6-25 or 7-30 models) has a transparent, rectangular casing. Refer to 2.4.2.3 for installation instructions. Refer to Table 6-4 and Figure 6-4 for a mast extension magnetic warning kit parts list and illustration for the 5-20, 6-27, 7-34, 8-30, 6-25, & 7-30 models. Refer to Table 6-5 and Figure 6-5 for a mast extension magnetic warning kit parts list for the 7-42, 8.5-48, 8.5-52, 9.5-56, 9-58, 10-60, 9-50, 10.3-60, & 10.8-76 models.

1.3.5 MAST LUBRICANT

The mast lubricant is a blue-colored mineral oil specifically designed for telescoping masts and their operating environment that is contained in a 16 oz capped plastic bottle. The mast lubricant is only required in only harsh conditions to ensure smooth operation and prolong useful life of the mast. Refer to 4.3.1 Mast Cleaning and Lubrication for recommended use.

1.3.6 NON-ROTATING BASE PLATE

The non-rotating (NR) base plate is a square aluminum plate used to stabilize the mast and to provide a means of securing the mast to a mounting structure. Countersunk holes in the NR base plate match threaded holes on the base mast section. Screws included in the hardware bag can be used to attach the NR base plate to the base mast section. Bolts, nuts and washers included in the hardware bag are sized for the through-holes in the corners of the NR base plate so the mast can be secured to a mounting structure. A larger hole in the center of the plate allows the option of routing air to the bottom of the base mast section. Refer to and Figure 2-3 for dimensions and illustration.

1.3.7 ROTATING HARDWARE KIT

The rotating hardware kit is used to stabilize the mast and to provide a means of, not only securing the mast to a mounting structure, but also enabling the mast to be rotated. The kit includes a rotating base plate assembly, a turning handle assembly, bolts, nuts and an instruction sheet. The rotating (R) base plate assembly consists of a painted weldment, a bearing, bolts and nuts. The weldment, typically painted white, is made of a steel ring welded to a square steel plate with (4) thru holes in the corners of the plate. Bolts, nuts and washers included in the hardware bag are sized for the thru holes in the corners of the weldment plate so the base plate assembly can be secured to a mounting structure. The mast is to be positioned inside the ring on the weldment. Bolts (2), threaded into the weldment ring, can be tightened once the mast is in place to restrict mast rotational movement. A hole in the center of the plate allows the option of routing air to the bottom of the base mast section. Refer to Table 2-4 and Figure 2-4 for dimensions and illustration. The turning handle assembly wraps around, and is secured to, the base mast section with the bolts and nuts included in the kit. Once the turning handle assembly is fitted to the base section, the operator can grip the handles and rotate the mast into position. Refer to point 9 in 2.4.1.1, Table 2-5 and Figure 2-5 for installation instructions and illustration.

1.3.8 SUPPORT BRACKET ASSEMBLY

The support bracket assembly, used to brace standard and heavy duty masts against a mounting structure, is constructed from a steel stand-off, (2) aluminum support brackets, a plastic bearing and fasteners to secure the assembly together. The stand-off is a formed sheet metal piece that positions the support brackets away from the mounting structure. The C-shaped support brackets close around the base mast section and are bolted together to hold the mast against the mounting structure. The plastic bearing, attached to the inside of the support brackets, protects the base mast section from being scraped by the support brackets and allows the mast to be rotated. A similar assembly is used to brace super heavy duty masts. Refer to Table 2-7, Table 2-8, Figure 2-7 and Figure 2-8 for dimensions and illustration.

1.3.9 INTERNAL MOUNTING KIT

The internal mounting kit contains the hardware used to position and support an internally mounted mast. Kits for standard and heavy duty masts include a weather bonnet, (2) gaskets, a ceiling plate, a roof flange and an o-ring. Kits for super heavy duty masts include a roof ring, (2) gaskets, a ceiling plate, a retaining ring and an o-ring. Bolts, lock washers and hex nuts, 1/4" or M6, not provided, can be used as fasteners. Bolt length will depend on the specific application and is to be determined by the installer. Refer to 2.4.1.1 for installation instructions and Figure 2-10 for illustration. See Table 2-6 and Figure 2-6 for roof flange, roof ring and stack-up dimensions.

1.3.10 EXTERNAL SHELF BRACKET ASSEMBLY

The external shelf bracket assembly is a painted, steel weldment that can be bolted into a mounting structure and used to position and support an externally mounted mast. Refer to Table 2-9 and Figure 2-9 for dimensions and illustration. See 2.4.1.2 for installation instructions.

1.3.11 MAST TOP COVER

The mast top cover is a large canvas bag with drawstrings. The mast top cover is drawn over the collars of a fully retracted locking mast to protect the locking mechanism from dust, debris and other foreign material when the mast is not being operated. It may be used on a non-locking mast.

1.3.12 PNEUMATIC SYSTEM

The pneumatic system refers to a means of safely controlling the pressurization and depressurization of the telescoping mast. Components in the hardware bag and a port near the bottom of the base mast section are provided to connect an air supply to the telescoping mast. See 2.4.2.2 for additional information on a pneumatic system.

1.3.13 GUY LINE KIT

The guy line kit includes guy lines, guy stakes or anchors and a ground anchor location drawing. The kit components are used to further stabilize the telescoping mast by resisting environmental conditions that may cause tip over and horizontal payload movement. Specific installation instructions will be provided with any guyed mast.

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1.4 REFERENCE DATA

1.4.1 STANDARD DUTY NON-LOCKING MASTS

Table 1-1 Part & Model Numbers – Standard Duty Non-locking Mast

Standard Duty Non-locking	
P/N	M/N
906021	5-20-1XX
906023	6-27-1XX
906025	7-34-1XX
906027	8-30-1XX

Table 1-2 Reference Data – Standard Duty Non-locking Mast

	Payload Capacity	Extended Height	Nested Height	Approx. Mast Weight	No. of Sections	Section Diameter	Maximum Operating Pressure
5-20	70 lb	20'	5' 4"	45 lb	6	5 - 2.5"	20 PSIG
	(32kg)	(6.10m)	(1.63m)	(21 kg)		(127 - 64mm)	(1.4 bar)
6-27	40 lb	26' 10"	6'	54 lb	7	5 - 2"	20 PSIG
	(18kg)	(8.18m)	(1.83m)	(25 kg)		(127 - 51mm)	(1.4 bar)
8-30	100 lb	29' 11"	8'	64 lb	5	5 - 3"	20 PSIG
	(45kg)	(9.12m)	(2.44m)	(29 kg)		(127 - 76mm)	(1.4 bar)
7-34	40 lb	33' 10"	7'	67 lb	7	5 - 2"	20 PSIG
	(18kg)	(10.31m)	(2.13m)	(31 kg)		(127 - 51mm)	(1.4 bar)

NOTE:

1. Section Diameter listed as Base Mast Section Diameter – Top Mast Section Diameter.
2. Dimensions and specifications provided are for reference only and are not intended for vehicle design purposes.
3. Specifications may be subject to change without notice.

1.4.2 HEAVY DUTY NON-LOCKING MASTS

Table 1-3 Part & Model Numbers – Heavy Duty Non-locking Mast

Heavy Duty Non-locking	
P/N	M/N
906029	6-25-3XX
906033	7-30-3XX
906035	7-42-3XX
906215	8.5-48-3XX
906037	8.5-52-3XX
906039	9.5-56-3XX
906041	9-58-3XX

Table 1-4 Reference Data – Heavy Duty Non-Locking Mast

	Payload Capacity	Extended Height	Nested Height	Approx. Mast Weight	No. of Sections	Section Diameter	Maximum Operating Pressure
6-25	150 lb	25'	5' 10"	110 lb	6	6.75 - 3"	35 PSIG
	(68kg)	(7.62m)	(1.78m)	(50 kg)		(171 - 76mm)	(2.4 bar)
7-30	150 lb	29' 1"	6' 8"	125 lb	6	6.75 - 3"	35 PSIG
	(68kg)	(8.86m)	(2.03m)	(57 kg)		(171 - 76mm)	(2.4 bar)
7-42	150 lb	41' 2"	7' 1"	235 lb	9	9 - 3"	35 PSIG
	(68kg)	(12.55m)	(2.16m)	(107 kg)		(229 - 76mm)	(2.4 bar)
8.5-48	200 lb	48'	8' 6"	275 lb	8	9 - 3.75"	35 PSIG
	(90kg)	(14.63m)	(2.59m)	(125 kg)		(229 - 95mm)	(2.4 bar)
8.5-52	100 lb	52'	8' 4"	266 lb	9	9 - 3"	35 PSIG
	(45kg)	(15.85m)	(2.54m)	(121 kg)		(229 - 76mm)	(2.4 bar)
9.5-56	200 lb	56' 2"	9' 6"	296 lb	8	9 - 3.75"	35 PSIG
	(90kg)	(17.12m)	(2.90m)	(135 kg)		(229 - 95mm)	(2.4 bar)
9-58	90 lb	58'	9'	290 lb	9	9 - 3"	35 PSIG
	(40kg)	(17.68m)	(2.74m)	(132 kg)		(229 - 76mm)	(2.4 bar)

NOTE:

1. Section Diameter listed as Base Mast Section Diameter – Top Mast Section Diameter.
2. Dimensions and specifications provided are for reference only and are not intended for vehicle design purposes.
3. Specifications may be subject to change without notice.

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1.4.3 HEAVY DUTY LOCKING MASTS

Table 1-5 Part & Model Numbers – Heavy Duty Locking Mast

Heavy Duty Locking	
P/N	M/N
906043	7-30-4XX
906045	7-42-4XX
906051	10-60-4XX
906053	14.5-80-4XX
906055	17-100-4XX
906057	20-134-4XX

Table 1-6 Reference Data – Heavy Duty Locking Mast

	Payload Capacity	Extended Height	Nested Height	Approx. Mast Weight	No. of Sections	Section Diameter	Maximum Operating Pressure	Collar Type	Guying Required
7-30	150 lb (68kg)	29' 1" (8.86m)	7' (2.13m)	125 lb (57 kg)	6	6.75 - 3" (171 - 76mm)	35 PSIG (2.4 bar)	Locking T Handles	Not Req.
7-42	150 lb (68kg)	41' 3" (12.57m)	7' 9" (2.36m)	235 lb (107 kg)	9	9 - 3" (229 - 76mm)	35 PSIG (2.4 bar)	Locking T Handles	Not Req.
10-60	200 lb (91kg)	59' 9" (18.21m)	10' 1" (3.07m)	330 lb (150 kg)	8	9 - 3.75" (229 - 95mm)	35 PSIG (2.4 bar)	Locking T Handles	Not Req.
14.5-80	225 lb (102kg)	79' 9" (24.31m)	14' 3" (4.34m)	416 lb (189 kg)	7	9 - 4.5" (229 - 114mm)	35 PSIG (2.4 bar)	Locking Triplines	4 Way
									4 Level
17-100	200 lb (90kg)	99' 9" (30.40m)	17' 2" (5.23m)	480 lb (218 kg)	7	9 - 4.5" (229 - 114mm)	35 PSIG (2.4 bar)	Locking Triplines	4 Way
									4 Level
20-134	150 lb (68kg)	133' 9" (40.77m)	20' 2" (6.15m)	600 lb (273 kg)	8	9 - 3.75" (229 - 95mm)	35 PSIG (2.4 bar)	Locking Triplines	4 Way
									5 Level

NOTE:

1. Section Diameter listed as Base Mast Section Diameter – Top Mast Section Diameter.
2. Dimensions and specifications provided are for reference only and are not intended for vehicle design purposes.
3. Specifications may be subject to change without notice.

1.4.4 SUPER HEAVY DUTY NON-LOCKING MASTS

Table 1-7 Part & Model Numbers – Super Heavy Duty Non-locking Mast

Super Heavy Duty Non-locking	
P/N	M/N
915507	10-38-5XX
710904800	12-48-5XX
TBD	13.6-45-5XX
TBD	14-67-5XX

Table 1-8 Reference Data – Super Heavy Duty Non-locking Mast

	Payload Capacity	Extended Height	Nested Height	Approx. Mast Weight	No. of Sections	Section Diameter	Maximum Operating Pressure
10-38	1000 lb	38'	10'	400 lb	5	11.25 - 7.5"	35 PSIG
	(453kg)	(11.58m)	(3.05m)	(181 kg)		(285 - 192mm)	(2.4 bar)
12-48	1000 lb	47' 11"	12'	475 lb	5	11.25 - 7.5"	35 PSIG
	(453kg)	(14.61m)	(3.66m)	(215 kg)		(285 - 192mm)	(2.4 bar)
13.6-45	1200 lb	44' 10"	13' 8"	475 lb	4	11.25 - 8.25"	35 PSIG
	(545kg)	(13.67m)	(4.1m)	(215 kg)		(285 - 211mm)	(2.4 bar)
14-67	800 lb	67'	13' 11"	575 lb	6	11.25 - 6.75"	35 PSIG
	(363kg)	(20.42m)	(4.17m)	(261 kg)		(285 - 173mm)	(2.4 bar)

NOTE:

1. Section Diameter listed as Base Mast Section Diameter – Top Mast Section Diameter.
2. Dimensions and specifications provided are for reference only and are not intended for vehicle design purposes.
3. Specifications may be subject to change without notice.

Pneumatic Mast

1.4.5 SUPER HEAVY DUTY LOCKING MASTS

Table 1-9 Part & Model Numbers – Super Heavy Duty Locking Mast

Super Heavy Duty Locking	
P/N	M/N
909959	9-50-6XX
909426	10.3-60-6XX
910916	10.8-76-6XX
912970	15.7-100-6XX

Table 1-10 Reference Data – Super Heavy Duty Locking Mast

	Payload Capacity	Extended Height	Nested Height	Approx. Mast Weight	No. of Sections	Section Diameter	Maximum Operating Pressure	Collar Type	Guying Required
9-50	450 lb	50' 5"	9' 2"	500 lb	8	11.25 - 5.25"	35 PSIG	Locking T Handles	Not Req.
	(205kg)	(15.37m)	(2.79m)	(227 kg)		(286 - 134mm)	(2.4 bar)		
10.3-60	450 lb	60' 6"	10' 5"	500 lb	8	11.25 - 5.25"	35 PSIG	Locking T Handles	Not Req.
	(205kg)	(18.44m)	(3.18m)	(227 kg)		(286 - 134mm)	(2.4 bar)		
10.8-76	200 lb	76' 2"	10' 9"	536 lb	10	11.25 - 3.75"	35 PSIG	Locking T Handles	4 Way
	(91kg)	(23.22m)	(3.28m)	(245 kg)		(286 - 96mm)	(2.4 bar)		1 Level
15.7-100	450 lb	100'	15' 8"	790 lb	8	11.25 - 5.25"	35 PSIG	Locking T Handles Trip Lines	4 Way
	(205kg)	(30.48m)	(4.78m)	(361 kg)		(286 - 134mm)	(2.4 bar)		4 Level

NOTE:

1. Section Diameter listed as Base Mast Section Diameter – Top Mast Section Diameter.
2. Dimensions and specifications provided are for reference only and are not intended for vehicle design purposes.
3. Specifications may be subject to change without notice.

CHAPTER 2

INSTALLATION

2.1 INTRODUCTION

The chapter provides instructions for installing a Pneumatic Mast.

2.2 TOOLS AND MATERIALS REQUIRED FOR INSTALLATION

Table 2-1 Tools and Materials Required for Installation

Wrenches	Hoist
Screwdrivers	Torque Wrench
Thread Tape	Safety Glasses
Safety Gloves	Hammer
Sling / Strap	Level
Measuring Tape	Saw
Silicone Sealant	Drill
String or Thin Wire	Air Supply
Plumb-bob	Sockets

Pneumatic Mast

2.3 UNPACKING

⚠ CAUTION

Lifting Hazard! Manually lifting over 55 lb (25kg) is prohibited. In the UK, all lifting equipment must be thoroughly examined annually by a competent person according to the Lifting Operations and Lift Equipment Regulations 1998. Equivalent regulations exist in other EU states.

Unpack the Pneumatic Mast as follows:

1. Carefully open shipping crate, remove all loose parts, the 2x4" block at the top end of the mast and the top half of the wooden mast saddles.

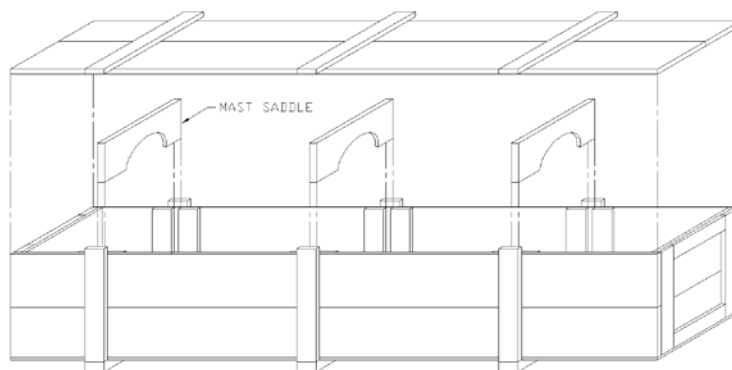
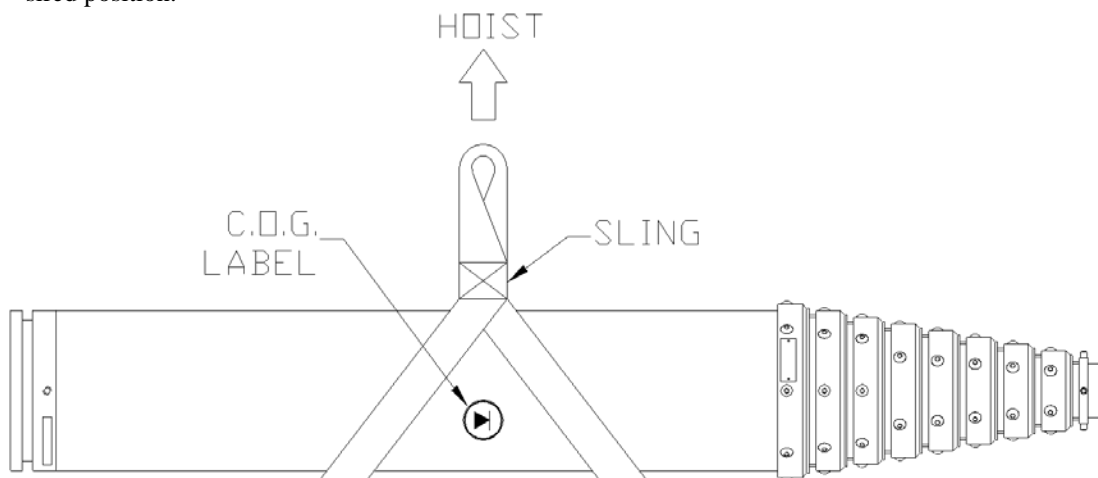


Figure 2-1 Shipping Crate

2. Inspect for any shipping damage. Notify carrier if damage is evident.
3. Using the center of gravity (C.O.G.) label as a reference, outfit the mast with a sling capable of supporting the mast weight. The sling should support the mast from at least 2 points. Attach the sling such that horizontal balance and control can be maintained while positioning the mast. Hoist and slowly lift the mast until just free of the mast saddles. Lower the mast and adjust the sling as necessary to balance the mast. Hoist the mast free from the crate and carefully move the mast into the desired position.



