Pneumatic Mast Warranty

Will-Burt warrants its pneumatic masts to be free from defects in material and workmanship for a period of five (5) years when used in commercial applications and two (2) years when used in military applications, with such time periods running from the date of shipment by Will-Burt. Will-Burt shall not be responsible for any damage resulting to or caused by its products by reason of failure to properly install, maintain or store the product; use of the product in a manner inconsistent with its design; unauthorized service, alteration of products, neglect, abuse, accident, or acts of God. This warranty does not extend to any component parts not manufactured by Will-Burt; provided, however, Will-Burt’s warranty herein shall not limit any warranties by manufacturers of component parts which extend to the buyer.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, AND NO REPRESENTATIONS, GUARANTEES OR WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, A WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT ARE MADE BY WILL-BURT IN CONNECTION WITH THE MANUFACTURE OR SALE OF ITS PRODUCTS. NO EMPLOYEE, DISTRIBUTOR, OR REPRESENTATIVE IS AUTHORIZED TO CHANGE THIS WARRANTY IN ANY WAY OR GRANT ANY OTHER WARRANTY ON BEHALF OF WILL-BURT.

Claims for defects in material and workmanship shall be made in writing to Will-Burt within thirty (30) days of the discovery of defect. Failure to provide notice as required hereby shall be conclusive evidence that the product was in conformity with the warranty, and Will-Burt shall be released from any and all liability relating to the product. Will-Burt may either send a service representative or have the product returned to its factory at Buyer’s expense for inspection. If judged by Will-Burt to be defective in material or workmanship, the product will be replaced or repaired at the option of Will-Burt, free from all charges except authorized transportation.

THE REMEDIES OF BUYER SET FORTH HEREIN ARE EXCLUSIVE AND ARE IN LIEU OF ALL OTHER REMEDIES. THE LIABILITY OF WILL-BURT WHETHER IN CONTRACT, TORT, UNDER ANY WARRANTY, OR OTHERWISE, SHALL NOT EXTEND BEYOND ITS OBLIGATION TO REPAIR OR REPLACE, AT ITS OPTION, ANY PRODUCT OR PART FOUND BY WILL-BURT TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP. WILL-BURT SHALL NOT BE LIABLE FOR COST OF INSTALLATION AND/OR REMOVAL, OR BE RESPONSIBLE FOR DIRECT, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY NATURE.
EC Declaration of Conformity
In accordance with EN ISO 17050-1: 2010-08

The Will-Burt Company,
401 Collins Blvd.
Orrville Ohio, 44667 USA

Declare that:

Equipment: Pneumatic Mast System
Model Name: Ultra-Heavy-Duty Locking
Model Number: All

In accordance with the following Directives:

2006/42/EG Directive
2004/108/EG Directive

Is in conformity with the applicable requirements of the following documents:

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Title</th>
<th>Edition/Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS EN ISO 12100-1&amp;2</td>
<td>Safety of machinery, basic concepts, general principles for design.</td>
<td>2011-03</td>
</tr>
<tr>
<td>BS EN 60204-1</td>
<td>Safety of machinery. Electrical equipment of machines. General Requirements.</td>
<td>2011-06</td>
</tr>
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</table>

Information may be requested from the following organization:

The Will-Burt Co. (EU) Ltd.
Unit 5b, Station Approach
Four Marks, Alton
Hampshire, GU34 5HN
United Kingdom
# Document History

<table>
<thead>
<tr>
<th>Document Numbers</th>
<th>Dates</th>
<th>Remarks</th>
</tr>
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<tbody>
<tr>
<td>TP-5042401-00</td>
<td>March 24, 2014</td>
<td>Original Release</td>
</tr>
<tr>
<td>TP-5042401-A</td>
<td>April 7, 2014</td>
<td>Added more details on the structural requirements at the support bracket and base plate.</td>
</tr>
<tr>
<td>TP-5042401-B</td>
<td>January 22, 2015</td>
<td>Updated the mast installation – external mounting instruction in 2.4.2 for the support bracket installation.</td>
</tr>
<tr>
<td>TP-5042401-C</td>
<td>November 3, 2016</td>
<td>Updated Section 1.4</td>
</tr>
<tr>
<td>TP-5042401-D</td>
<td>October 9, 2017</td>
<td>Restructured and updated the entire manual.</td>
</tr>
<tr>
<td>TP-5042401-E</td>
<td>February 13, 2018</td>
<td>Updated Section 5.5.1</td>
</tr>
<tr>
<td>TP-5042401-F</td>
<td>August 2, 2018</td>
<td>Updated Section 1.5.6</td>
</tr>
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Safety Summary

This section describes safety information for the Ultra-Heavy-Duty Locking Pneumatic Mast System. These are recommended precautions that personnel must understand and apply throughout installation, operation, transportation, maintenance, storage, and troubleshooting. Be sure to read and understand the entire manual and contact The Will-Burt Company with any questions before performing any procedure outlined in this manual.

Signal Word Definitions

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

⚠️ DANGER

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

⚠️ WARNING

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

⚠️ CAUTION

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 Instructions

The following are general safety precautions that are not related to any specific procedures. These are recommended precautions that personnel must understand and apply throughout installation, operation, maintenance, and troubleshooting.

⚠️ DANGER

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. Be sure to allow sufficient clearance on all sides of the mast to allow for side sway. 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.

⚠️ WARNING

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.
**WARNING**

**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.

**WARNING**

**Safety Equipment!** Helmets or hard hats, eye protection, gloves, and safety shoes must be properly worn while working in the deployment area. Death or serious injury could result if proper safety equipment is not properly worn.

**WARNING**

**Tip Over Hazard!** Mast tip over could result in death or serious injury. Do not operate in high winds. Be certain mast is level, stable, and secure before and during installation, operation, maintenance, and transportation. 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.