2.4 INSTALLATION

2.4.1 Mast

Table 2-2 Installation Dimensions - Mast

P/N	MODEL	A		B		C	
		in	mm	in	mm	in	mm
906021	5-20-1XX	64	1626	51.8	1316	41.8	1062
906023	6-27-1XX	72	1829	58.4	1483	48.3	1227
906025	7-34-1XX	84	2134	70.4	1788	60.3	1532
906027	8-30-1XX	96	2438	88.4	2245	71.6	1819
906029	6-25-3XX	70	1778	59.8	1519	47.6	1209
906033	7-30-3XX	79	2007	69.1	1755	55.3	1405
906035	7-42-3XX	85	2159	69.1	1755	49.6	1260
906215	8.5-48-3XX	103	2616	89.0	2261	73.6	1869
906037	8.5-52-3XX	99	2515	83.5	2121	64.0	1626
906039	9.5-56-3XX	113	2870	99.0	2515	79.5	2019
906041	9-58-3XX	107	2718	91.5	2324	72.0	1829
906043	7-30-4XX	84	2134	68.3	1735	55.3	1405
906045	7-42-4XX	92	2337	68.4	1737	49.6	1260
906051	10-60-4XX	122	3099	101.1	2568	82.4	2093
906053	14.5-80-4XX	171	4343	152.5	3874	129.7	3294
906055	17-100-4XX	208	5283	186.6	4740	163.8	4161
906057	20-134-4XX	245	6223	221.0	5613	189.9	4823
915507	10-38-5XX	119	3023	110.1	2797	86.3	2192
710904800	12-48-5XX	144	3658	133.9	3401	110.2	2799
TBD	13.6-45-5XX	164	4166	156.4	3973	127.7	3244
TBD	14-67-5XX	167	4242	156.4	3973	127.7	3244
909959	9-50-6XX	110	2794	89.6	2276	66.5	1689
909426	10.3-60-6XX	125	3175	104.6	2657	81.5	2070
910916	10.8-76-6XX	131	3327	104.6	2657	81.5	2070
912970	15.7-100-6XX	187	4750	166.6	4232	143.5	3645

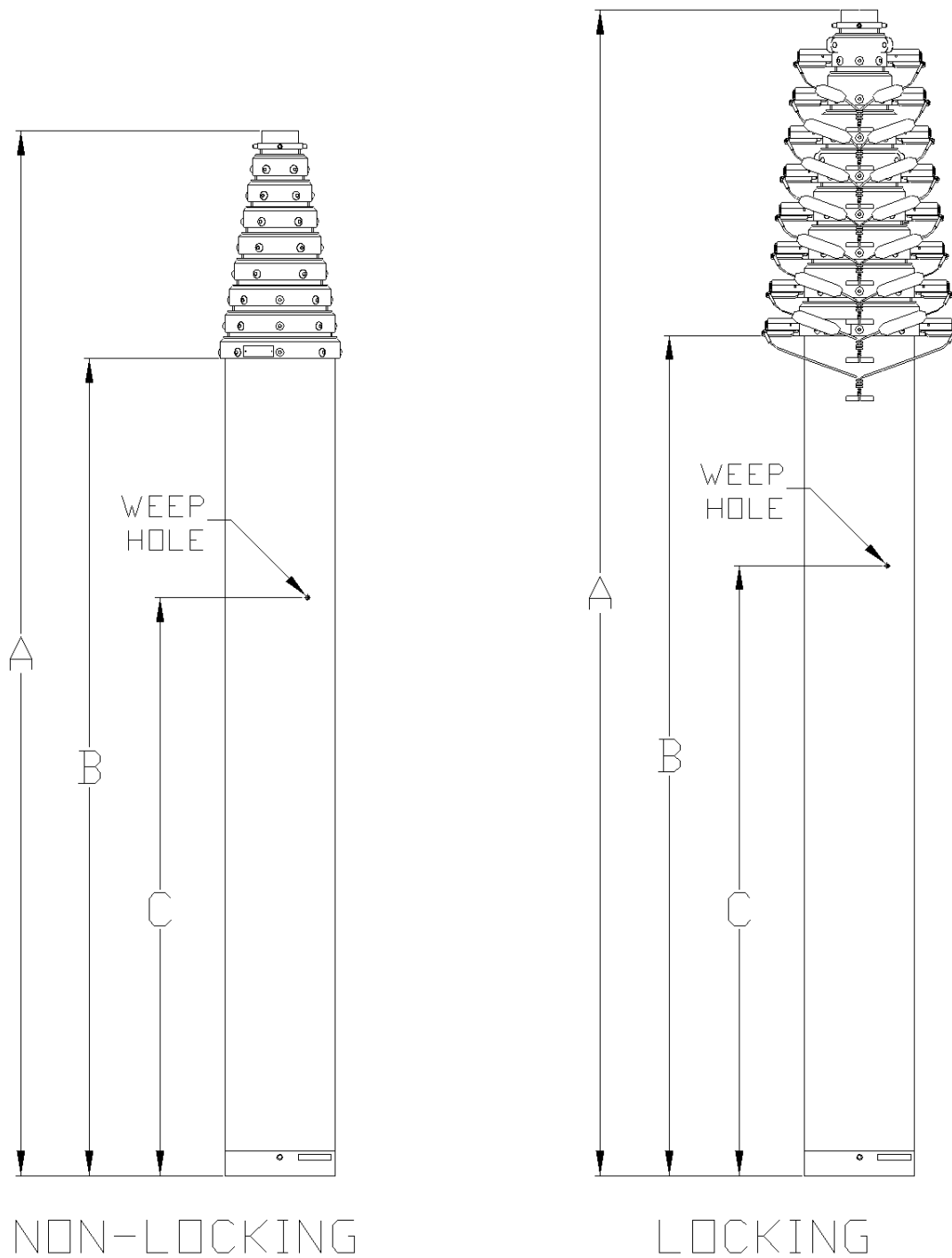


Figure 2-2 Installation Dimensions – Mast

Table 2-3 Non-Rotating Base Plate Dimensions

NON-ROTATING BASE PLATE ASSEMBLY						
BASE TUBE	A		B		ØC	
	in	mm	in	mm	in	mm
11 1/4	12	305	11	279	9/16	14
9	9	229	8	203	7/16	11
6 3/4	6 3/4	171	5 3/4	146	7/16	11
5	5	127	4	102	7/16	11

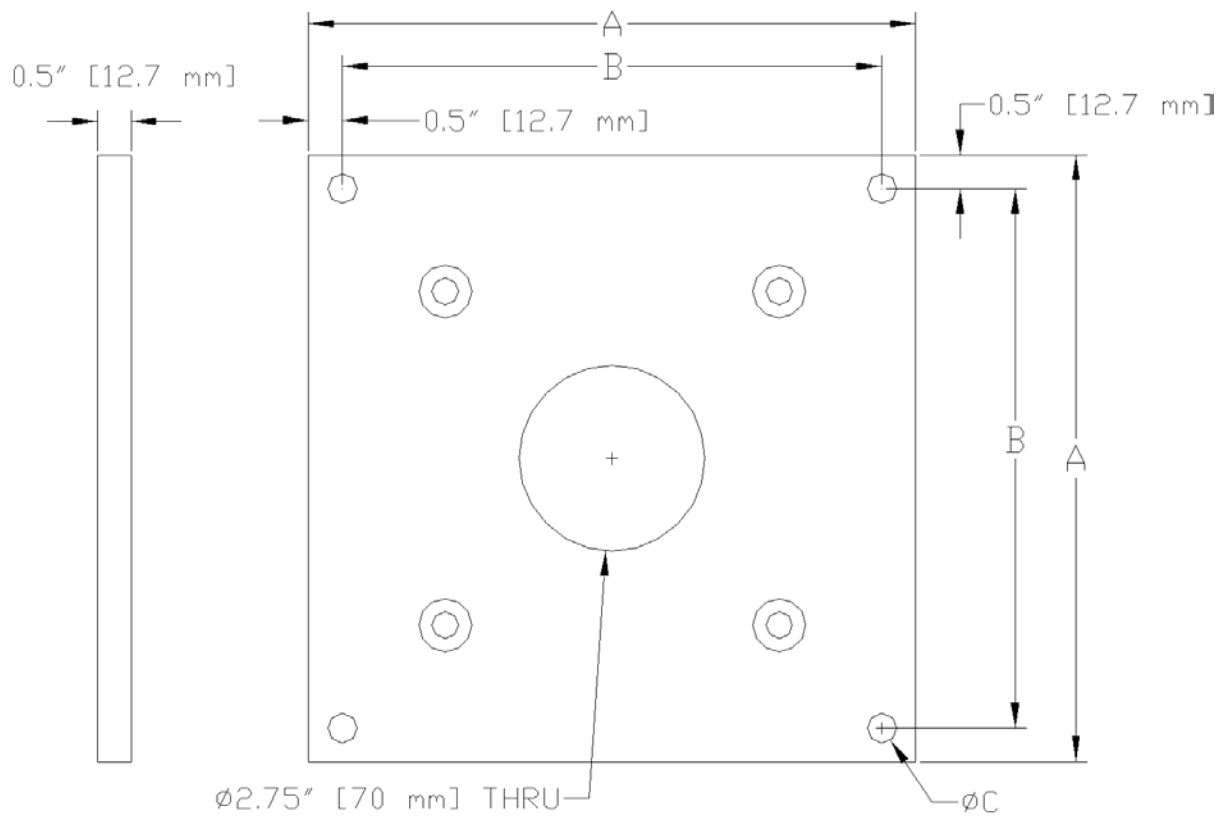


Figure 2-3 Non-Rotating Base Plate

Table 2-4 Rotating Base Plate Dimensions

ROTATING BASE PLATE ASSEMBLY						
	A		B		C	
BASE TUBE	in	mm	in	mm	in	mm
11 1/4	13	330	11	279	0.50	12.7
9	12	305	11	279	0.38	9.7
6 3/4	9 3/4	248	8.7	222	0.38	9.7
5	8	203	7	178	0.38	9.7

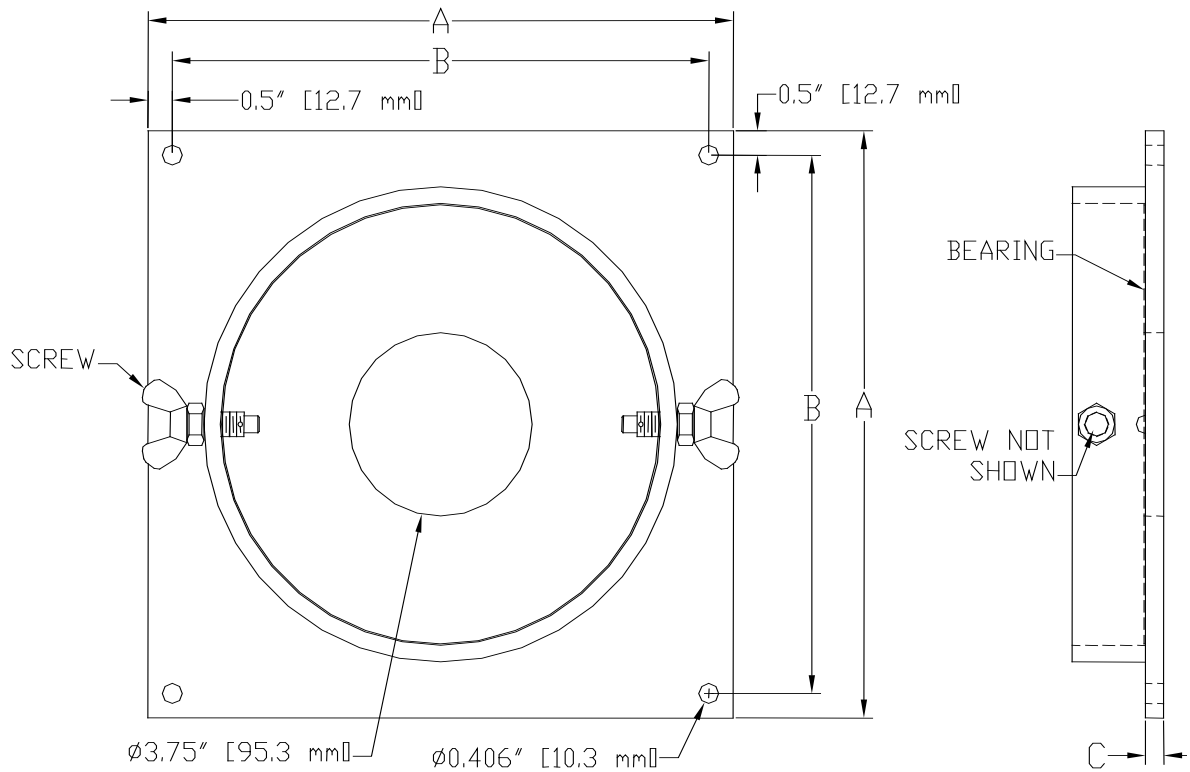


Figure 2-4 Rotating Base Plate

Table 2-5 Turning Handle Assembly

BASE TUBE	A	
	in	mm
9	18	457
6 3/4	16	406
5	14	356

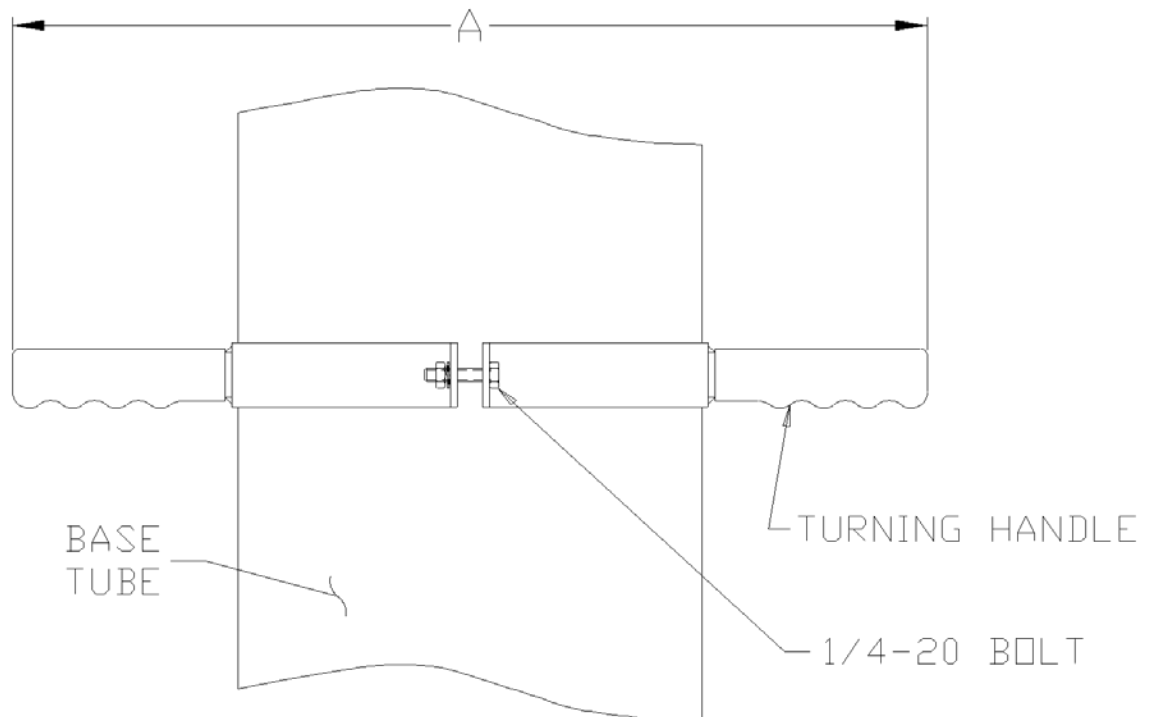


Figure 2-5 Turning Handle Assembly

NOTES FOR TURNING HANDLE ASSEMBLY:

- 1.) When assembling the mast turning handles to the base mast section, do not over tighten the 1/4-20 bolts. Over tightening the bolts may distort the base mast sections, causing the next largest mast section to stick when extended or lowered.
- 2.) For Masts with Ø 9.00" Base Mast Section: Torque 1/4-20 bolts to 120 in-lbs MAX.
- 3.) For Masts with Ø 6.75" Base Mast Section: Torque 1/4-20 bolts to 100 in-lbs MAX.
- 4.) For Masts with Ø 5.00" Base Mast Section: Torque 1/4-20 bolts to 60 in-lbs MAX.
- 5.) See point 9 in 2.4.1.1 Mast Installation – Internal Mounting for more information on turning handle installation.