Before operating, the Base Tube for masts extended up to 60 feet (18.2 m) shall be within:

- 5° of vertical for payloads 200 lb. (90.7 kg) or less
- 4° of vertical for payloads 200 lb. to 800 lb. (90.7 kg to 362.9 kg)
- 2° of vertical for payloads 800 lb. to 1,200 lb. (362.9 kg to 544.3 kg)

Before operating, the Base Tube for masts extended 60 to 80 feet (18.2 to 24.4 m) shall be within:

- 4° of vertical for payloads 600 lb. (272.2 kg) or less
- 1° of vertical for payloads 600 lb. to 1,200 lb. (272.2 kg to 544.3 kg)

All values assume a maximum of 12 inch (30.5 cm) payload offset. If offsetting any payload greater than 600 lb. (272 kg), the payload offset direction must be in-line with the tube keys, and nor perpendicular to the keys.

**WARNING**

**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.

**WARNING**

**Health and Safety Hazard!** Solvent used to clean parts is potentially dangerous. Follow solvent manufacturer’s safety procedures and recommendations. Avoid inhalation of fumes and also prolonged contact to skin. Death or serious injury could occur if solvents are not handled properly.
Specific Safety Instructions

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**

Lifting Hazard – Intended Use! 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. Large payload wind sail areas can reduce payload capacity. Consult Will-Burt engineering.

**WARNING**

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

High forces to the mounting structure may result, depending on the payload, wind load, and if the mast is guyed or not. The support bracket mounting should be designed to take a minimum 4,500 pound load in any direction combined with a moment of 200 ft.-lb. (271.2 N m). At these loads, a maximum of ⅛ inch (3 mm) displacement is acceptable.

The mounting surface to which the Base Plate is secured will also see high downward forces and moments. A typical unguyed mast can cause a 500 ft.-lb. (677.9 N m) torque. A typical guyed mast will produce 3,500 lb. (1587.6 kg) of downward force onto the Base Plate. Will-Burt engineering should be consulted for specific payload and mounting requirements.

**WARNING**

Crush Hazard – Hoist Failure! Use extreme caution while installing the Base Plate to the mast. Be certain mast is properly secured during installation of Base Plate. Death or serious injury could occur if hoist fails or mast slips suddenly.

**WARNING**

Crush Hazard – Mast Failure! 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. Wear head protection gear.

**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 Ultra-Heavy-Duty masts. Keep personnel clear of safety valve exhaust direction.
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.

Impact Hazard! The mast should operate smoothly during extension and retraction. If erratic mast motion is observed during extension or retraction that results in impact loading between the tube and the tube collar (mechanical travel stop), cease use of the mast and contact Will-Burt service. Operating a mast with erratic mast tube motion over time could result in mast separation and could cause damage to the mast or result in death or serious injury.

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.

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

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. Do not install mast on a vehicle without installing the Magnetic Warning Kit.

Safety Instruction – Observe Proper Procedures! Use extreme caution while lifting the Mast System and when Mast System is suspended to avoid injury and equipment damage. Be certain the Mast System is properly secured. All operators should be aware of and follow the applicable local, regional, and national standards and codes of practice for slinging and transporting equipment. Never lift Mast System over people. Ensure lifting equipment including, but not limited to, lifting straps and hoist, are capable of handling the forces generated from lifting the system. Observe manufacturer instructions on lifting equipment. Death or serious injury could result if proper procedures are not followed.
**WARNING**

**Safety Instruction – Mounting Instructions!** Before operation, be certain the mounting structure is capable of resisting forces generated from all loading and environmental conditions including, but not limited to payload size and weight, sail size, and wind and ice loading. The mounting hardware must include proper means to resist vibration loosening such as thread-locking compound or locking hardware. Mounting the payload into a structure unable to resist the forces generated from the customer-specific loading scenario could result in death or serious injury, and could damage the mast and mounting structure.

**WARNING**

**Safety Instruction – Operation!** At all times prior to mast operation, ensure:

- The mast area is free of personnel and mechanical obstruction
- All electrical cables are undamaged and properly terminated
- The operator has full view of the mast during use
- Any transit tie-downs on the payload have been removed
- The vehicle is not moving
- The Magnetic Warning Kit is installed on a vehicle
- The area above the mast is free of mechanical obstructions and electrical power lines
- Before operating, the Base Tube for masts extended up to 60 feet (18.2 m) shall be within:
  - 5° of vertical for payloads 200 lb. (90.7 kg) or less
  - 4° of vertical for payloads 200 lb. to 800 lb. (90.7 kg to 362.9 kg)
  - 2° of vertical for payloads 800 lb. to 1,200 lb. (362.9 kg to 544.3 kg)
- Before operating, the Base Tube for masts extended 60 ft. to 80 ft. (18.2 m to 24.4 m) shall be within:
  - 4° of vertical for payloads 600 lb. (272.2 kg) or less
  - 1° of verticals for payloads 600 lb. to 1,200 lb. (272.2 kg to 544.3 kg)

**WARNING**

**Safety Instruction – Operation!** For outdoor use only. Do not use in areas that have been classified as hazardous as defined in Article 500 of the National Electric Code.

**WARNING**

**Safety Instruction – Keep Clear!** Keep personnel clear of the Mast System during operation.

**WARNING**

**Safety Instruction – Potential Air Contaminants!** If internally mounted, air from the mast will discharge into the vehicle while the Drain Cock is open.
Safety Instruction – Rapid Release of Air Pressure! If the Mast System air pressure is not fully discharged prior to removing the Air Hoses, a rapid release of air pressure will occur causing a need for hearing and eye protection.

Safety Instruction – Power! Make sure all power has been disconnected prior to performing maintenance.

Equipment Damage – Qualified Personnel! All persons installing and maintaining this equipment should be suitably qualified and work to local, regional, and national standards and codes of practice.

Equipment Damage – Forces! Before unloading the system, be certain the unloading region is capable of resisting forces generated from unloading the system including but not limited to system weight. Ensure the unloading region is level and has sufficient room and strength to hold the system. If the unloading region is incapable of meeting the requirements of the system, damage to the system and/or unloading region could occur.

Safety Instruction – Guy Anchors! When using Guy Lines, the installer shall verify the Guy Anchor point strength is adequate to support the Guy Line forces.

Safety Instruction – Air Control Valve! Improper positioning and operation of Air Control Valve can result in moderate injury or equipment damage. Air Control Valve must be mounted in a location where the operator has full view of the mast, but does not make contact with the mast during operation. Only use a Hold-To-Run type Air Control Valve or switch. The Air Control Valve shall be normally open when the mast is in transit or not in use.

Safety Instruction – Follow Procedures! 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.

Equipment Damage – Band Clamp Fasteners! Do not overtighten the Band Clamp fasteners. Overtightening may damage the Base Tube causing the mast tubes to stick.

Equipment Damage – Deviation! Deviation from standard operating conditions and procedures could cause system failure.
**Safety Instruction – Installation!** At all times while using pipe and hose during installation, recognize that:

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

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

**Safety Instruction – Mast Access!** The operator must provide safe means to access the top of the mast during installation and removal of the payload.

**Lifting Hazard – Manually Lifting!** Manually lifting over 55 lb. (25 kg) 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.

**Equipment Damage – Obstruction!** Check for and remove any objects that might obstruct motion, cause binding, or hinder function of the Mast System. Hitting obstructions will cause damage to the mast.

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

**Pressurized Device Hazard!** Mast disassembly prior to depressurization may release pressurized air jet. Completely lower the mast, depressurize and shut down power before disassembly. Ensure an over-pressurization safety valve is installed in the system.
**Frozen Water Hazard!** Water freezing inside mast or air fittings may render mast inoperable and cause major equipment damage. Open Drain Cock, when mast is not in operation. The Drain Cock shall be installed at the lowest position in the Pneumatic System. Cover locking masts when not in use. Non-locking masts stored outdoors should be covered if possible. Will-Burt P/N: 5063501 is available from Will-Burt.

**Symbols**

The following are symbols that are used with the system and their meaning. Symbols are provided for quick reference only. Read the label information with the symbols for additional safety information. Contact The Will-Burt Company with any questions before performing any procedure outlined in this manual.

- This symbol indicates an electrocution hazard.
- This symbol indicates a tip-over hazard.
- This symbol indicates a pinch point hazard.
- This symbol indicates a burst hazard.
- This symbol indicates a general hazard. In this unit, this symbol indicates a frozen water hazard.
- This symbol is used to remind operators to read the operator’s manual. Failure to follow operating instructions could result in death or serious injury.
- This symbol is used to indicate the center of gravity (COG) of a fully nested mast.
Section 1 Introduction

Review this manual in its entirety. Contact The Will-Burt Company with any questions before performing any procedure outlined in this manual. The views depicted in this manual are provided for clarification and are subject to change without notice. Views are not to scale.

This manual describes installation, operation, transportation, maintenance, storage, and troubleshooting procedures for the Ultra-Heavy-Duty Locking Pneumatic Mast System. These procedures assume the use of standard catalog Mast Systems. Procedures and characteristics for Mast Systems customized to meet customer-specific needs may vary.

This manual is for the following pneumatic masts:

- Ultra-Heavy-Duty Locking Pneumatic Masts (UHDL)

This manual is not for the following pneumatic masts:

- Standard-Duty Non-Locking Pneumatic Masts
- Heavy-Duty Non-Locking and Locking Pneumatic Masts (HDNL and HDL)
- Super-Heavy-Duty Non-Locking and Locking Pneumatic Masts (SHDNL and SHDL)
- Internally Wired Pneumatic Masts (IWM)
- Yacht Masts
- Low Profile Pneumatic Masts
- Night Scan®, Inflexion™, and InflexionPlus™ Masts

See www.willburt.com for information on these and other Will-Burt products.

A typical Pneumatic Mast System consists of:

- A Telescoping Mast
- A Pneumatic System (Sold Separately)
- Mounting Hardware (Sold Separately)
- Additional Accessory Options (Sold Separately)

The pneumatic mast is designed to lift a specific payload for lighting, surveillance, or communication use only. Do not use mast to lift personnel. The UHDL does not currently support Rotatable Base Plates and Shelf Brackets. Contact The Will-Burt Company with any questions on the intended use.

1.1 Safety Precaution Notification

Refer to the Safety Summary for precautions to be observed while installing, operating, or maintaining this equipment.
1.2 Manual Organization
This manual is organized into the following sections:

Section 1 Introduction
Section 2 Installation
Section 3 Operation
Section 4 Transportation
Section 5 Maintenance
Section 6 Long-Term Storage
Section 7 Troubleshooting
Section 8 Reference

1.3 Definitions of Terms
Throughout this manual, the following terms are used:

- “Mast” to refer to the telescoping pneumatic mast
- “Mast System” to refer to the entire Pneumatic Mast System (telescoping mast, pneumatic system, mounting hardware, and additional accessories)
- “Payload” to refer to the object or equipment being raised by the mast to an operational height

See Section 8.1 for an Extended Glossary of Terms used within this manual. The Extended Glossary of Terms includes:

- General Terms and Abbreviations (Section 8.1.1)
- Mounting Position Terms (Section 8.1.2)
1.4 Specifications

This section describes specifications for pneumatic masts. The model numbers listed in this section are for standard catalog masts only. Masts with other heights, capacities, and finishes are available. For more information on additional mast sizes, capabilities, and finishes, see www.willburt.com.