Table 2-6 Internal Mounting Kit Information

ROOF FLANGE & RING					
BASE TUBE	A		B	C	
	in	mm		in	mm
11 1/4	14	356	8	13	330
9	11 7/8	301	8	11	279
6 3/4	9 3/4	248	8	8 3/4	222
5	9	229	6	8	203

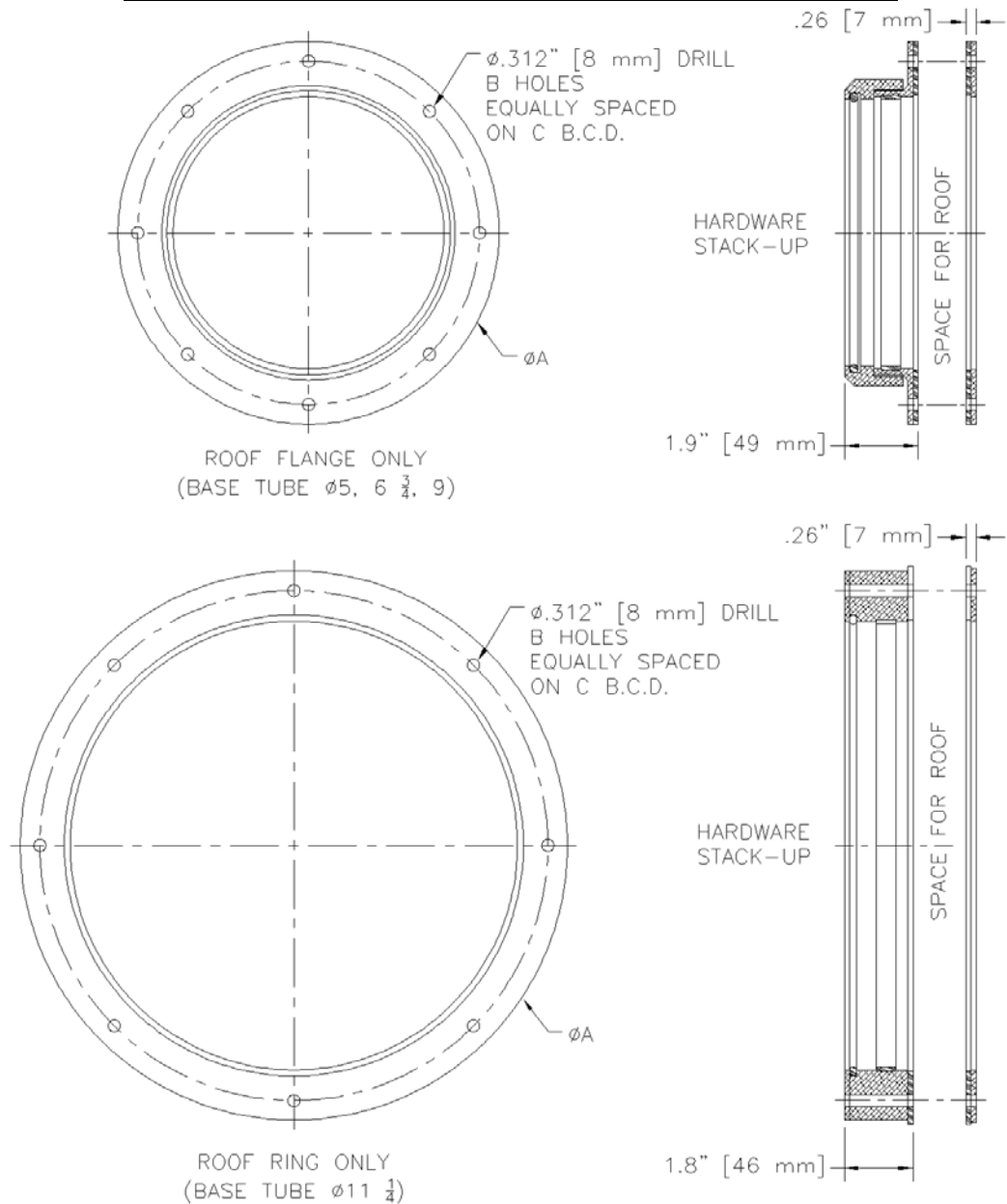


Figure 2-6 Internal Mounting Kit Hardware

Table 2-7 Support Bracket Assembly – Standard & Heavy Duty

SUPPORT BRACKET ASSEMBLY – STANDARD & HEAVY DUTY								
BASE TUBE	O.D.		A		B		EST. WT.	
	in	mm	in	mm	in	mm	lbs	kg
9	10 1/2	267	9 3/4	248	13.84	352	15.6	7.1
6 3/4	7 3/4	197	8 1/4	210	12.10	307	10.0	4.5
5	6	152	7 1/2	191	11.24	285	8.9	4.0

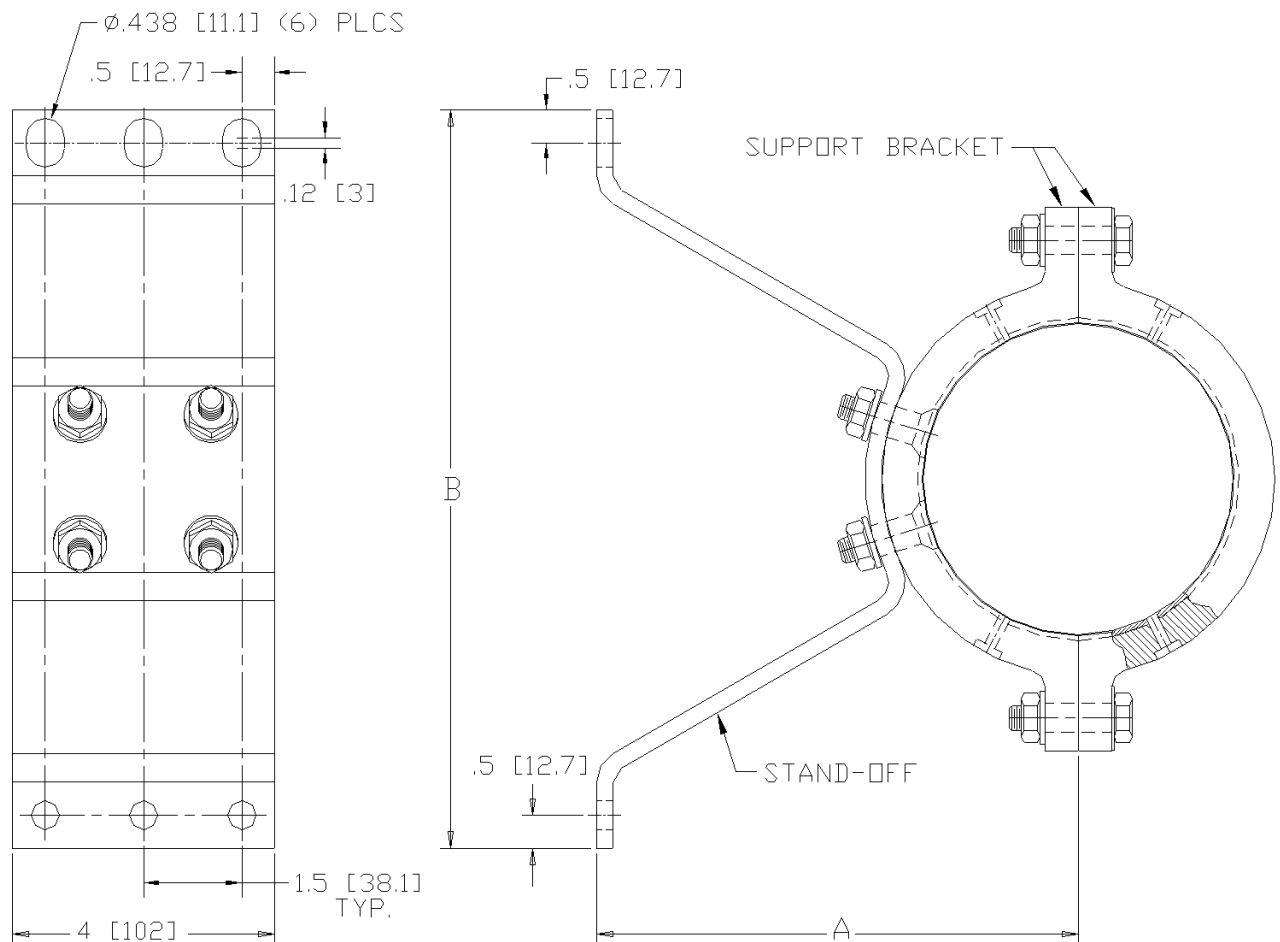


Figure 2-7 Support Bracket Assembly – Standard & Heavy Duty

Table 2-8 Support Bracket Assembly – Super Heavy Duty

SUPPORT BRACKET – SUPER HEAVY DUTY											
A		B		C		D		E		F	
in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
8.00	203	16.34	415	19.75	502	13.75	349	1.50	38	3.00	76

G		H		J		K		L	
in	mm	in	mm	in	mm	in	mm	in	mm
6.00	152	0.56	14	2.50	64	6.00	152	2.00	51

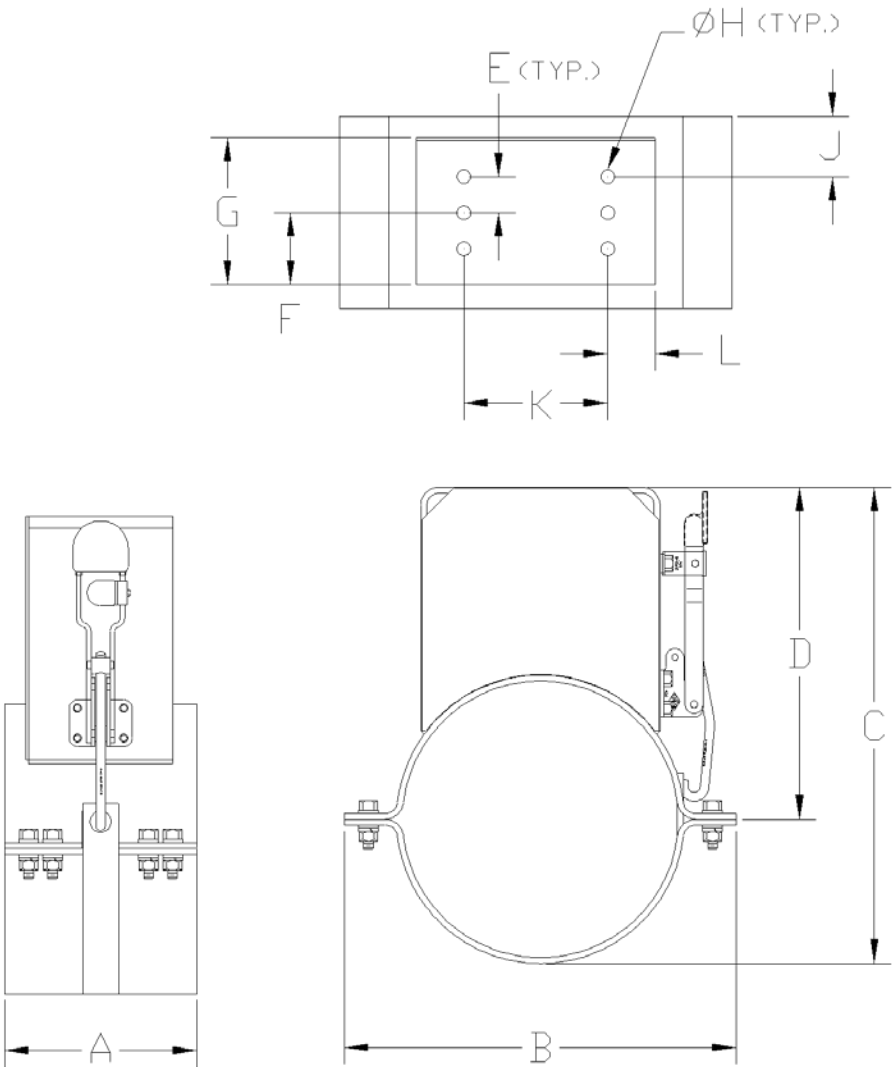
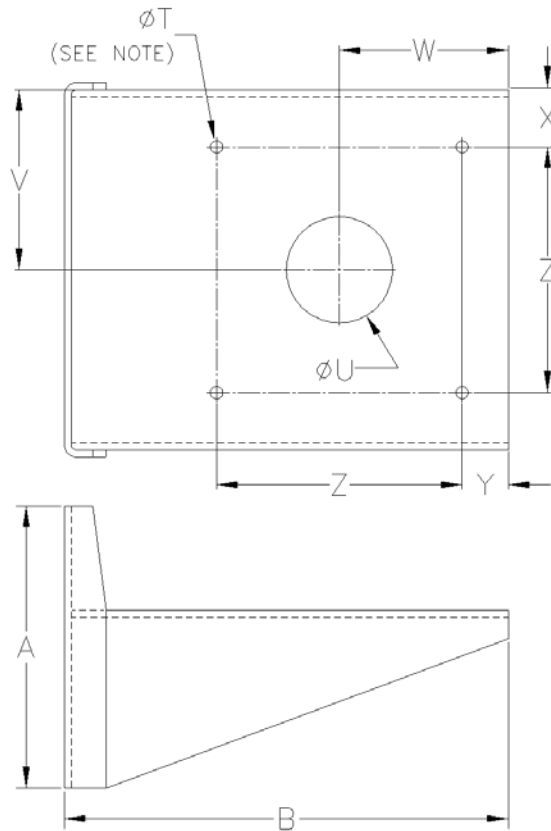


Figure 2-8 Support Bracket Assembly – Super Heavy Duty

Table 2-9 External Shelf Bracket Assembly

EXTERNAL SHELF BRACKET														
Base Tube	A		B		C		D		E		F		G	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
5	8.0	203	11.6	295	6.00	152	9.25	235	6.50	165	4.3	109	0.44	11
6 ¾	9.8	249	14.3	363	7.75	197	10.94	278	8.44	214	6.0	152	0.56	14
9	10.0	254	15.8	401	8.00	203	13.25	337	10.75	273	6.3	160	0.56	14
11 ¼	12.0	305	20.3	516	8.00	203	14.50	368	10.24	260	6.0	152	0.56	14

Base Plate		U		V		W		X		Y		Z	
		in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
5	Non-rotating	3.75	95	4.38	111	3.78	96	2.25	57	2.02	51	4.25	108
	Rotating	3.75	95	4.38	111	3.78	96	0.88	22	0.65	17	7.00	178
6 ¾	Non-rotating	3.75	95	4.38	111	3.78	96	1.5	38	0.52	13	5.75	146
	Rotating	5.25	133	5.22	133	5.25	133	0.087	2	1.67	42	8.70	221
9	Non-rotating	5.25	133	5.22	133	5.25	133	1.23	31	0.50	13	8.00	203
	Rotating	3.75	95	6.38	162	6.00	152	0.88	22	0.50	13	11.0	279
11 ¼	Non-rotating	4.00	102	6.88	175	6.50	165	1.38	35	1.00	25	11.0	279



NOTE:

FOR Ø11 ¼ BASE PLATE:
ØT IS 0.56 [14].

FOR OTHER BASE PLATES:
ØT IS 0.44 [11].

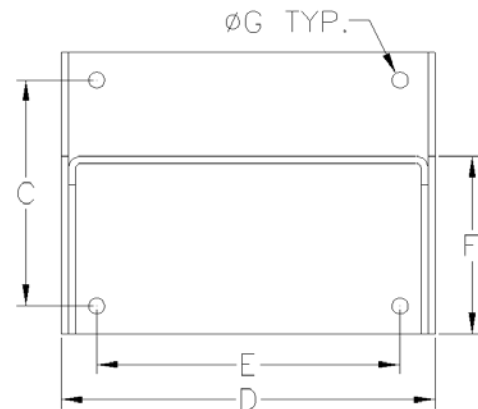


Figure 2-9 External Shelf Bracket Assembly

Pneumatic Mast

2.4.1.1 Mast Installation – Internal Mounting

WARNING

Mounting Structure Hazard! Mounting mast into a structure unable to resist the forces generated from customer-specific loading scenario could result in death or serious injury and could damage the mast. Before operation, be certain mounting structure is capable of resisting forces generated from all loading and environmental conditions, including, but not limited to, mast size and weight, payload size and weight, sail size, wind speed, guy line arrangement, support bracket or roof line location and base plate assembly.

CAUTION

Safety Instruction – Roof Access! If mast will be mounted to a vehicle, user must provide safe means to access the roof of the vehicle during installation and maintenance.

1. To select a suitable location for the mast in a vehicle consider the following:
 - A. Roof must be as flat as possible at the location of the mast. The roofline must lie in between the weep hole and base tube collar. Mounting hardware should be at least 1"[25 mm] above the weep hole and 3"[76 mm] below the collar. Refer to Figure 2-10 for hardware illustration, Figure 2-6 for clearance information, Table 2-2 and Figure 2-2 for weep hole and collar location.
 - B. The floor must be level and solid. If not, it must be reinforced.
 - C. The area underneath the floor must be free of obstructions to allow for accessibility to base plate fasteners and the bottom air inlet port, if used.
 - D. For manually rotating models only, the location of the mast must allow enough clearance from the wall to accommodate the turning handles and the air hose if the air is routed to the side port. Swivel fittings (Will-Burt part numbers 900481 & 900483) for the bottom air inlet are available.
2. Remove any roofline or ceiling panels. Cut a round hole in the roof ¼" larger than the diameter of the mast base section. See 1.4 for mast base section diameter. Cut the same size hole in the roof liner or ceiling panel. Center the ceiling plate over the hole. Use it as a template to drill bolt holes for attachment.
3. If irregularities exist in the roof, washers or short spacers made of 1/4" pipe can be used. Size ¼" or M6 bolts, not provided, to length allowing for the thickness of any bolt fasteners (not provided) and the mounting kit hardware. Refer to Figure 2-10 for hardware illustration and Figure 2-6 for clearance information.
4. To assemble the roof mounting hardware, apply a bead of silicone sealant to both sides of one rubber gasket. Line up all holes and fit the gasket between the roof flange and the roof. For super heavy duty masts, the gasket fits between the roof ring and the roof. The other gasket needs no sealant and fits against the inside of the roof. It is held in place by the ceiling plate. Line up all holes and fasten this assembly together using the appropriately sized fasteners. Securely tighten all nuts. Clean off any silicone sealant that may have squeezed out into the hole cut for the mast. Replace the roof liner or ceiling panel before installing the mast.
5. To locate the base plate for the mast, first make sure the floor of the vehicle is level. Find the base plate location by using a plumb bob supported from the center of the roof hardware or by using a carpenter's level held against the base tube of the mast. In the latter case, slide the weather bonnet, or retaining ring and o-ring for super heavy duty masts, over the bottom of the mast base section and up the mast past the weep hole towards the collar. If the weather bonnet is difficult to maneuver, put soapy water or oil on the mast to allow it to slide more freely. Lower the mast partially through the roof and attach the base plate before lowering the mast to the floor. It is necessary to check the mast in two places 90 degrees apart when using a level. Be certain to orient the mast so the operator has a clear view of the mast hazard labels. Additional labels are provided with the operator's manual that can be applied where the operator deems appropriate. Once located, the base plate may be used as a template to drill holes through the floor. Secure the base plate to the floor.
6. After the mast is secured to the base plate and the base plate is fastened to the vehicle, slide the weather bonnet down the mast and over the roof flange. For super heavy duty masts, remove any fasteners from the mounting hardware, slide the o-ring and retaining ring down the mast and tight against the roof ring and reattach all fasteners. If the weather bonnet or roof ring is difficult to maneuver, put soapy water or oil on the mast to allow it to slide more freely.