Table 1-1 Ultra-Heavy-Duty Mast Part and Model Numbers

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Model Number</th>
<th>Finish*</th>
<th>Wipers</th>
</tr>
</thead>
<tbody>
<tr>
<td>710991201</td>
<td>8-39 (2.4-12 m)</td>
<td>Clear Anodize</td>
<td>No</td>
</tr>
<tr>
<td>710905700</td>
<td>11.3-59 (3.4-18 m)</td>
<td>Clear Anodize</td>
<td>No</td>
</tr>
<tr>
<td>710992000</td>
<td>9.8-65.6 (3-20 m)</td>
<td>Clear Anodize</td>
<td>No</td>
</tr>
<tr>
<td>710908000</td>
<td>14.3-80 (4.4-24 m)</td>
<td>Clear Anodize</td>
<td>No</td>
</tr>
</tbody>
</table>

* Additional finishes and options available.
## Table 1-2 Ultra-Heavy-Duty Mast Specifications

<table>
<thead>
<tr>
<th></th>
<th>8-39</th>
<th>11.3-59</th>
<th>9.8-65.6</th>
<th>14.3-80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payload Capacity</td>
<td>980 lb.</td>
<td>1,200 lb.</td>
<td>530 lb.</td>
<td>1,200 lb.</td>
</tr>
<tr>
<td></td>
<td>444 kg</td>
<td>544 kg</td>
<td>240 kg</td>
<td>544 kg</td>
</tr>
<tr>
<td>Extended Height</td>
<td>39.3 Feet</td>
<td>59 Feet</td>
<td>65.6 Feet</td>
<td>80 Feet</td>
</tr>
<tr>
<td></td>
<td>12 Meters</td>
<td>18 Meters</td>
<td>20 Meters</td>
<td>24.3 Meters</td>
</tr>
<tr>
<td>Nested Height</td>
<td>7.9 Feet</td>
<td>11.3 Feet</td>
<td>9.8 Feet</td>
<td>14.3 Feet</td>
</tr>
<tr>
<td></td>
<td>2.4 Meters</td>
<td>3.4 Meters</td>
<td>3 Meters</td>
<td>4.4 Meters</td>
</tr>
<tr>
<td>Approximate Mast</td>
<td>607 lb.</td>
<td>814 lb.</td>
<td>852 lb.</td>
<td>1,078 lb.</td>
</tr>
<tr>
<td>Weight</td>
<td>275 kg</td>
<td>369 kg</td>
<td>387 kg</td>
<td>489 kg</td>
</tr>
<tr>
<td>Number of Sections</td>
<td>8</td>
<td>7</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Tube Diameter</td>
<td>13.5 – 6.75 Inches</td>
<td>13.5 – 7.5 Inches</td>
<td>13.5 – 5.25 Inches</td>
<td>13.5 – 7.5 Inches</td>
</tr>
<tr>
<td></td>
<td>34.29 – 17.15 cm</td>
<td>34.29 – 19.05 cm</td>
<td>34.29 – 13.34 cm</td>
<td>34.29 – 19.05 cm</td>
</tr>
<tr>
<td>Collar Type</td>
<td>Locking with Super Pins</td>
<td>Locking with Super Pins</td>
<td>Locking with Super Pins</td>
<td>Locking with Super Pins</td>
</tr>
<tr>
<td>Guying Required</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Required</td>
</tr>
</tbody>
</table>

**Note:**
1. Tube Diameter listed as Base Tube Diameter – Top Tube 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
4. Payload Capacity assumes:
   - 12 inch maximum offset payload from mast centerline
   - Mast deployment angle for masts extended up to 60 ft. (18.2 m) is:
     - 0° to 5° for payloads 200 lb. (90.7 kg) or less
     - 0° to 4° for payloads 200 lb. to 800 lb. (90.7 kg to 362.9 kg)
     - 0° to 2° for payloads 800 lb. to 1,200 lb. (362.9 kg to 544.3 kg)
   - Mast deployment angle for masts extended 60 ft. to 80 ft. (18.2 m to 24.4 m) is:
     - 0° to 4° for payloads 600 lb. (272.2 kg) or less
     - 0° to 1° for payloads 600 to 1,200 lb. (272.2 kg to 544.3 kg)
   - Operating temperature is -20° to 60°C
   - Mast maximum pressure of 35 PSIG (2.4 Bar)
   - Not applicable to internally wired masts
1.5 Major Components

This section describes major components of a Mast System assuming the use of standard catalog Mast Systems. Characteristics of components customized to meet customer-specific needs may vary. If necessary, contact The Will-Burt Company for additional details.

Major components of the pneumatic mast include:

- Telescoping Mast
  - Hardware Bag (P/N: 5032501)
  - Drain Kit (P/N: 902982)
  - Magnetic Warning Kit (P/N: 54500xx)
  - Mast Top Cover (P/N: 5063501)
  - Identification Plate (P/N: 902851)
  - Label Kit (English)

- Pneumatic System Options (Sold Separately)
  - Air Compressors
  - Filter Regulator Lubricator (P/N: 900484)
  - Filter Lubricator (P/N: 900634)
  - Solenoid Air Valve Kit
  - Hand Pump (P/N: 5050101)

- Mounting Hardware Options (Sold Separately)
  - Non-Rotatable Base Plate
  - Support Bracket Options

- Payload Platforms (Sold Separately)
- Guy Line Kit Options (Sold Separately)
- Additional Accessory Options (Sold Separately)
1.5.1 Telescoping Mast

The telescoping mast:

- Is the structure used to raise the payload to an operational height
- Consists of concentric, nesting mast tubes
- Extends and retracts pneumatically
- Is non-rotating
- Has locking Collars. When desired tubes are raised and locked into position, the mast is depressurized.
- Has Collars fitted to the top end of each tube except the Top Tube which is fitted with a Top Tube Stop
- Has a Top Tube Stop that allows for the Payload Platform to be rotated to 0°, 45°, or 90°
- Has two rectangular keys along each tube, except the Base Tube. These keys align with keyways in the next larger adjacent tube’s collar and are used to establish azimuth (rotational) integrity between the tubes.
- Uses Super Pins which are three times as strong as Universal Pins

![Telescoping Mast Diagram](Figure 1-1 Locking Mast with T-Handle Yoke Assemblies (P/N: 710905700 Shown))
The Locking Collars (Figure 1-2):

- Have T-Handle Yoke Assemblies to aid in operating the locking mechanisms
- Include Guy Lugs on every collar to allow Guy Lines to be attached
- Use Super Pins in the locking mechanism to resist downward forces applied by the Guy Lines

![Locking Collar for 13.5 and 12.375 Mast Sections](image1)

![Locking Collar for 11.25, 10.0, 9.12, and 8.25 Mast Sections](image2)

Figure 1-2  Locking Collars (Not to Scale)

Items shipping with the mast include:

- Hardware Bag (P/N: 5032501)
- Drain Kit (P/N: 902982)
- Magnetic Warning Kit (P/N: 54500xx)
- Mast Top Cover (P/N: 5063501)
- Identification Plate (P/N: 902851) (Ships installed on mast)
- Label Kit (Labels ship installed on the mast and with the manual)

1.5.1.1  Hardware Bag (P/N: 5032501)

The Mast System includes a Hardware Bag. Depending on the specific installation application, all hardware may not be used.

The contents of the Hardware Bag (Figure 1-3) are used to:

- Secure the Base Plate to the mast:
  - (4) Screw ½-13x1.25 Flathead Stainless Steel (P/N: 5402)
- Secure the Base Plate to a mounting surface:
  - (6) Bolt ⅜-16 x 1-½ Inch, Stainless Steel (P/N: 901594)
  - (6) Flat Washer, ¾ Inch, Stainless Steel (P/N: 2054)
  - (6) Lock Washer, ¾ Inch, Stainless Steel (P/N: 0801)
  - (6) Nut ¾-16 Inch, Hex, Heavy-Duty, Stainless Steel (P/N: 901593)
- Protect the mast from over-pressurization:
  - (1) Safety Valve ¼ Inch NPT, 35 PSI (P/N: 913961)
    Note: Do not operate mast without Safety Valve properly installed
- Drain water and connect to the Air Supply Line:
  - (2) Close Nipple ¼ Inch Brass (P/N: 900508)
  - (1) Brass Cross (P/N: 900516)
  - (1) Drain Cock #64-T (P/N: 900382)
  - (1) ⅜ x ¼ Inch Reducing Bushing, 125 lb. Red Brass, NPT (P/N: 900522)
  - (1) Threaded Hex Bushing ½ x ¾ Inch NPT Brass (P/N:4097601)
1.5.1.2 Drain Kit (P/N: 902982)

The Drain Kit provides a means to route draining water away from the mast by attaching one end of the Drain Kit to the Drain Hole and the other end outside the mounting structure area. Water that has accumulated in the mast should be periodically drained, particularly after the mast has been exposed to rain, in order to prevent damage.

The Drain Kit (Figure 1-4) includes:

- (1) Washer ¾ Inch, ID x ¾, OD x 1/16 Thick (P/N: 900555)
- (1) Lock Nut ⅛ Inch Brass (P/N: 900556)
- (1) ¼ Inch Hose Adaptor (P/N: 900564)
- (1) ¼ Inch Bulkhead Fitting (P/N: 900565)
- 8 Feet (2.4 m), ¼ Inch (6.35 mm) ID, Clear Polyethylene Tube (P/N: 900566)
- (1) Service Sheet 414 (P/N: 4306601) (Not shown)
- (1) Polyethylene Bag 11 x 18, 2 MILS (P/N: 4306301) (Not shown)

![Figure 1-4 Drain Kit (P/N: 902982)](image)
1.5.1.3 Magnetic Warning Kit (P/N: 54500xx)

The Magnetic Warning Kit (Table 1-3) is a system designed to warn against moving a vehicle while the mast is partially or fully extended. The operator should always visually confirm that the mast is entirely retracted before moving the vehicle.

The Magnetic Warning Kit is packaged in a brown cardboard box, and in general includes the:

- Clamp which is a thin strip of coiled metal used to brace the switch assembly against the Base Tube
- Magnet which is cylindrical and covered with a wax-like coating
- Switch Assembly which is attached to a small, rectangular casing
- Labels which are gray
- Flasher which has a cylindrical metal casing and is packaged in a rectangular box
- Two red plastic lights

Table 1-3 lists the standard Magnetic Warning Kits for each mast model.

<table>
<thead>
<tr>
<th>Magnetic Warning Kit</th>
<th>Mast(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P/N: 5450001 (For 7 ½ Top Tubes)</td>
<td>710905700, 710908000</td>
</tr>
<tr>
<td>P/N: 5450002 (For 6 ¾ Top Tubes)</td>
<td>710991201</td>
</tr>
<tr>
<td>P/N: 5450003 (For 5 ¼ Top Tubes)</td>
<td>710992000</td>
</tr>
</tbody>
</table>

Figure 1-5 Magnetic Warning Kit

Table 1-3 Magnetic Warning Kits
1.5.1.4 Mast Top Cover (P/N: 5063501)
The Mast Top Cover (Figure 1-6) comes standard with locking masts. The Mast Top Cover may be ordered separately for non-locking masts.

The Mast Top Cover is:

- A large bag with draw strings
- Pulled over the collars of a fully retracted mast to help protect the locking mechanism and interior of the mast from water, dust, debris, and other foreign material when the mast is not in use

![Mast Top Cover](image)

Figure 1-6 Mast Top Cover

1.5.1.5 Identification Plate (P/N: 902851)
Information pertaining to the mast can be found on the Identification Plate secured to the third collar up (Figure 1-7).

![Identification Plate](image)

Figure 1-7 Identification Plate (P/N: 902851)

1.5.1.6 Label Kit (English)
The Label Kit is used to identify potential hazards within the Mast System. Some of the labels come installed on the Mast System. Additional labels are provided with the operator’s manual (this document). These labels should be applied where the operator will have a clear view of them while operating the mast.

Contact The Will-Burt Company for information pertaining to alternate language label kits.
1.5.2 Pneumatic System Options (Sold Separately)

The Pneumatic System refers to a means of safely controlling the pressurization and depressurization of the mast. Components in the Hardware Bag (Section 1.5.1.1) are provided to connect the Air Supply to the mast through an Air Inlet Port.

Possible options for the Pneumatic System include:

- Air Compressors
- Filter Regulator Lubricator (P/N: 900484)
- Filter Lubricator (P/N: 900634)
- Solenoid Air Valve Kits
- Hand Pump (P/N: 5050101)
### 1.5.2.1 Air Compressors

Will-Burt offers a variety of low-maintenance oil-less Air Compressor systems including those listed in Table 1-4.

**Table 1-4 Air Compressor Specifications**

<table>
<thead>
<tr>
<th>Functional Characteristic</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>12 VDC Compressor (P/N: 5058501)</strong>*</td>
<td></td>
</tr>
<tr>
<td>System Weight</td>
<td>29.8 lb. (13.5 kg)</td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
<td>8 x 11.6 x 11.7 inches (203 x 295 x 298 mm)</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-4 to 122°F (-20 to 50°C)</td>
</tr>
<tr>
<td>Air Flow</td>
<td>6.1 CFM (173 LPM)</td>
</tr>
<tr>
<td>Current Draw at 2.4 Bar</td>
<td>55 Amps</td>
</tr>
<tr>
<td>Check Valve Cut Out</td>
<td>32 ± 2 psi</td>
</tr>
<tr>
<td><strong>24 VDC Compressor (P/N: 5058502)</strong>*</td>
<td></td>
</tr>
<tr>
<td>System Weight</td>
<td>29.8 lb. (13.5 kg)</td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
<td>8 x 11.6 x 11.7 inches (203 x 295 x 298 mm)</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-4 to 122°F (-20 to 50°C)</td>
</tr>
<tr>
<td>Air Flow</td>
<td>6.7 CFM (191 LPM)</td>
</tr>
<tr>
<td>Current Draw at 2.4 Bar</td>
<td>30 Amps</td>
</tr>
<tr>
<td>Check Valve Cut Out</td>
<td>32 ± 2 psi</td>
</tr>
<tr>
<td><strong>230 VAC 50Hz/60Hz Compressor (P/N: 5255801)</strong>*</td>
<td></td>
</tr>
<tr>
<td>System Weight</td>
<td>36.4 lb. (16.5 kg)</td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
<td>8 x 11.6 x 11.9 inches (203 x 295 x 302 mm)</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-4 to 122°F (-20 to 50°C)</td>
</tr>
<tr>
<td>Air Flow</td>
<td>6.5 CFM (185 LPM)</td>
</tr>
<tr>
<td>Current Draw at 2.4 Bar</td>
<td>5.1 Amps</td>
</tr>
<tr>
<td>Check Valve Cut Out</td>
<td>32 ± 2 psi</td>
</tr>
</tbody>
</table>

*Continued*
<table>
<thead>
<tr>
<th>Functional Characteristic</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>110 VAC 50Hz/60Hz Compressor (P/N: 5255802)</strong></td>
<td></td>
</tr>
<tr>
<td>System Weight</td>
<td>25.4 lb. (11.5 kg)</td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
<td>8 x 11.6 x 11.9 inches (203 x 295 x 302 mm)</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-4 to 122°F (-20 to 50°C)</td>
</tr>
<tr>
<td>Air Flow</td>
<td>6.5 CFM (185 LPM)</td>
</tr>
<tr>
<td>Current Draw at 2.4 Bar</td>
<td>10 Amps</td>
</tr>
<tr>
<td>Check Valve Cut Out</td>
<td>32 ± 2 psi</td>
</tr>
</tbody>
</table>

| **110 VAC 60Hz Compressor (P/N: 902404)** | |
| System Weight            | 45 lb. (20.4 kg) |
| Dimensions (W x H x D)   | 15 x 8.91 x 11.61 inches (381 x 227 x 295 mm) |
| Operating Temperature Range | 50° to 104°F (10° to 40°C) |
| Air Flow                 | 4.4 CFM (125 LPM) |
| Current Draw at 2.4 Bar   | 10.6 Amp |
| Check Valve Cut Out      | 32 ± 2 psi |

| **220 VAC 60Hz Compressor (P/N: 912361)** | |
| System Weight            | 45 lb. (20.4 kg) |
| Dimensions (W x H x D)   | 15 x 8.91 x 11.61 inches (381 x 227 x 295 mm) |
| Operating Temperature Range | 50° to 104°F (10° to 40°C) |
| Air Flow                 | 3.6 CFM (101 LPM) |
| Current Draw at 2.4 Bar   | 5.3 Amp |
| Check Valve Cut Out      | 32 ± 2 psi |