7. Air to operate the mast may be provided by an air compressor or other source of clean dry air. The air system should be regulated to not exceed the maximum operating pressure of the mast being used. Refer to tables in 1.4 for maximum operating pressures. Refer to 2.4.2.2 for installation instructions of the pneumatic system.
8. Install the weep hole drain kit provided with the mast. Refer to 2.4.2.1 for instructions.
9. For rotating masts, locate the turning handles at the desired height. Tighten the turning handle bolts just enough to allow the turning handles to rotate the mast without slipping. Tightening the turning bolts too much can deform the base tube and impede the movement of the next internal mast section. Lock the mast in place by tightening the locking screws located on the base plate assembly at all times unless the mast is to be rotated. See Chapter 3 for instructions on rotating the mast. Refer to Figure 2-4 and Figure 2-5 for illustrations of the rotating base plate and turning handles.

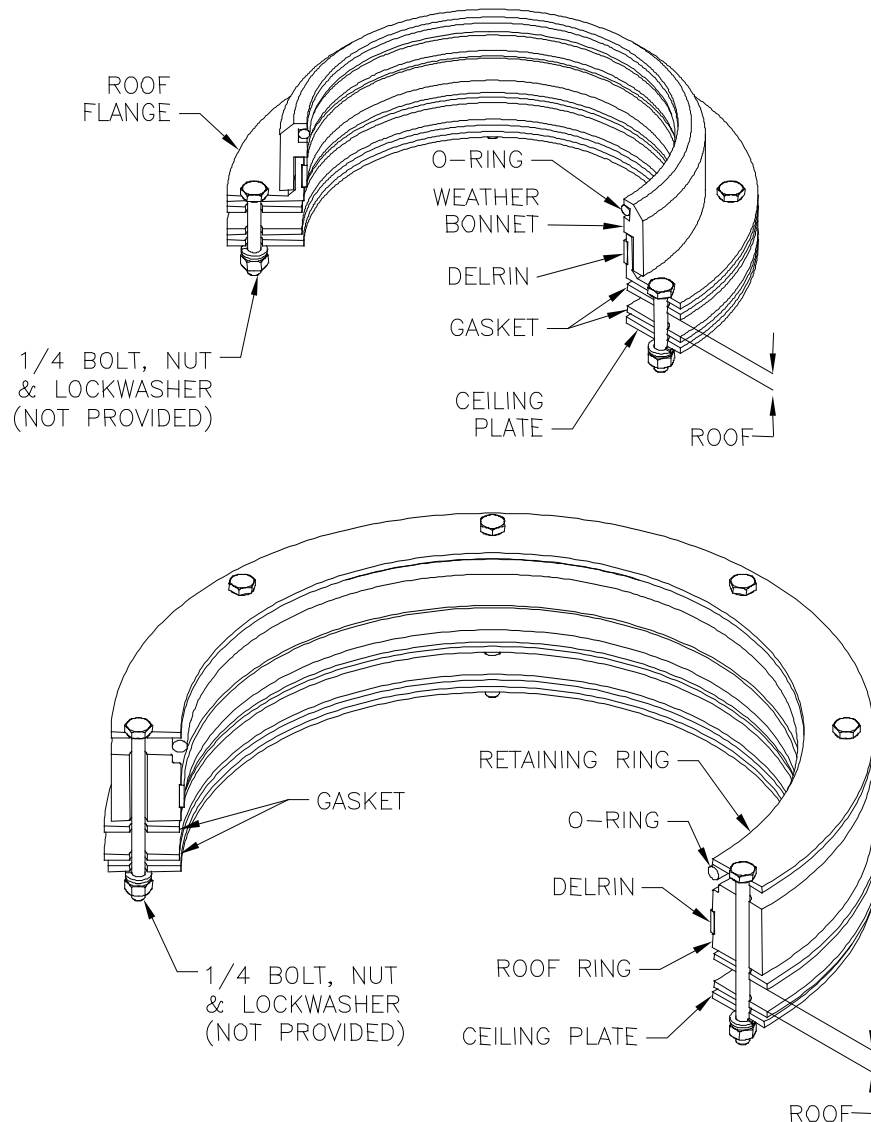


Figure 2-10 Mast Installation - Internal Mounting

Pneumatic Mast

2.4.1.2 Mast Installation – External Mounting

WARNING

Mounting Structure Hazard! Mounting mast into a structure unable to resist the forces generated from customer-specific loading scenario could result in death or serious injury and could damage the mast. Before operation, be certain mounting structure is capable of resisting forces generated from all loading and environmental conditions, including, but not limited to, mast size and weight, payload size and weight, sail size, wind speed, guy line arrangement, support bracket or roof line location and base plate assembly.

CAUTION

Safety Instruction – Roof Access! If mast will be mounted to a vehicle, user must provide safe means to access the roof of the vehicle during installation and maintenance.

1. When selecting the location for the mast on the vehicle, check the strength and rigidity of the body where the mast is to be externally attached.
2. Make sure the vehicle is on a flat level area.
3. If using the external shelf bracket, securely attach it to the vehicle. Be certain the shelf bracket is level.
4. Attach the base plate to the external shelf bracket or other mounting structure.
5. Attach the external support bracket around the mast base section. The support bracket should be positioned at least 1" [25.4 mm] above the base mast section weep hole and close to, but at least 1" [25.4 mm] below, the base mast section collar. Do not cover the weep hole. Refer to Table 2-2 and Figure 2-2 for dimensions to the weep hole and collar.
6. Secure the support bracket to the wall structure. Spacers may be added between the support bracket and the wall as needed to keep the correct alignment between the support bracket and the shelf bracket.
7. Periodically inspect all fasteners and welds to make sure the mast is securely attached.
8. A bottom air inlet is available on all standard model masts. The base plates and external shelf brackets are machined to allow access to the bottom air inlet. Swivel fittings (Will-Burt part numbers 900481 & 900483) for the bottom air inlet are available for rotating masts.
9. Air to operate the mast may be provided by an air compressor or other source of clean dry air. The air system should be regulated to not exceed the maximum operating pressure of the mast being used. Refer to 1.4 for maximum operating pressures. Refer to 2.4.2.2 Installation – Pneumatic System for installation instructions of the pneumatic system.
10. For rotating masts, locate the turning handles at a desired height (preferably above the weep hole if feasible). Tighten the turning handle bolts just enough to allow the turning handles to rotate the mast without slipping. Tightening the turning handles too much can deform the base tube and impede the movement of the next internal mast section. Lock the mast in place by tightening the locking screws located on the base plate. The locking screws should be tightened in against the mast at all times unless the mast is to be rotated. See Chapter 3 for instructions on rotating the mast.
11. The weep hole drain kit, intended to protect the interior of a vehicle from damage due to water drainage, is not required for externally mounted masts. However, the elbow from the kit may be used to shield the weep hole from blow sand, dust and other debris. Refer to point 2 in 2.4.2.1 for instructions on installing the elbow.

- | | |
|--|-------------------------------|
| 1. Mast | 6. Air control valve |
| 2. Support Bracket | 7. Air hose (side air port) |
| 3. Turning handles (with manually rotating mast) | 8. Air hose (bottom air port) |
| 4. External Shelf bracket | 9. Warning light |
| 5. Pneumatic system (several models available) | |

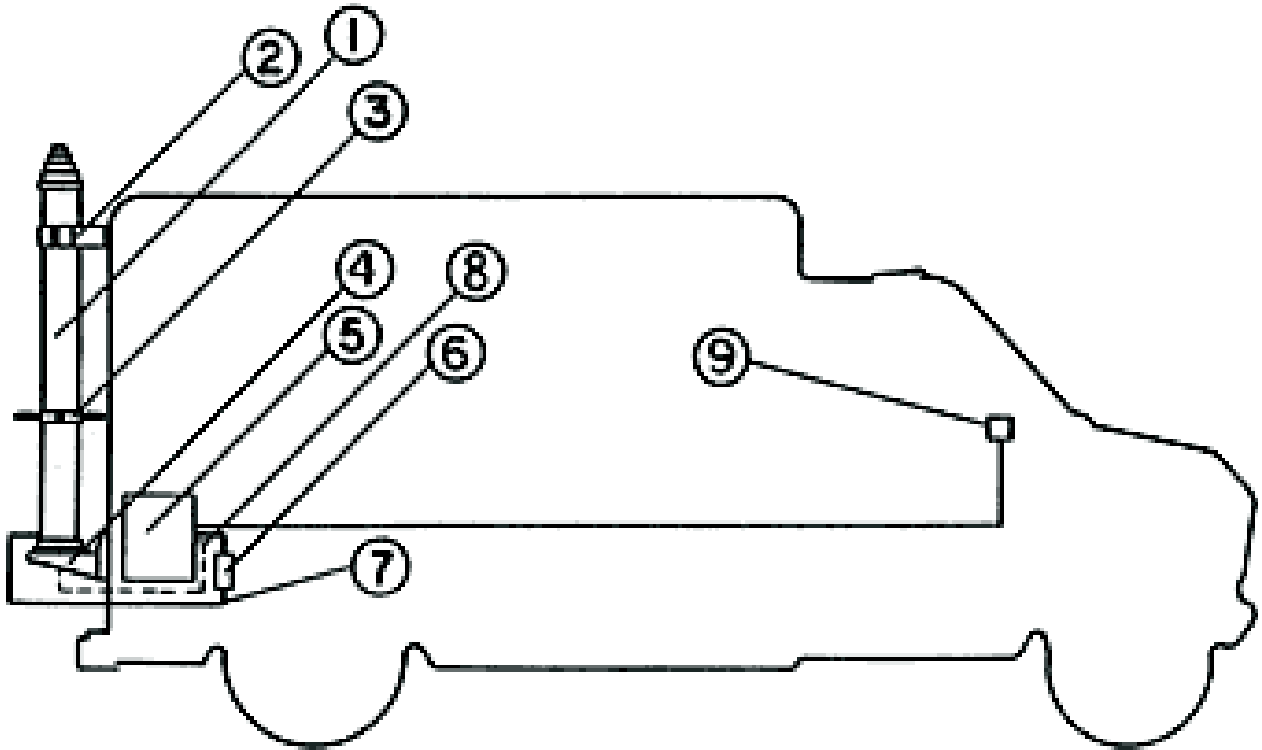


Figure 2-11 Mast Installation - External Mounting

Pneumatic Mast

2.4.2 Controls

2.4.2.1 Installation – Weep Hole Drain Kit

The intended use of the weep hole drain kit is to route water, from inside the mast, outside a vehicle or enclosure. The weep holes on each mast section are located to facilitate the drainage of water during periods of extension. Water can enter the mast through condensation in the air supply or by rain running down the mast sections and entering at the collars. Water can freeze in or on the mast causing it to work erratically or not at all. Keeping water out of the mast is very important to avoid damage to the mast and possible delays in operation.

A drain cock, provided in the hardware bag, should also be connected to the air inlet near the base of the mast. The drain cock should be used, periodically, to empty water that may have accumulated inside the base mast section, particularly after the mast has been exposed to rain.

CAUTION

Safety Instruction – Follow Procedure! Failure to follow drain kit installation instructions could damage the mast and render the mast inoperable. Read and understand the installation instructions before installing the drain kit.

NOTE: Complete internal mast installation before installing the weep hole drain kit.

1. Be certain the locknut and washer are threaded over the end of 1/4" hose adapter.
2. Fasten hose adapter to base mast section weep hole. Turn the hose adapter in ONLY 1 1/2 to 2 turns after initial engagement of threads. Further turning will damage mast. Tighten the locknut to secure in place.
3. Drill hole in vehicle or enclosure to route water outside. Fasten bulkhead fitting to hole.
4. Attach drain tube to hose adapter and bulkhead fitting.

See Figure 2-12 below and refer to Table 6-3 and Figure 6-3 for illustrations of the weep hole drain kit.

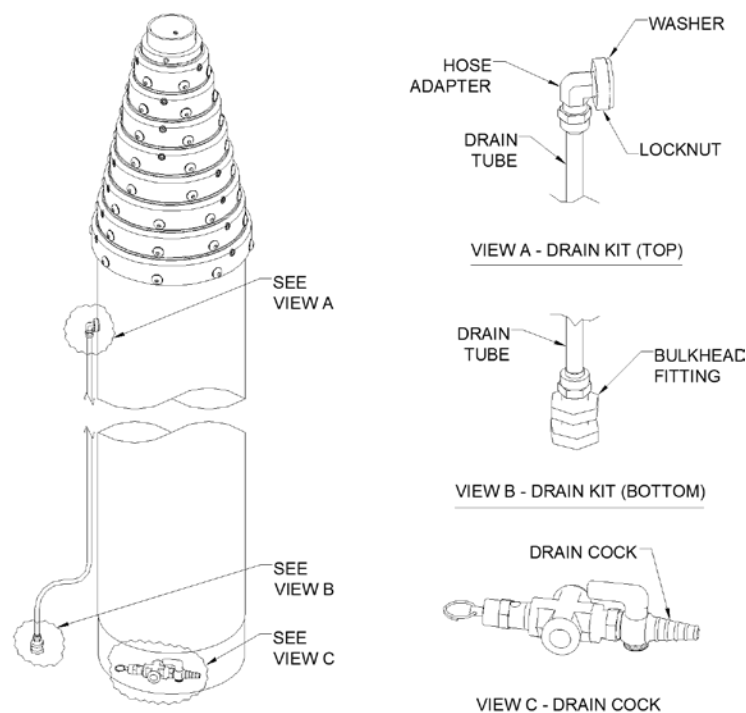


Figure 2-12 Weep Hole Drain Kit

2.4.2.2 Installation – Pneumatic System

⚠ CAUTION

Safety Instruction – Installation! At all times while using pipe and hose during installation, recognize that:

- 1.) Pipe and hose should be routed, mounted and restrained to protect from damage;
- 2.) Do not use second hand piping for installation;
- 3.) Do not bend air pipe and hose at a radius less than specified by the manufacturer;
- 4.) Pipes should be marked to avoid hazards from incorrect connection;
- 5.) The exhaust should be fitted with a silencer and be directed away from personnel;
- 6.) When routing piping, install in such a way as to minimize torsion on the joints;
- 7.) Mounting air pipe and hose shall be accomplished only by the use of tools to prevent readily disconnecting air pipe and hose from mast.

⚠ CAUTION

Safety Instruction – Control Valve! Improper positioning and operation of Control Valve can result in moderate injury or equipment damage. Control valve must be mounted in a location such that the operator has full view of the mast, but does not make contact with the mast during operation. Use only a Hold-To-Run type control valve.

1. **MOUNTING** – When mounting the pneumatic system, leave enough space around the unit for ventilation and for access to make initial installation, periodic adjustments, and future maintenance procedures as easy as possible. To reduce vibration in the system place rubber washers or grommets on the bolts between the mounting pads and the mounting surface. To reduce noise, separate the system from the inside workspace of the vehicle.
2. **ELECTRICAL** – In accordance with applicable electrical codes, select the proper wiring size, circuit breakers, or fuse size according to the maximum current draw of the pneumatic system being installed. Refer to rating information plate on the compressor motor. Be sure to properly ground the compressor motor and all other electrical components. Operation of the compressor may cause interference unless proper isolation or shielding is used. NOTE: A qualified electrician should perform installation and adjustments.
3. **AIR SUPPLY** – The compressor should have adequate ventilation to provide at least 10 SCFM of clean dry air at the air intake at all times. The recommended temperature range for inlet air is 32° F (0° C) to 95° F (35° C), so it works best when located in a heated compartment. The compressor should not be operated without the air filters in place.
4. **CONTROL VALVE** – A control valve should be installed to direct airflow in and out of the mast. The control valve should be positioned to avoid unintentional operation. Mast movement should stop when the controller is released (hold-to-run type). If the controller is not a hold-to-run type, an emergency stop must be provided. The control valve should be operable by a person wearing gloves and mounted so it can be used with the mast in full view. The control valve should be suitable for outdoor use and marked “Up”, “Down” or similar. A check valve or similar device should be installed directly to the mast through rigid piping that would prevent an extended mast from exhausting uncontrollably if there is a pneumatic failure, such as a hose burst.
5. **DRAIN & RELIEF FITTINGS** – A drain cock and a safety valve should be installed at the air inlet at the base of the mast. The drain cock empties water that may have accumulated inside the mast. The drain cock should be opened periodically to drain the mast, particularly after the mast has been operated in the rain. The drain cock on any mast should be left open once the mast is fully retracted and once a locking mast is completely extended and locked into position. The safety valve prevents the mast from being over pressurized. Refer to Table 6-2 and Figure 6-2 for illustrations and installation schematics for the drain cock and safety valve.
6. **PLUMBING** – A length of 3/8" airline hose plus additional loose fittings are supplied with a Will-Burt pneumatic system, if purchased. The hose can be cut to the required length at installation. A drain hose should be attached to the exhaust port of the control valve to drain condensation or oil mist that may exhaust from the mast.

Pneumatic Mast

Do not remove any hose or piping without first completely exhausting all air from the mast and then disconnecting the power supply.

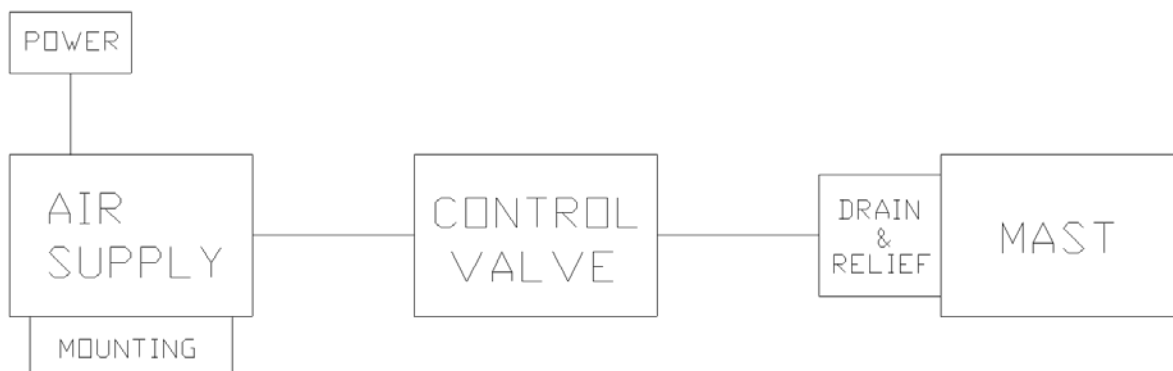


Figure 2-13 Pneumatic System

2.4.2.3 Installation – Mast Extension Magnetic Warning Kit

The vehicle should be equipped with a mast extension warning system. The mast extension magnetic warning kit includes items to install a system for warning against moving a vehicle while the telescoping mast is partially or completely extended. Test and ensure magnetic warning kit functions properly before operating the mast.

A magnetic sensitive switch is attached to the base mast section. Magnets inside the top mast section activate the switch when the mast has nested. When correctly installed, flashing lights will indicate partial or full extension of the mast when the ignition is on. When the mast is lowered and completely nested or the ignition is off the lights will cease to illuminate. The lead to the positive battery terminal should be connected to the ignition switch such that the lights will only illuminate when the mast is extended *and* the ignition is on. Vehicle operator should always visually confirm that the mast is entirely retracted before moving the vehicle.

The system should be installed per the diagrams shown below. One flashing light should be mounted to the vehicle dash in full view of the driver. The mast extension magnetic warning kit will not operate unless it is installed properly. Refer to Figure 2-14, Table 6-4 and Figure 6-4 for mast models 5-20, 6-27, 7-34, 8-30, 6-25, & 7-30 and refer to Figure 2-15 and Figure 2-16, Table 6-5 and Figure 6-5 for mast models 7-42, 8.5-48, 8.5-52, 9.5-56, 9-58, 10-60, 9-50, 10.3-60, & 10.8-76.

INSTALLATION INSTRUCTIONS:

1. Loop one end of a length of string or wire securely around the set of magnets. Carefully insert the magnets into the top of the top mast section positioned so the side with (3) screws enters the tube first. Using the string or wire, lower the magnets to the bottom. It is important that the magnets rest on the bottom of the top mast section. Remove any excess string or wire.
2. Assemble the magnetic switch assembly and the stainless steel clamp as shown. Attach the switch assembly loosely around the mast base tube, approximately 6 to 20" [15 to 51 cm] above the base plate.
3. Use 16 AWG stranded wire (not included) to connect the flasher, lights and relay (not included or necessary in kits for the 5-20, 6-27, 7-34, 8-30, 6-25, & 7-30 models) to the wires exiting the switch assembly. Connect the wires according to the diagram and schematic as shown. Be certain to observe any local codes or regulations.
4. With the ignition on, have the mast fully nested and the flasher/light installed and connected through the ignition to the battery. The lights should be flashing unless the switch is in proximity with the magnet assembly. Slide the magnetic switch assembly up and down along the lower two feet of the mast base tube to locate the magnet assembly inside the tube. When the magnet is located, the lights will stop flashing. The vertical sensing range should be about 1 to 3" [2.5 to 7.5 cm]. Tighten the band to clamp the switch assembly in the sensing range, but not lower than 1" [2.5 cm] above the lower limit. The switch can be located anywhere around the perimeter of the base tube.
5. Pressurize the mast to extend it 1 to 2' [31 to 61 cm] several times to test the mast extension magnetic warning kit.
6. Attach the "NOTICE" label in a visible area on the mast base tube.

NOTE: Do not mount the relay any closer than 6" [0.15 m] from the switch assembly that is clamped to the mast. When energized, the relay produces an electromagnetic field that could affect the performance of the reed switch if the relay is mounted closer than 6" [15 cm].

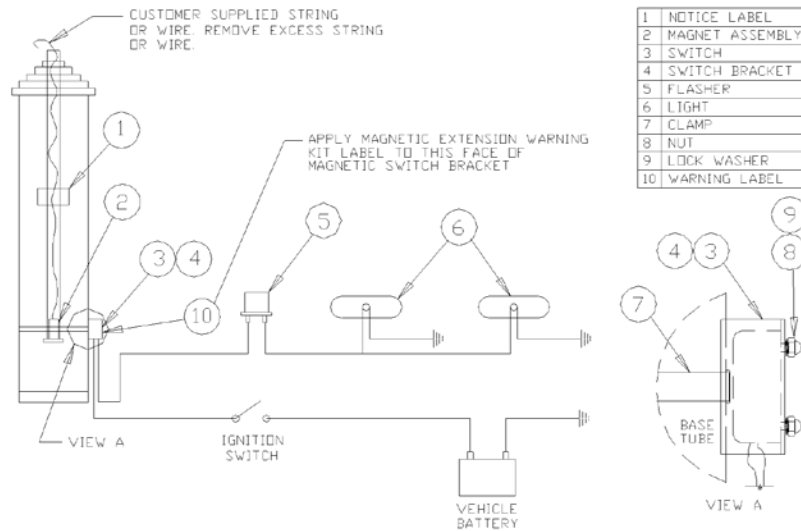


Figure 2-14 Magnetic Warning Kit

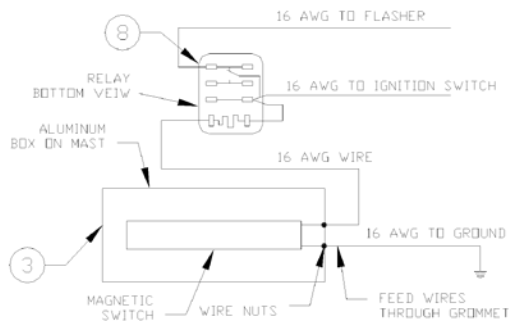


Figure 2-15 Switch & Relay Assembly

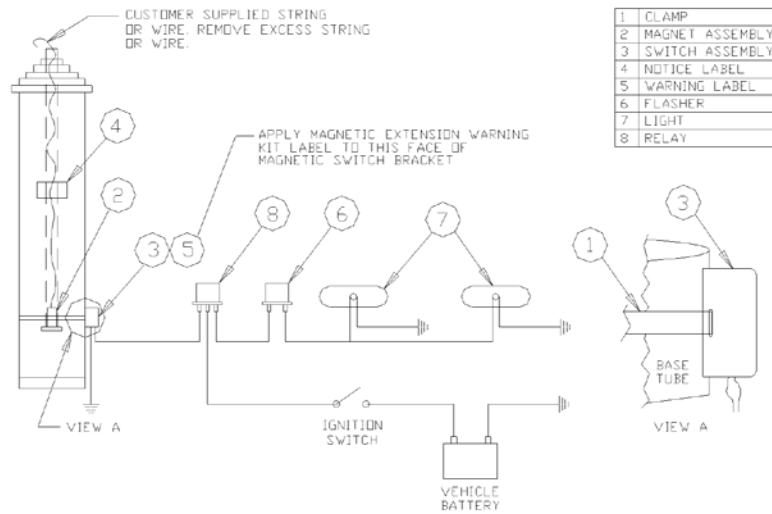


Figure 2-16 Magnetic Warning Kit

CHAPTER 3 OPERATING INSTRUCTIONS

WARNING

Safety Instruction – Operation! At all times prior to mast operation, insure that:

- 1.) The mast area is free of personnel and mechanical obstruction;
- 2.) All electrical cables are undamaged and properly terminated;
- 3.) The operator must have full view of the mast during use;
- 4.) Any transit tie-downs on the payload have been removed;
- 5.) The vehicle is not moving;
- 6.) The area above the mast is free of mechanical obstructions.

WARNING

Relocation Hazard! Relocating the mast during operation or after extension could result in death or serious injury. Do not relocate the mast during operation or while extended. This applies especially to masts mounted to vehicles. Operate the mast only if the vehicle is stationary and the vehicle engine is off.

WARNING

Mast Extension Hazard! Extending mast into obstructions could result in death or serious injury and could render the mast inoperable and partially extended. Before applying power and operating the mast, be certain there is sufficient clearance above and to all sides of the expected location of the fully extended mast and payload. Keep all persons clear of mast and mast extension. Do not lean directly over the mast.

WARNING

Lifting Hazard! The mast is intended to lift a specific payload for lighting, surveillance or communication use only. Any other use without written consent is prohibited and could cause death or serious injury. Do not use mast to lift personnel. Do not exceed specified payload capacity.

WARNING

Pinch Point Hazard! Moving parts can crush and cut resulting in death or serious injury. Keep clear of moving parts while operating mast.

WARNING

Crush Hazard! Death or serious injury could result if mast fails suddenly. Do not stand directly beneath the mast or its payload. Be certain payload is properly installed and secured.

WARNING

Burst Hazard! Over pressurizing mast will trip safety valve and could result in death or serious injury. Do not exceed maximum operating pressure of 35 psi (241 kPa) for Heavy and Super Heavy Duty masts. Do not exceed maximum operating pressure of 20 psi (138 kPa) for Standard Duty masts. Keep personnel clear of safety valve exhaust direction.

CAUTION

Entanglement Hazard! Tangled cables can cause equipment damage. Ensure control cables are not tangled and are free to pay out as mast is extended.

CAUTION

Frozen Water Hazard! Water freezing inside mast or air fittings may render mast inoperable and cause major equipment damage. Open drain, when mast is not in operation, in temperatures near or below freezing.

Pneumatic Mast

3.1 INTRODUCTION

The chapter provides instructions for operating the Pneumatic Mast.

3.2 OPERATION – NON-LOCKING MASTS

3.2.1 EXTENDING THE MAST

1. Select an area free of power lines or other overhead obstructions. Mast location should be no closer than a horizontal distance equal to the extended height of the mast away from any overhead power lines.
2. The mast should be located on level terrain.
3. Remove the canvas top cover (if used) and secure the payload and any required cables to the mast.
4. Attach the pneumatic system to the mast. Using the control valve, pressurize the mast to extend it. Do not exceed the maximum recommended operating pressure of the mast at any time. (20 PSIG for Standard Duty Masts and 35 PSIG for Heavy Duty Masts.) Maintain visual contact with the mast throughout extension to avoid cable entanglements or overhead obstructions.

3.2.2 ROTATING THE MAST

1. If the mast is a manually rotating model, loosen the locking screws on the base plate approximately one turn. Using its turning handles, rotate the mast to the desired direction. Re-tighten the locking screws to hold the position. Refer to Figure 2-4 and Figure 2-5 for illustrations of the rotating base plate and turning handles.

3.2.3 LOWERING THE MAST

1. Before lowering the mast, rotate the mast or top load to allow for enough clearance in the stowed position.
2. Using the control valve, exhaust air from the mast. The mast will retract by its own weight and the weight of the payload. Maintain visual contact with the mast during retraction to avoid cable and/or payload hang-ups.



Pinch Point Hazard! Moving parts can crush and cut resulting in death or serious injury. Keep clear of moving parts while operating mast.

3. Periodically open the drain cock when exhausting the mast to drain off any accumulated water.
4. To eliminate the possibility of inadvertent mast extension, disconnect the air supply or open the drain cock while the mast is not in use.
5. Securely tie the canvas top cover (if used) over the mast.
6. Always visually confirm that the mast is fully retracted before moving the mast.



Frozen Water Hazard! Water freezing inside mast or air fittings may render mast inoperable and cause major equipment damage. Open drain, when mast is not in operation, in temperatures near or below freezing.

3.3 OPERATION – LOCKING MASTS

3.3.1 MASTS WITH T-HANDLE YOKE ASSEMBLIES (Refer to Figure 3-1)

EXTENDING THE MAST

1. Select an area free of power lines or other overhead obstructions. Mast should be no closer than a horizontal distance equal to the extended height of the mast away from any overhead power lines.
2. The mast should be located on level terrain.
3. Remove the canvas top cover (if used) and secure the payload to the mast. If guy lines are used, attach the lines to the color-coded lugs on the collars.
4. Attach the pneumatic system to the mast.
5. Make sure all persons and obstructions are clear of the extension path of the mast. Before tripping any yoke assemblies make sure the mast is not pressurized.
6. For masts with T handle yokes extend the mast sections from the smallest to largest. Pull down firmly on the top T handle attached to the smallest collar. While holding down the T handle, pressurize the mast using the air control valve to extend the first internal mast section. Continue holding down on the T handle while the section is extending. When the section is fully extended, release the T handle and stop pressurizing the mast. The spring loaded latch pins will lock this section in the extended position. Exhaust all air from the mast to confirm that the section is locked. If the section comes down, repeat this step.
7. Follow the same procedure for each subsequent mast section going from smallest to largest. Watch carefully that none of the cables become tangled or snag on anything as each mast section is extended.
8. Any combination of sections can be extended if the full height of the mast is not required.

ROTATING THE MAST

1. If the mast is a manually rotating model, loosen the locking screws on the base plate approximately one turn. Using its turning handles, rotate the mast to the desired direction. Re-tighten the locking screws to hold the position. Refer to Figure 2-4 and Figure 2-5 for illustrations of the rotating base plate and turning handles.

LOWERING THE MAST

1. Before lowering the mast, rotate the mast or payload to allow for enough clearance in the stowed position.
2. For masts with T handles, pressurize the mast to lift the load until the base section yoke assembly latch pins can be disengaged by pulling the bottom T handle. Once the latch pins are disengaged, exhaust the air from the mast while firmly holding down the T handle. Continue holding down the T handle while the first internal mast section above is retracting. When this section is fully retracted, stop exhausting air pressure and release the T handle, locking the retracted section into position. Keep hands clear of retracting mast sections and collars.



Pinch Point Hazard! Moving parts can crush and cut resulting in death or serious injury. Keep clear of moving parts while operating mast.

3. Follow the same procedure for each subsequent mast section, working from largest to smallest.
4. Periodically, open the drain cock when exhausting the mast to drain off any accumulated water.
5. Once all sections are nested remove the payload and fit the mast top cover (if used) over the mast.

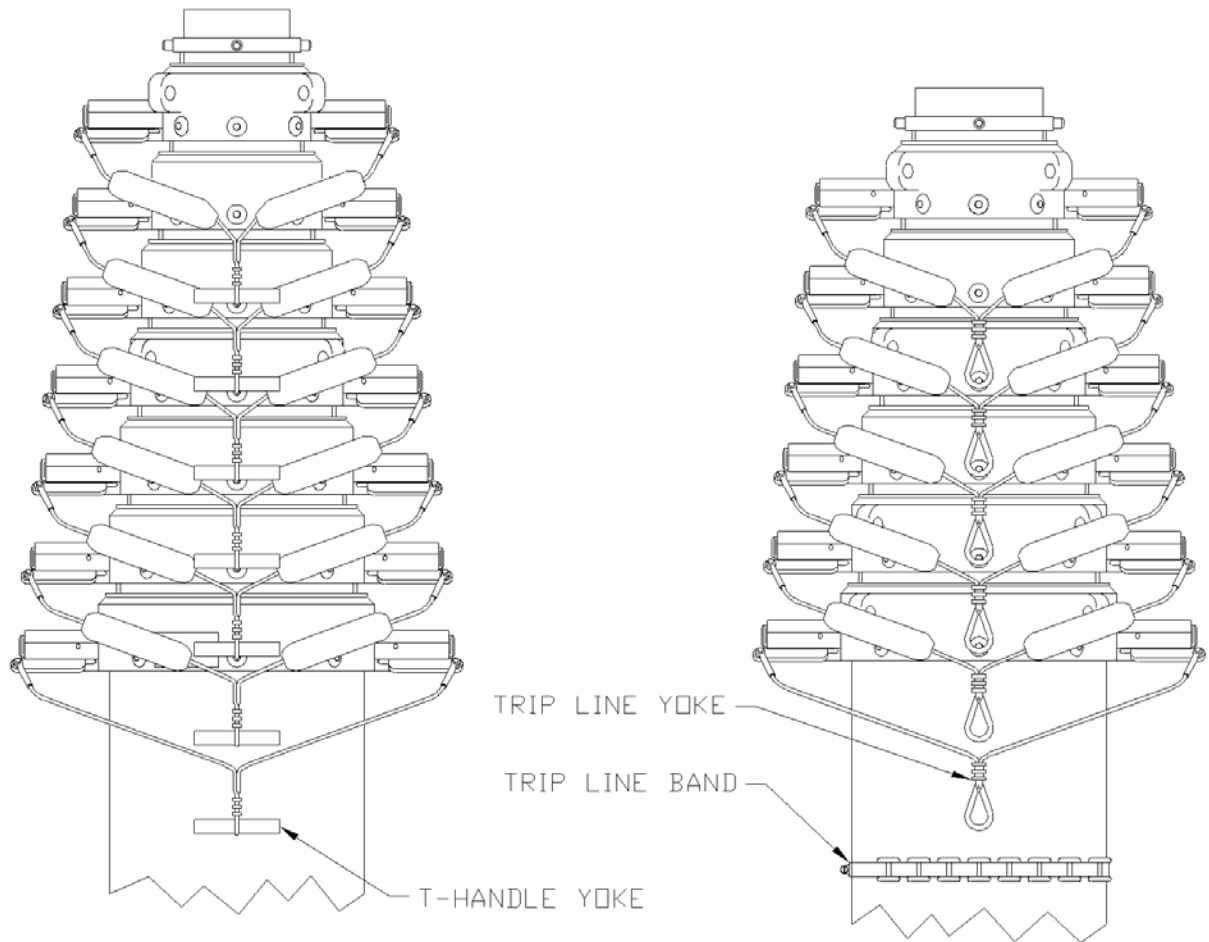


Figure 3-1 T-Handle & Trip Line Yoke Assemblies

⚠ CAUTION

Frozen Water Hazard! Water freezing inside mast or air fittings may render mast inoperable and cause major equipment damage. Open drain, when mast is not in operation, in temperatures near or below freezing.