* Has an optional a Hand-Held Remote Control with a 16 feet (5 m) cable (P/N: 5346601)
** Includes in-line manual Air Control Valve

Note: Specifications provided are for reference only and may be subject to change without notice
1.5.2.2 Filter Regulator Lubricator (P/N: 900484)
A Filter Regulator Lubricator (Figure 1-9) is available for use with the following Air Compressors:

- 110 VAC Air Compressor (P/N: 902404)
- 220 VAC Air Compressor (P/N: 912361)

![Filter Regulator Lubricator](image)

Figure 1-9  Filter Regulator Lubricator (P/N: 900484)

1.5.2.3 Filter Lubricator (P/N: 900634)
A Filter Lubricator (Figure 1-10) is available for use with the following Air Compressors:

- 110 VAC Air Compressor (P/N: 902404)
- 220 VAC Air Compressor (P/N: 912361)

![Filter Lubricator](image)

Figure 1-10  Filter Lubricator (P/N: 900634)
1.5.2.4 Solenoid Air Valve Kits

Will-Burt offers the following Solenoid Air Valve Kits (Figure 1-11):

- 110 VAC Solenoid Air Valve Kit (P/N: 911145) for use with Air Compressor P/N: 902404
- 220 VAC Solenoid Air Valve Kit (P/N: 5079301) for use with Air Compressor P/N: 912361

A Hand-Held Remote Controller (HHRC) (P/N: 912247) (Figure 1-12) is available with these Solenoid Air Valve Kits.
1.5.2.5 Hand Pump (P/N: 5050101)

The Hand Pump (Figure 1-13) is used to deploy the mast where electric or pneumatic power is not available.

Features:

- Constructed of steel and aluminum
- Pumps air in both downward and upward stroke
- Operates between -4°F and 140°F (-20°C and 60°C)

The Hand Pump includes:

- (1) Hand Pump (P/N: 5050001)
- 6 feet (1.8 m) of Air Hose (P/N: 108768)
- (2) Push Connector Fittings (P/N: 4024001)

Figure 1-13  Hand Pump (P/N: 5050001)
1.5.3 Mounting Hardware Options (Sold Separately)

Mounting hardware is used to secure the mast in place.

Possible options for the mounting hardware include:

- Non-Rotatable Base Plate
- Support Bracket Options
  - External Support Bracket
  - Internal (Roof) Mounting Kit

1.5.3.1 Non-Rotatable Base Plate

The Non-Rotatable Base Plate is used to stabilize the mast and to provide a means of securing the mast to a mounting surface. The Non-Rotatable Base Plate (Figure 1-14) is a square plate with countersunk holes that match threaded holes on the Base Tube.

![Non-Rotatable Base Plate (P/N: 4995301 Shown)](image)

Screws from the Hardware Bag (Section 1.5.1.1) can be used to attach the Non-Rotating Base Plate to the base of the mast. Bolts, nuts, and washers from the Hardware Bag are sized for the through holes in the corners of the Base Plate so the mast can be secured to a mounting surface.

For more information on Non-Rotatable Base Plate options, see [www.willburt.com](http://www.willburt.com).
1.5.3.2 Support Bracket Options

The Support Bracket is used to secure the mast to a support structure.

The Support Bracket can be an:

- External Support Bracket
- Internal (Roof) Mounting Kit

**External Support Bracket**

The External Support Bracket (Figure 1-15) is used to position and support the mast.

The External Support Bracket is constructed from:

- Support Bracket Weldment which positions the mast away from the support structure
- Support Bracket Clamp which fits around the mast and is bolted to the Support Bracket Weldment to hold the mast against the mounting structure
- Shims and a Washer Plate which are used to allow for slight variation between mast tubes
- Hardware to secure the assembly together

For more information on the External Support Bracket, see [www.willburt.com](http://www.willburt.com).

---

*Figure 1-15  External Support Bracket (P/N: 4989201 Shown)*
Internal (Roof) Mounting Kit

The Internal Mounting Kit (P/N: 5476101) (Figure 1-16) contains the hardware used to position and support an internally mounted mast.

Internal Mounting Kits for the UHDL include:

- (1) Roof Ring
- (2) Gaskets
- (1) Bearing Strip
- (1) Ceiling Plate
- (1) Retaining Ring
- (1) O-Ring
- (8) ⅜-16x3.50 Bolts
- (16) ⅜x1.0 Flat Washers
- (8) ⅜-16 Nyloc Nuts

Note: Included hardware is sized for a ¼ inch (6.35 mm) roof. If a thicker roof is present, the customer must supply appropriate hardware.

For more information on Internal Mounting Kit options, see www.willburt.com.
1.5.4 Payload Platforms (Sold Separately)

Payload Platforms (Figure 1-17) attach to the top of the mast and are used to secure and support the payload during operation. Payload Platforms come in varying sizes and configurations. It is possible to guy directly to some Payload Platforms.

Payload Platforms are available both with through holes to allow for quick installation of customer payloads, and without through holes to allow the customer to drill through holes to match payload-specific mounting hole patterns.

Note: The Top Tube Stop is designed to allow the Payload Platform to be attached at 0°, 45°, or 90° (Figure 1-18).
1.5.5 Guy Line Kit Options (Sold Separately)

Guy Line Kits are used to further stabilize the mast by resisting environmental conditions that may cause tip-over and horizontal payload moment. Use of a Guy Line Kit is required for the operation of some of the taller model masts (Section 1.4). Use of a Guy Line Kit may be required for customer-specific payloads or to achieve specific survival wind speeds. Consult Will-Burt engineering.

The exact configuration of the Guy Kit will vary based on the mast configuration and environmental requirements. Some Guy Kits require a Payload Platform that can be directly guyed.