3.3.2 MASTS WITH TRIP LINES (Refer to Figure 3-1)

EXTENDING THE MAST

1. Select an area free of power lines or other overhead obstructions. The Mast should be no closer than a horizontal distance equal to the extended height of the mast away from any overhead power lines.
2. The mast should be located on level terrain.
3. Remove the canvas top cover (if used) and secure the payload to the mast. If guy lines are used, attach the lines to the color-coded lugs on the collars.
4. For masts with trip lines, attach color-coded trip lines to the matching colored yoke assemblies. Feed the trip lines under the cable guides on all collars up to the collar where they are to be attached.
5. Attach the pneumatic system to the mast.
6. Make sure all persons and obstructions are clear of the extension path of the mast. Before tripping any yoke assemblies make sure the mast is not pressurized.
7. For masts with trip lines, pull down firmly on the bottom trip line attached to the largest collar. While holding down the trip line, pressurize the mast using the air control valve to extend the first internal mast section. Continue holding down on the trip line when the section is extending. When the section is fully extended, release the trip line and stop pressurizing the mast. The spring loaded latch pins will lock this section in the extended position. Exhaust all air from the mast to confirm that the section is locked. If the section comes down, repeat this step.
8. Pull the trip line on the next smaller collar to release the next section. Pressurize the mast to extend that section. Continue holding down on the trip line while the section is extending.
9. Follow the same procedure for each subsequent mast section going from largest to smallest. The color code sequence for the trip lines from largest to smallest tube diameter is white (11.25), blue (10), black (9), brown (8.25), red (7.5), orange (6.75), yellow (6), green (5.25), blue (4.5) and white (3.75). Maintain visual contact with mast throughout extension to avoid trip line or cable entanglements and watch for overhead obstructions.

ROTATING THE MAST

1. If the mast is a manually rotating model, loosen the locking screws on the base plate approximately one turn. Using its turning handles, rotate the mast to the desired direction. Re-tighten the locking screws to hold the position. Refer to Figure 2-4 and Figure 2-5 for illustrations of the rotating base plate and turning handles.

LOWERING THE MAST

1. Before lowering the mast, rotate the mast or payload to allow for enough clearance in the stowed position.
2. For masts with trip lines, pressurize the mast until pulling the trip line can disengage the top yoke assembly latch pins. Sufficient pressure to disengage the top latch pins is obtained when this mast section is supported by air pressure. Once latch pins are retracted, exhaust air from the mast while firmly holding down the trip line. The top mast section will begin to retract. Continue holding down on the trip line while the section above is retracting. As soon as this section is fully retracted, stop exhausting air and release the trip line, locking the retracted section into position.



Pinch Point Hazard! Moving parts can crush and cut resulting in death or serious injury. Keep clear of moving parts while operating mast.

3. Follow the same procedure for each subsequent mast section working from smallest to largest.
4. Once all sections are nested, remove trip lines and payload and fit the mast top cover (if used) over the mast.

Pneumatic Mast



CHAPTER 4 MAINTENANCE AND SERVICE INSTRUCTIONS

WARNING

Fire Hazard! Cleaning solvent, used for maintenance, is flammable and can be explosive resulting in death or serious injury. Do not smoke. Use cleaning solvent in a well-ventilated area. Keep cleaning solvent away from ignition sources. Always store cleaning solvent in the proper marked container.

CAUTION

Pressurized Device Hazard! Mast disassembly prior to depressurization may release pressurized air jet. Completely lower the mast, depressurize and shut down power before disassembly.

CAUTION

Safety Instruction – Roof Access! If mast will be mounted to a vehicle, user must provide safe means to access the roof of the vehicle during installation and maintenance.

CAUTION

Lifting Hazard! Manually lifting over 55 lb (25kg) is prohibited. In the UK, all lifting equipment must be thoroughly examined annually by a competent person according to the Lifting Operations and Lift Equipment Regulations 1998. Equivalent regulations exist in other EU states.

4.1 INTRODUCTION

The chapter provides instructions for maintaining and servicing a Pneumatic Mast.

To order spare or replacement parts, always refer to the mast model number and serial number. This information is included in the operator's manual supplied with each mast. The mast serial number is stamped at the bottom of the base mast section. Model number, serial number and additional information is also engraved on the mast identification plate(s). The plate(s) are fixed to the base mast section's collar. Refer to Table 6-1 and Figure 6-1 for identification plate abbreviation explanation and illustration.

4.2 TOOLS & MATERIALS RECOMMENDED/REQUIRED

Safety Glasses	Safety Gloves	Thread Tape	Level
Rags, Clean & Dry	Non-abrasive cleanser	Utility Knife	Acetone (or other solvent)
Hoist	Sling	Loctite 380 or equal	File
Screwdrivers	Ratchet Straps	Allen Wrenches	Chisel
Sockets Measuring Tape	Wrenches	Flat Punch	Saw Horses
Silicone Sealant	Hammer	Torque Wrench	Air Supply
Drill	String or Thin Wire		

4.3 REFERENCE DIMENSIONAL INFORMATION

Table 4-1 Tube Diameters

STANDARD DUTY TUBE			
	Tube	A	
		in	mm
	2	2.00	51
	2 1/2	2.50	64
	3	3.00	76
	3 1/2	3.50	89
	4	4.00	102
	4 1/2	4.50	114
B	5	5.00	127

SUPER HEAVY & HEAVY DUTY TUBE			
	Tube	A	
		in	mm
	3	3.00	76
	3 3/4	3.75	95
	4 1/2	4.50	114
	5 1/4	5.25	133
	6	6.00	152
B	6 3/4	6.75	171
	6 3/4	6.75	171
	7 1/2	7.50	191
	8 1/4	8.25	210
B	9	9.00	229
	9 1/8	9.14	232
	10	10.00	254
	11 1/4	11.25	286

NOTE: "B" Designates a base tube section.

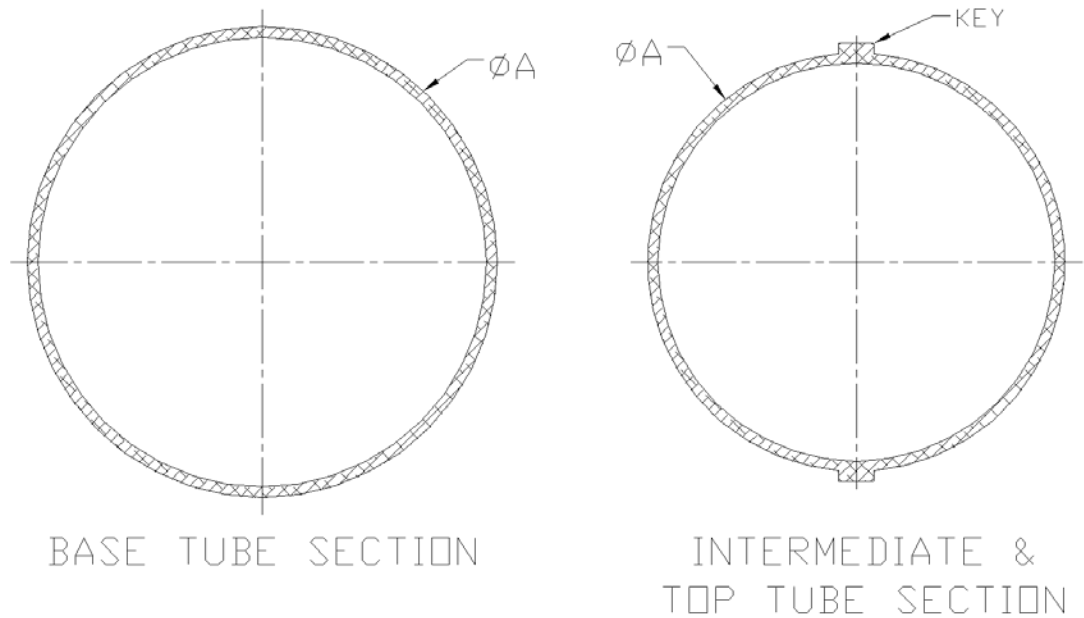


Figure 4-1 Tube Diameters

Table 4-2 Collar Information

STANDARD DUTY COLLAR			
Tube	Non-locking OD		Collar Bolts
	in	mm	
2 1/2	3.25	83	4
3	3.75	95	4
3 1/2	4.25	108	6
4	4.75	121	6
4 1/2	5.25	133	6
5	5.75	146	6

SUPER HEAVY & HEAVY DUTY COLLAR							
Tube	Non-locking OD		Collar Bolts	Locking OD*		A	
	in	mm		in	mm	in	mm
3 3/4	4.50	114	6	4.50	114	10.50	267
4 1/2	5.20	132	6	5.25	133	11.25	286
5 1/4	6.00	152	6	6.00	152	12.00	305
6	6.75	171	6	6.75	171	12.75	324
6 3/4	7.50	191	8	7.50	191	13.50	343
7 1/2	8.25	210	8	8.25	210	14.25	362
8 1/4	9.00	229	8	9.00	229	15.00	381
9	9.75	248	8	9.75	248	15.75	400
9 1/8	10.13	257	8	9.75	248	15.75	400
10	11.00	279	8	10.75	273	16.63	422
11 1/4	12.13	308	8	11.75	298	17.50	445

*All super heavy and heavy duty locking collars have 6 collars bolts.

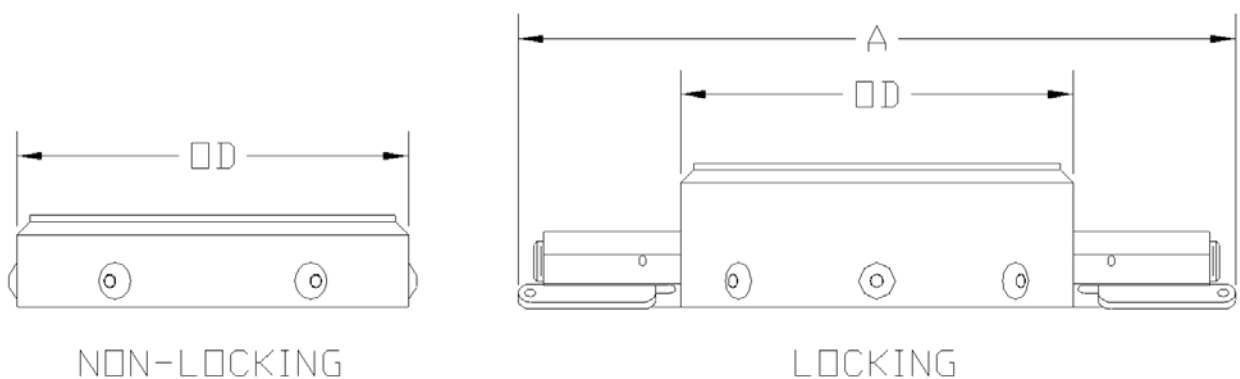


Figure 4-2 Collar Information

Pneumatic Mast

4.4 SCHEDULED MAINTENANCE

4.4.1 Mast Cleaning and Lubrication

Will-Burt pneumatic telescoping masts come from the factory pre-lubricated and require no scheduled maintenance under normal operating conditions. In extremely harsh environmental conditions, maintenance of the mast might be required. Signs that cleaning and lubrication are needed can be:

- A noticeable gritty film on the exterior surfaces of the mast sections
- Erratic extension or retraction of the mast
- Noisy operation of the mast
- Sticking of one or more mast sections when mast is extending or retracting

PROCEDURE:

1. Remove top load from the mast. This will allow the sections of a non-locking mast to more easily be extended from smallest to largest. See Step 3. On locking masts, the sequence of extension can be controlled by the locking collars.
2. When a regulator exists in the pneumatic system, reduce its pressure to between 5 and 10 PSIG.

NOTE: 10 PSIG should be sufficient pressure to extend all sections of the mast without a top load. If any section will not extend with 10 PSIG the mast may require overhaul. Consult the factory.

3. One person operating the air control valve should slowly pressurize the mast just enough to extend the top mast section. Another person may need to hold down the larger mast section collars to assure the proper sequence of extension. Close the air control valve as soon as the mast section is up.
4. Dampen a rag with a non-abrasive cleanser or solvent such as lacquer thinner to wipe down the extended mast section. Do not allow the cleaning fluid or solvent to run down inside the collar.
5. Repeat steps 3 and 4 for the next larger mast section.
6. Inject approximately 1/2 oz. of Mast Lubricant* or a lightweight machine oil into the weep hole (drain) of the exposed mast section. The weep holes are located between one and three feet below the collar on each tube except the top one.
7. Repeat steps 3, 4 and 6 for each of the remaining mast sections. The larger diameter sections should be injected with approximately 1 oz. of lubricant.
8. Lower the mast completely. Allow several minutes for the lubricant to settle and spread around the wear ring and seal at the bottom of each mast section.



Pinch Point Hazard! Moving parts can crush and cut resulting in death or serious injury. Keep clear of moving parts while operating mast.

9. Extend the mast again one section at a time in the same sequence (smallest to largest). Wipe off any excess lubricant that flows out of the weep holes.

NOTE: Do not lubricate the exterior of the mast. This will attract dust and contaminants from the air.

* Mast Lubricant is specifically formulated for cold weather use, but is suitable for year around use. Regular winter maintenance and the frequent use of Mast Lubricant should significantly reduce the potential for mast freeze ups. Mast Lubricant is also intended for use in air in-line lubricators.

4.5 CORRECTIVE MAINTENANCE

4.5.1 REPLACING SEALS – STANDARD DUTY

1. Place the mast horizontally on a pair of sawhorses or similar supports. Secure the mast base tube to the supports so that the mast does not roll off. To disassemble the mast, start with the top section and work toward the base section. Remove any plugs from air inlet ports. Refer to the drawing in Chapter 5 for identifying parts.
2. To remove the top mast section pull it out several inches away from the collar and remove the top tube stop. On locking collar models, it is necessary to retract the latch pins to allow the mast section to be pulled out. Remove the collar bolts on the top collar and slide the collar over the end of the mast section. On locking collar models, retract the latch pins fully to allow the collar to slide off the end of the mast section. Slide the top section out. Do not drop the mast section as it comes out.
3. Remove the wear ring from the butt plate and wipe it clean. Remove the old seal and clean the seal groove. The mast section should be cleaned inside and outside with a solvent such as lacquer thinner. Do not use anything that might scratch the inside surface of the mast section. Repeat this procedure for each subsequent mast section.
4. Refer to 4.5.3 for replacement of collar bearing strips; 4.5.4 for replacement of wear rings; 4.5.5 for replacement of collar inserts; 4.5.6 for replacement of internal bumpers; and 4.5.7 for replacement of external bumpers.
5. Apply a coat of Mast Lubricant or lightweight machine oil such as SAE 10 to the inside surface of all mast sections except the top section. Oil the new seal. With the lip edge of the seal toward the bottom end of the mast section, slide it on the butt plate and into the seal groove. Replace the wear ring on the butt plate. Repeat this procedure for each mast section.
6. When reassembling the mast, start with the base section and work toward the top section.
7. Secure the base mast section of the mast horizontally on saw horses or similar supports. Using a second person or using some other brace to support the top end, hold the next mast section so that the top end of the section is at a lower elevation than the seal end. Next, rest the lip of the seal on the inside of the receiving section. Refer to Figure 4-3. Slowly raise the lower end of the mast section to horizontal while carefully pressing the lip of the seal into the receiving section. Use your thumbs and forefingers on both sides of the seal to simultaneously press both sides of the seal in an upward motion. Work this way until your fingers meet at the top. Make sure that the seal is in correctly. If not, the mast will eventually leak air. If the seal has not been inserted into the receiving tube correctly, remove the mast section and try again. Once the seal is inserted, guide the wear ring into position within its groove, and slide in the mast section. Be careful not to damage the seal as it slides past the collar bolt holes that are located near the insertion end of the receiving section.
8. Slide the section in leaving several inches protruding. Rotate the section so that the match mark "O" stamped on one of the keys at the end of the section is in line with the "O" stamped on the end of the base section.
9. Replace the collar on the mast section. Line up the match mark "O" on the collar with the "O" on the mast section. On locking collar masts, retract the latch pins to allow the collar to slide onto the end of the mast section. Make certain that all the bolt holes in the collar align exactly with the holes in the mast section. Install and hand tighten the collar bolts and lock washers. Torque the collar bolts to 80 lbs-in maximum.
10. Repeat steps 6 through 9 for each subsequent mast section.

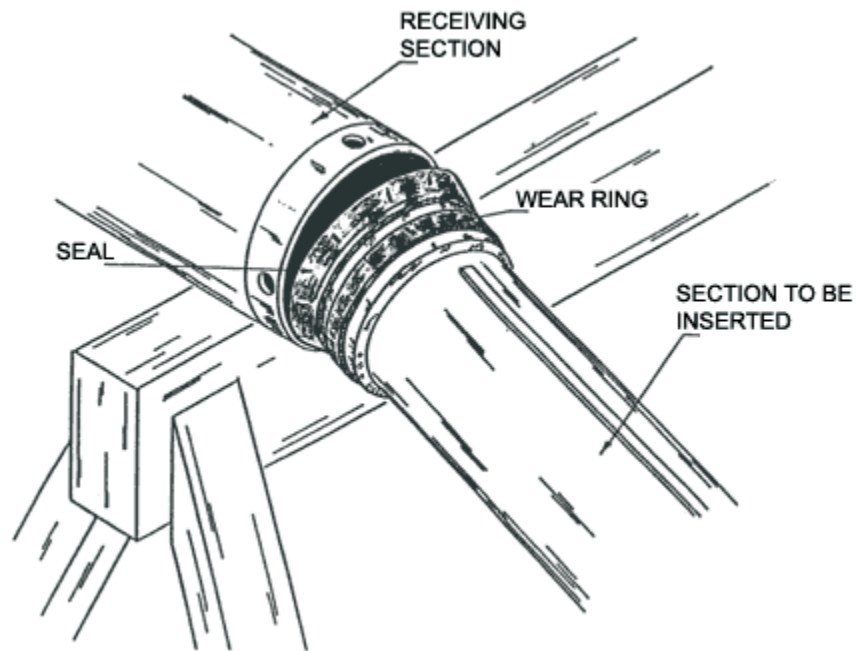


Figure 4-3 Seal Replacement - Standard Duty

4.5.2 REPLACING SEALS, EXPANDERS AND YOKE ASSEMBLIES – HEAVY DUTY & SUPER HEAVY DUTY

1. Place the mast horizontally on a pair of sawhorses or similar supports. Secure the mast base tube to the supports so that the mast does not roll off. To disassemble the mast, start with the top section and work toward the base section.
2. To remove the top mast section, pull firmly on the yoke assembly of the top collar while pulling the top section out. Pull the top section out several inches away from the collar. Remove the set screw from the end of each latch pin lug (ears on each side of the collar). Refer to Figure 4-5. Slide out the latch pin spring from the end of each lug. Using a hammer and a punch, drive out the roll pin on each lug just far enough to remove the yoke assembly. Slide the latch pin out of the latch pin lug using a small screwdriver inserted into the slot located on the underside of each lug. Remove the collar bolts and slide the collar over the end of the mast section. Slide the top mast section out. Be careful not to drop it as it comes out.
3. Remove the orifice bolt, lock washer, back-up washer, expander and seal from the bottom of the mast section. Note orifice bolt ID and corresponding mast section for use when reassembling. Thoroughly clean and inspect all parts. The mast section should be cleaned inside and outside with a solvent such as lacquer thinner. Do not use anything that might scratch the honed inside surface of the mast section. The mast sections may need cleaned repeatedly before reassembly to remove all debris. Repeat this procedure for each subsequent mast section.
4. Refer to 4.5.3 for replacement of collar bearing strips; 4.5.4 for replacement of wear rings; 4.5.5 for replacement of collar inserts; 4.5.6 for replacement of internal bumpers; and 4.5.7 for replacement of external bumpers.
5. Reassemble the orifice bolt, lock washer, back-up washer, new expander and new seal on the bottom of the mast section. Match orifice bolts with the correct mast section by using the orifice bolt ID and the mast section tube OD. The ID of the orifice bolts should increase as the tube OD decreases. For example, the top mast section will have the smallest tube diameter and the orifice bolt with the largest ID. Refer to the illustration. As the orifice bolt is being tightened, center the seal, expander and back-up washer on the butt plate. Torque the orifice bolt to 16 lbs-ft. Repeat this procedure for each mast section.
6. Before reassembling the mast, lightly oil the lip of the seal and the inside honed surface of each mast section with Mast Lubricant or lightweight machine oil such as SAE 10. When reassembling the mast, begin with the base section and work toward the top section.
7. Secure the base section of the mast horizontally on saw horses. Using a second person or using some other brace to support the top end, hold the next mast section so that the top end of the section is at a lower elevation than the seal end. Next, rest the lip of the seal on the inside of the receiving section. Refer to the Figure 4-3. Slowly raise the lower end of the mast section to horizontal while carefully pressing the lip of the seal into the receiving section. Use your thumbs and forefingers on both sides of the seal to simultaneously press both sides of the seal in an upward motion. Use caution, pressing too hard will bend the expander. Work this way until your fingers meet at the top. Make sure that the seal is in correctly. If not, the mast will eventually leak air. If the seal has not been inserted into the receiving tube correctly, remove the mast section and try again. Once the seal is inserted, guide the wear ring into position within its groove, and slide in the mast section. Be careful not to damage the seal as it slides past the collar bolt holes that are located near the insertion end of the receiving section.
8. Slide the section in leaving several inches protruding. Rotate the section so that the match mark "O" stamped on one of the keys at the end of the section is in line with the "O" stamped on the end of the base section.
9. Replace the collar on the mast section. Line up the match mark "O" on the collar with the "O" on the mast section. On locking collar masts, retract the latch pins to allow the collar to slide onto the end of the mast section. Make certain that all the bolt holes in the collar align exactly with the holes in the mast section. Install and hand tighten the collar bolts and lock washers. Torque the collar bolts to 80 lbs-in maximum.

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10. Replace the latch pins with the flats on the ends perpendicular to the key on the mast section. Replace the yoke assembly. Make sure that the hole in the lever lines up with the hole in the latch ear. Drive in the roll pin while holding it in place with a punch. Make sure that the lever does not get jammed. Install the latch pin spring and set screw. Turn the set screw all the way in until it stops. Then, back out the screw approximately 1/4 to 1/2 turn. Repeat this procedure for the other latch ear. Check the yoke assembly for smooth operation. It may be necessary to readjust the set screw as much as one full turn. If the set screw is too tight, it may not allow the latch pin to retract fully when the yoke assembly is pulled. If the set screw is too loose, spring tension may not adequately load the latch pin.
11. While pulling the yoke assembly, slide the mast section through the collar several times. Check for smooth operation. Observe the flat surface on the keys of the mast section for wear marks. If wear marks exist, the latch pin is causing friction and the set screw must be loosened.
12. Repeat steps 6 through 11 for each subsequent mast section.

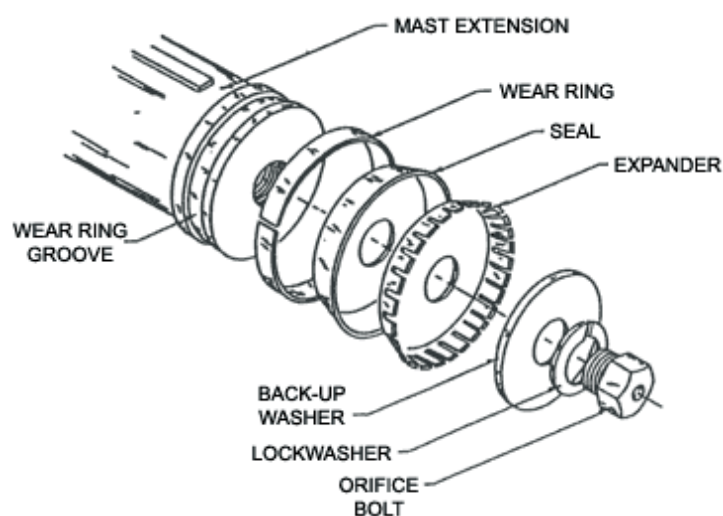


Figure 4-4 Seal Area - Heavy Duty & Super Heavy Duty

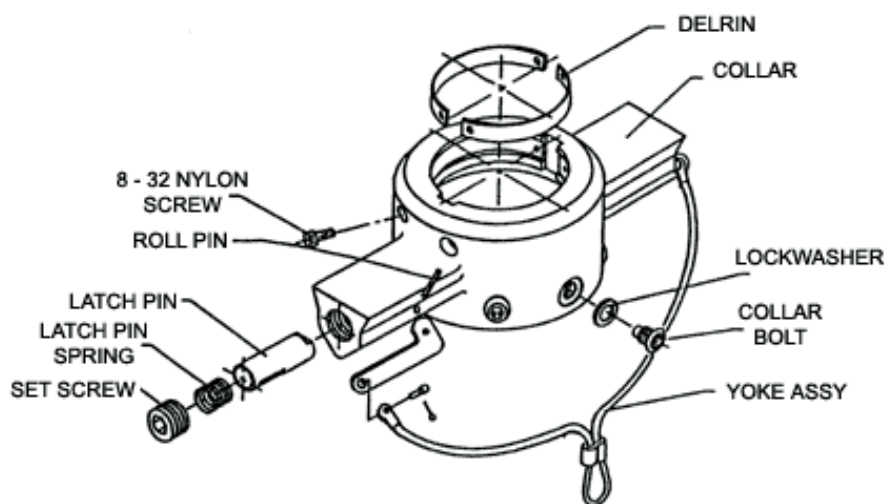


Figure 4-5 Locking Collar Assembly

4.5.3 REPLACING COLLAR BEARING STRIPS

1. Inspect the Delrin and the machined keyways of the collar for wear. If the keyways of the collar are badly worn, the collar should be replaced. If the Delrin strips are worn down to the metal collar, they should be replaced.
2. To remove the old Delrin strips, remove the nylon screws from the collar. Pull out the Delrin strips and clean the collar.
3. Press the new Delrin strips firmly into the groove. Align the holes in the Delrin with those in the collar. Refer to Figure 4-6 for a non-locking collar and Figure 4-5 for a locking collar. Install new nylon screws through the collars into the threaded holes in the Delrin. Apply LOCTITE® 495 adhesive or equivalent to the nylon screws before installation. Do not over tighten the nylon screws.
4. Cut off or file off the ends of the nylon screws protruding through the Delrin until they are flush.
5. Carefully file off any excess Delrin, which may protrude into the keyway of the collar.
6. Before reassembling the mast, slide each collar over its mating mast section. If the collar does not slide freely over the tube, it will be necessary to sand high spots on the Delrin to fit. The high spots will be evident by shiny or gray marks on the white Delrin strip.
7. Wipe the collars clean before reassembling the mast.

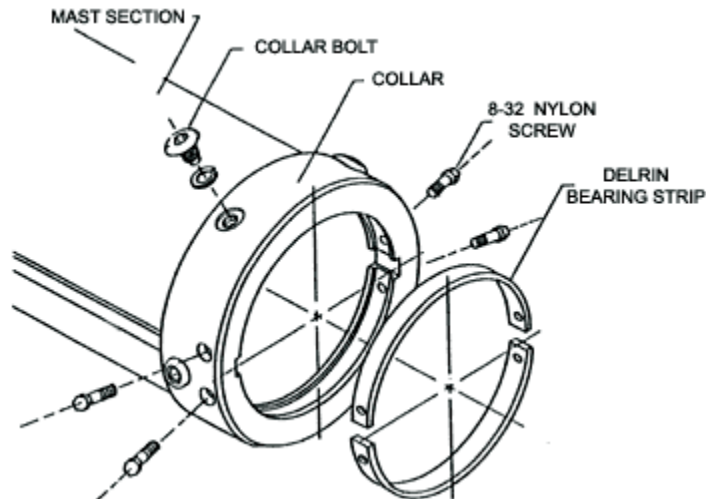


Figure 4-6 Replacing Collar Bearing Strips

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4.5.4 REPLACING WEAR RINGS

1. Wear rings are preformed split synthetic bearings that fit around the butt plate above the seal on each interior mast section. Wear rings can be replaced when the mast is disassembled for seal replacement. Check the wear rings for wear. If the wear ring is worn down to the butt plate surface, it must be replaced.
2. Clean the butt plate and wear ring groove. Slide the wear ring over the mast and into the groove. Press the wear ring into the groove to make sure there is at least 1/8" clearance between the two ends. If necessary, cut enough off one end to get the required gap.
3. The wear ring must be held in place until this mast section is inserted into the receiving mast section. Apply a bead of adhesive inside the groove on the butt plate to bond the wear ring in place. If the Wear Ring prevents the Mast Section from sliding inside the next Section, grind the Wear Ring OD as necessary. Before reassembling the mast section, slide each mast section inside its mating mast section. If the smaller mast section does not slide freely inside the next largest mast section, it will be necessary to sand high spots on the wear ring to fit. The high spots will appear as shiny or discolored marks on the outside diameter of the wear ring.
4. On mast manufactured before 1986, Delrin bearing strips were cemented to the butt plates of the mast sections. Wear rings can be used to replace the old Delrin bearings in many of these masts. Consult the factory with your model and serial number for verification before ordering replacement wear rings.

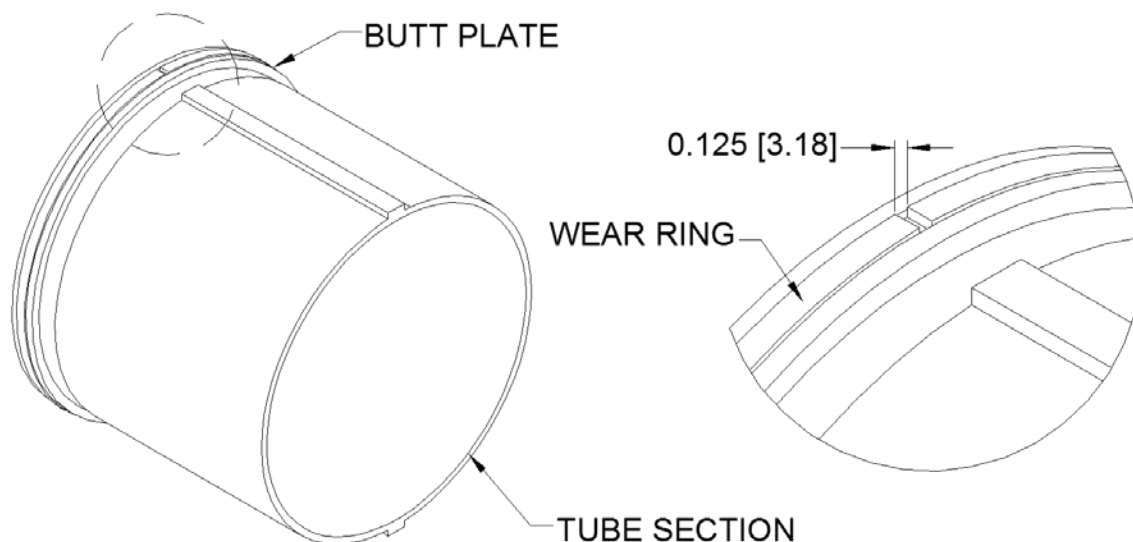


Figure 4-7 Replacing Wear Rings

4.5.5 REPLACING COLLAR INSERTS – NON-LOCKING

1. Inspect the collar insert and the machined keyways in it for wear. If the keyways of the collar are badly worn (elongated), the collar insert should be replaced.
2. Using a knife, remove the flat rubber external bumper that is glued to the top of the collar.
3. To remove the Delrin insert, remove the (3) 1/4-28 socket head cap screws from the collar with an allen wrench.
4. With a hammer and flat punch or chisel, carefully tap around the top edge of the insert to drive it out the bottom of the collar. Note that the insert can only be removed from the bottom of the collar. After removing the old insert, clean the collar.
5. Install the new insert into the collar. Make sure to align the holes in the insert with the holes in the collar. It may be necessary to gently tap the insert into the collar. Do not damage the insert.
6. Apply thread-locking compound, such as LOCTITE® Super Bonder 495, to the ends of the 1/4-28 socket head cap screws. Replace the screws.
7. Replace the external bumper. See 4.5.7 Replacing External Bumpers.
8. Before reassembling the mast, slide each collar over its mating mast section. If the collar does not slide freely over the mast section, it will be necessary to sand high spots on the insert to fit. The high spots will appear as shiny or discolored marks on the inside diameter of the Delrin insert.
9. Clean the collars before reassembling the mast.

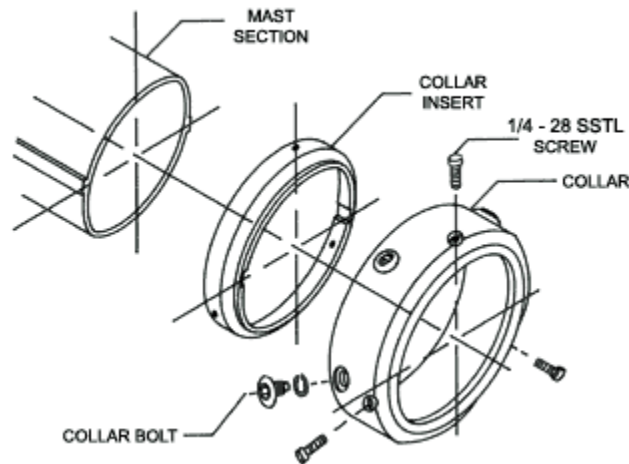


Figure 4-8 Replacing Collar Inserts

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4.5.6 REPLACING INTERNAL BUMPERS

1. The internal bumper, which looks like an O ring, is located on the top edge of the stop panel on each internal mast section. When the mast is disassembled, check the condition of the internal bumper. If the internal bumper has deteriorated, it should be replaced.
2. Remove the old bumper and carefully stretch the new bumper over the end of the mast section and insert it into the groove machined in the keys. The bumper should fit tightly against the mast section immediately above the stop panel.

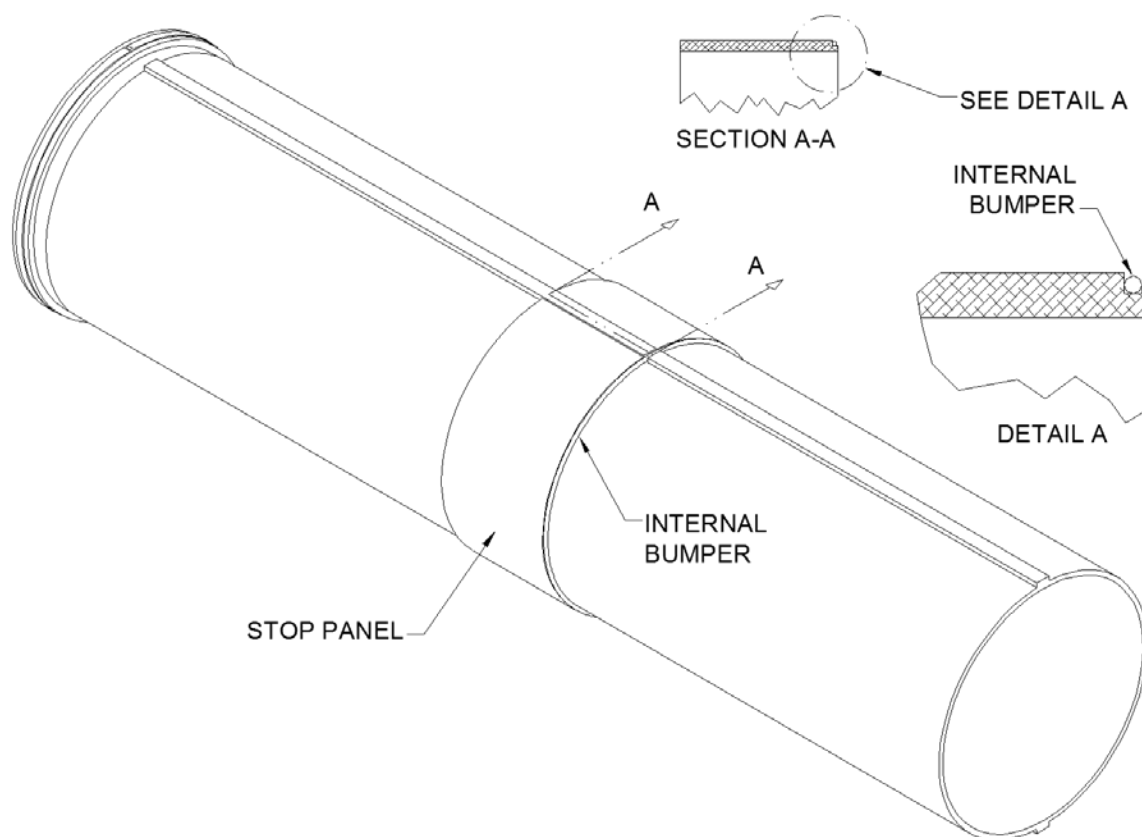


Figure 4-9 Replacing Internal Bumpers

4.5.7 REPLACING EXTERNAL BUMPERS

1. The external bumper is a flat rubber ring cemented to the top of each mast collar. Check the condition and the adhesion of each external bumper. If the external bumpers become loose they can usually be reused unless they have been damaged.
2. Remove the old bumper. Use acetone to clean off any old adhesive from the collar. Clean the replacement bumper with acetone. Allow it to dry thoroughly.
3. At room temperature, apply a light bead of LOCTITE® Black Max Adhesive 380 or equivalent around the top of the collar. Follow the manufacturer's instructions.
4. Place the external bumper on the collar and align the inside diameter edges. Hold pressure on the bumper and collar using a uniform weight for at least 90 seconds.
5. Using a razor knife, notch out keyways in the external bumper to match those in the collar.

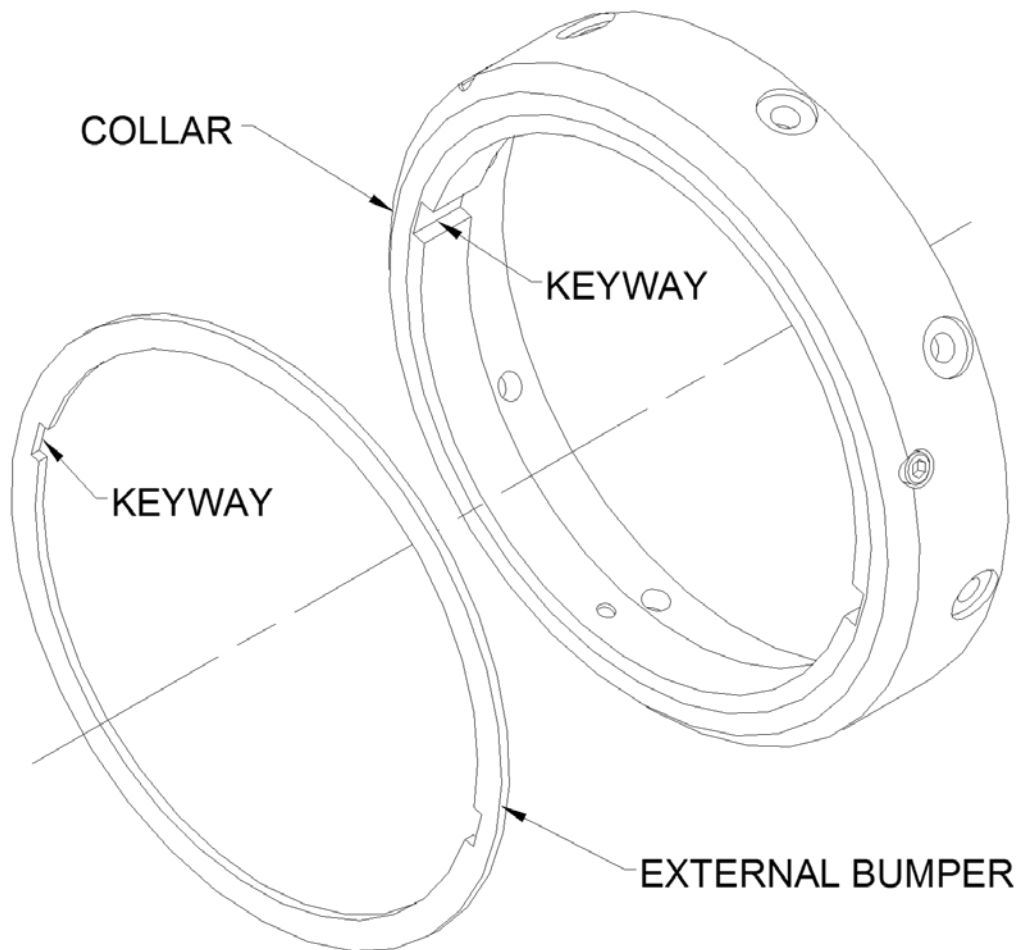


Figure 4-10 Replacing External Bumpers

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4.6 TROUBLE SHOOTING

PROBLEM	POSSIBLE CAUSE(S)	POSSIBLE SOLUTION(S)
Mast frozen in extended position.	1) Mast Base Section not drained routinely. Typically freezes around collar area.	1) Wrap warming blankets around collar until ice melts. Use heat gun or 500W quartz light. 2) Depressurize Mast. Inject 1 oz. Anti-freeze, suited for aluminum engines, where top of collar and Intermediate tube meet.
Mast frozen in nested position.	1) Mast Base Section not drained routinely. Typically damages Tubes.	1) Send to manufacturer for repair or replacement.
Mast will not lower without rocking.	1) Not enough weight. *Typ. Standard Duty* 2) Bent Tube. 3) Broken internal bumper. 4) Inserts tight. *Typ. Heavy & Super Heavy Duty*	1) See 4.4.1 Mast Cleaning & Lubrication. 2) Add weight to platform or stub adapter. 3) Check tube trueness. Order replacement if bent. 4) Depressurize. Remove collar & lift tube to check Internal bumper. Order replacement. See 4.5.6. 5) Depressurize. Disassemble. File & grind to prefit collar inserts as necessary.
Largest Intermediate Tube Section stuck	1) Turning Handles tight. *Typ. Standard Duty* 2) Support bracket tight.	1) Remove Turning Handles and cycle. <i>Cycles properly:</i> Reinstall Handles per point 9 in 2.4.1.1 Internal Mounting. <i>Does not cycle:</i> Tubes damaged; Order replacement. 2) Loosen bolts. Shim as necessary between clamp halves.
Rotational movement in Mast Sections	1) Bearing Strips or Inserts worn.	1) Locking Strip Collar: Order Insert Collar.* 2) Non-locking Insert Collar: Order Insert.* * Customer must prefit.
Cannot slide Weather Bonnet over Base Section.	1) Bonnets are designed tight.	1) Use soapy water per point 6 in 2.4.1.1 Internal Mounting. 2) Oil O-ring and use mallet to tap evenly around diameter of Bonnet.

For additional information, please contact The Customer Service at 330-684-5298.

CHAPTER 5

MAST DRAWING & INSTALLATION INSTRUCTIONS

5.1 MAST DRAWING

This chapter includes the mast drawing with the bill of materials and may also include additional installation instructions specific to the mast model. Refer to the following pages for the drawing and any additional information included.

CHAPTER 6 REFERENCE DRAWINGS

6.1 INTRODUCTION

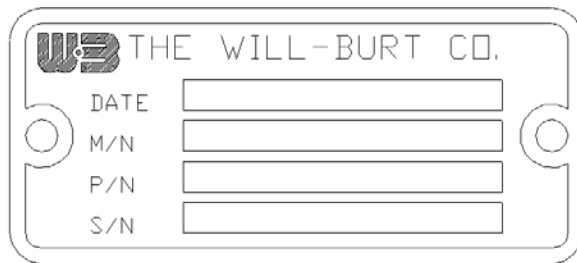
The chapter provides reference drawings related to the Heavy Duty Non-locking Pneumatic Mast.

6.2 REFERENCE DRAWINGS

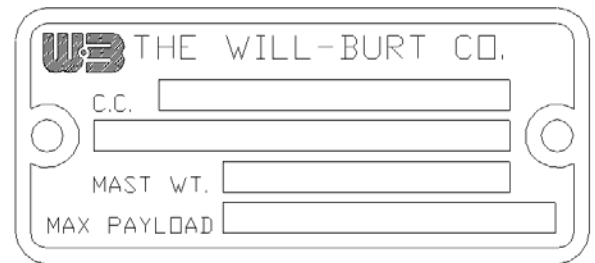
Table 6-1 Identification Plate Abbreviations

DATE	Date of Assembly or Year of Manufacture
M/N	Model Number
P/N	Part Number
S/N	Serial Number
C.C.	The Will-Burt Co. Cage Code
MAST WT.	Approximate Mast Weight
MAX PAYLOAD	Mast Maximum Payload Capacity

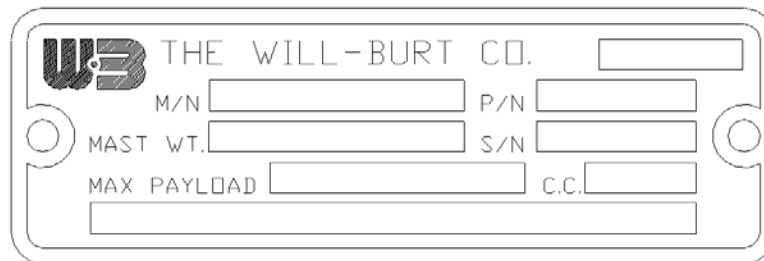
(Box in top, right corner of 902851 used for Date or Year)



P/N 902852



P/N 914098



P/N 902851

Figure 6-1 Identification Plates

Table 6-2 Hardware Bag Parts List

MK	DESCRIPTION	QTY
1	MB 3/8-16 x 1 1/2 LG, Hex Head, SSTL	4
2	Flat Washer, 3/8, SSTL	4
3	Lock Washer, 3/8, SSTL	4
4	Nut 3/8-16, Hex, Heavy Duty, SSTL	4
5	MS 3/8-16 x 1 LG, Flat HD, SSTL	4
6	Drain Cock, 1/4 NPT	1
7	Reducer, M x F 3/8 x 1/4 NPT	1
8	Close Nipple, 1/4 NPT	2
9	Cross, 1/4 NPT, Brass	1
10	Safety Valve, 1/4 NPT	1

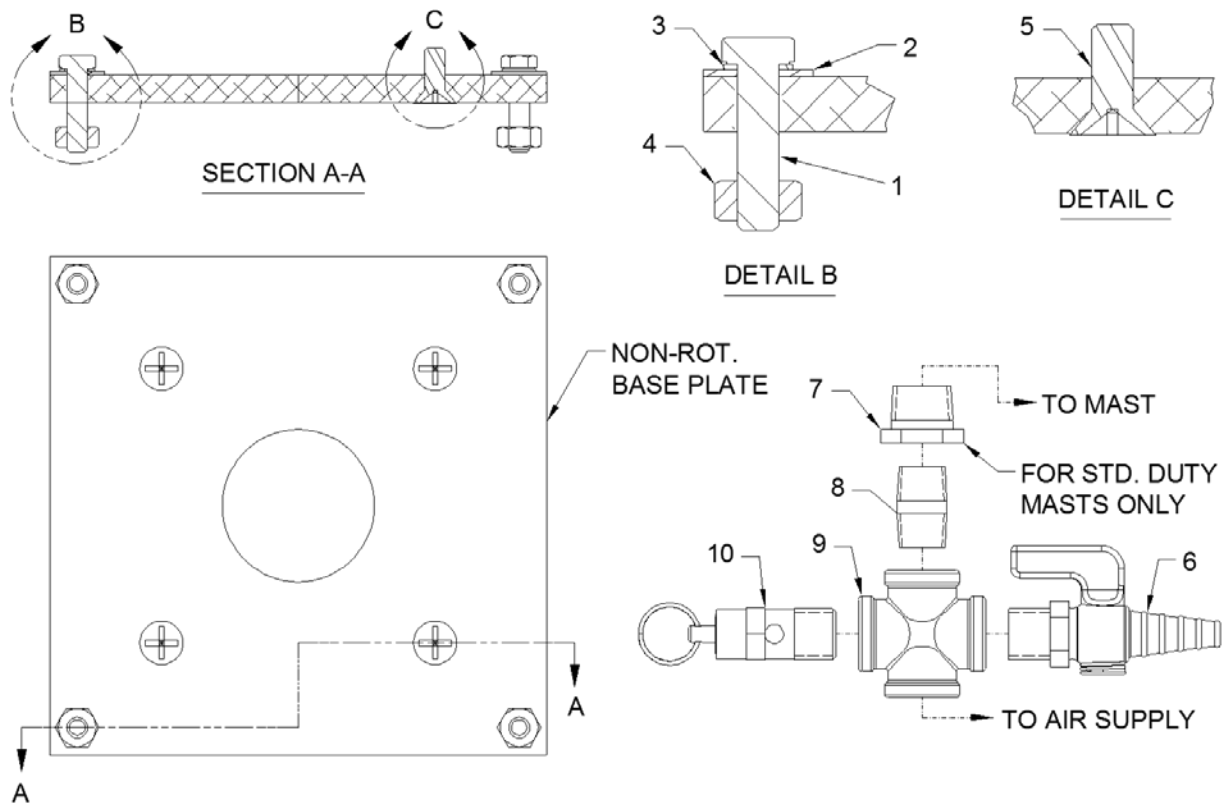


Figure 6-2 Hardware Bag Items

Table 6-3 Drain Kit

DRAIN KIT			
P/N: 902982 - D/N: C-9571			
PARTS LIST			
MK	P/N	QTY	DESCRIPTION
1	900555	1	Washer, 1/16 Thk. x 3/8 ID x 3/4 OD
2	900556	1	Locknut, 1/8 NPT x 3/16 Thk.
3	900564	1	Male Elbow, 1/8 NPT - 1/4 Hose
4	900565	1	Bulkhead Fitting, 1/4 NPT-1/4 Hose
5	900566	8'	Plastic Tube, 1/4 OD (Not Shown)

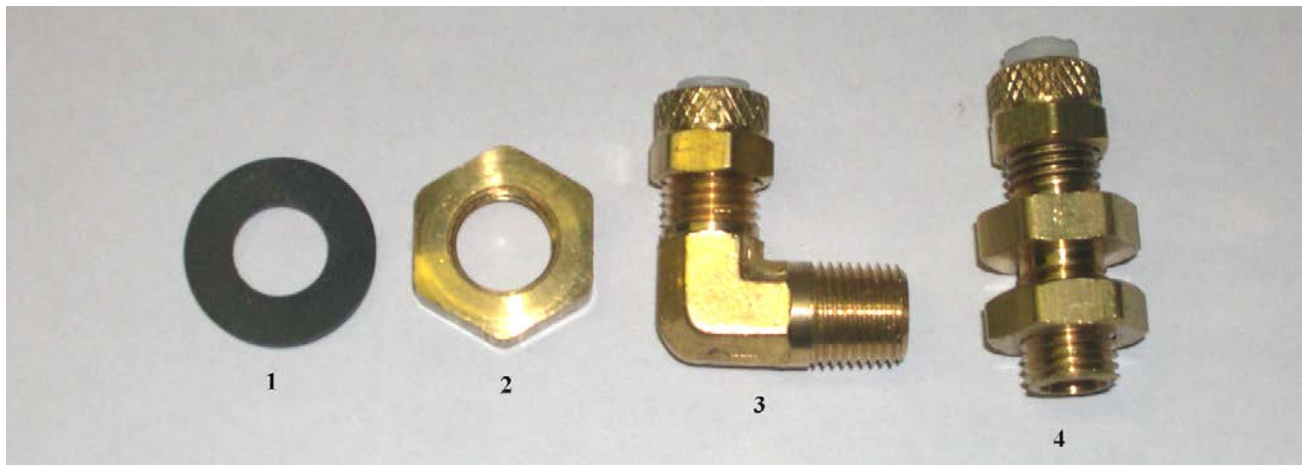


Figure 6-3 Drain Kit Fittings

Table 6-4 Magnetic Warning Kit

MAGNETIC WARNING KIT		
PARTS LIST		
MK	QTY	DESCRIPTION
1	1	Notice Label
2	1	Magnet Assembly
3	1	Switch
4	1	Switch Bracket
5	1	Flasher
6	2	Light
7	1	Clamp
8	2	Nut
9	2	Lock washer
10	1	Warning Label
11	1	Carton (Not Shown)

FOR MAST MODELS 5-20, 6-27, 7-34, 8-30, 6-25 & 7-30



Figure 6-4 Magnetic Warning Kit

Table 6-5 Magnetic Warning Kit

MAGNETIC WARNING KIT		
PARTS LIST		
MK	QTY	DESCRIPTION
1	1	Clamp
2	1	Magnet Assembly
3	1	Switch Assembly
4	1	Notice Label
5	1	Warning Label
6	1	Flasher
7	2	Light
8	1	Relay
9	1	Carton (Not Shown)

FOR MAST MODELS 7-42, 8.5-48, 8.5-52, 9.5-56, 9-58, 10-60, 9-50, 10.3-60, 10.8-76



Figure 6-5 Magnetic Warning Kit