Components may include:

- Guy Line Assemblies
- Ground Anchors
- A Ground Anchor location drawing

For additional information on Guy Kits, see www.willburt.com.

1.5.6 Additional Accessory Options

Will-Burt provides a number of additional accessory options (Table 1-5) for the Mast System.

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Used To:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumatic Mast Antifreeze Kit (P/N: 4725801)</td>
<td>Weatherize pneumatic masts in extremely harsh environmental conditions.</td>
</tr>
<tr>
<td>D-TEC Safety System</td>
<td>Provide overhead power line detection and above the mast illumination.</td>
</tr>
<tr>
<td>PositionIt™</td>
<td>Remotely pan and tilt a payload.</td>
</tr>
<tr>
<td>Yoke Snagger</td>
<td>Enable access to yokes beyond arms reach.</td>
</tr>
<tr>
<td>Intermediate Tube Clamps</td>
<td>Assist in attaching a payload on an Intermediate Tube.</td>
</tr>
<tr>
<td>External Wipers</td>
<td>Protect against sand and dust.</td>
</tr>
</tbody>
</table>

For more information on these and other additional accessory options, or customized solutions to customer-specific scenarios, see www.willburt.com.
Section 2 Installation

This section describes the installation of the Mast System and provides general procedures that must be followed to ensure a successful installation. Use care to understand and follow all precautions while installing.

2.1 Pre-Installation Check

Before installing the Mast System, ensure:

- All installers read and understand the entire installation procedure
- Only a properly trained and qualified certified electrician performs electric installations and maintenance
- The mounting structure is level and has sufficient room and strength to mount the Mast System (Section 1.4 and 2.6)
- All purchased components are included (Section 1.5)
- All required equipment is readily available (Section 2.2)
- When installing in a vehicle, that the vehicle is stationary and on a level surface
- That the following precautions are understood and followed:


### WARNING

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

High forces to the mounting structure may result, depending on the payload, wind load, and if the mast is guyed or not. The support bracket mounting should be designed to take a minimum 4,500 pound load in any direction combined with a moment of 200 ft.-lb. (271.2 N m). At these loads, a maximum of ¼ inch (3 mm) displacement is acceptable.

The mounting surface to which the Base Plate is secured will also see high downward forces and moments. A typical unguyed mast can cause a 500 ft.-lb. (677.9 N m) torque. A typical guyed mast will produce 3,500 lb. (1587.6 kg) of downward force onto the Base Plate. Will-Burt engineering should be consulted for specific payload and mounting requirements.


### CAUTION

Equipment Damage – Qualified Personnel! All persons installing and maintaining this equipment should be suitably qualified and work to local, regional, and national standards and codes of practice.
Safety Instruction – Roof Access! If mast will be mounted to a vehicle, the operator must provide safe means to access the roof of the vehicle during installation and maintenance.

2.2 Installation Equipment

Table 2-1 lists general equipment recommended for installation. Depending on the Mast System configuration, additional equipment may be required.

<table>
<thead>
<tr>
<th>Personal Protective</th>
<th>Work Gloves</th>
<th>Nitrile or Vinyl Gloves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Glasses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hearing Protection</td>
<td>Hard Hat or Helmet</td>
<td>Safety Shoes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hand Tools</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Drill</td>
<td>Hammer</td>
<td>Hex Wrenches</td>
</tr>
<tr>
<td>Level</td>
<td>Measuring Tape</td>
<td>Plumb-Bob</td>
</tr>
<tr>
<td>Rubber Mallet</td>
<td>Saw</td>
<td>Screwdrivers</td>
</tr>
<tr>
<td>Sockets</td>
<td>Torque Wrench</td>
<td>Wrenches</td>
</tr>
<tr>
<td>Rope or Thin Wire</td>
<td>Washers or Spacers (For shimming)</td>
<td></td>
</tr>
<tr>
<td>16 AWG Stranded Wire (For the Magnetic Warning Kit)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate Hardware (Section 2.3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressed Air Supply</td>
<td>Hoist</td>
<td>Sling / Strap</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expendables</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Thread Sealant or PTFE Tape</td>
<td>Rags (Clean and Dry)</td>
<td>Silicone Sealant</td>
</tr>
<tr>
<td>Loctite® 242/243 (Blue) or Equivalent</td>
<td>Soapy Water (When installing the Weather Bonnet)</td>
<td></td>
</tr>
</tbody>
</table>

* Note:

- Depending on the local, regional, and national standards and codes of practice, and the environment, additional personal protective equipment may be necessary.

- Depending on the Mast System configuration, additional equipment, including but not limited to, rubber washers or grommets (for the pneumatic system), electrical components (e.g. wire, fuses, circuit breakers, etc.), and Air Control Valves, switches, air hose and fittings, may be required.

- When disposing of any disposables or components, do so according to any applicable local, regional, and national standards and codes of practice.
### 2.3 Installation Hardware

Table 2-2 describes hardware that may be used during installation.

#### Table 2-2 Hardware for Installation

<table>
<thead>
<tr>
<th>Hardware*</th>
<th>Supplied By</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Rotatable Base Plate (To the Mast)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) ½-13x1.25 Flathead Screws (P/N: 5402)</td>
<td>Will-Burt</td>
<td>Found in the Hardware Bag</td>
</tr>
<tr>
<td>External Support Bracket (To the Support Structure)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6) Sets of ¾ Inch Hardware</td>
<td>Customer</td>
<td>The bolts should be sized to length to allow for the thickness of the External Support Bracket, support structure, any spacers, and all mounting hardware (e.g. flat washers, lock washers, and nuts).</td>
</tr>
<tr>
<td>Internal Mounting Kit (To the Roof) (Used in place of the External Support Bracket)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(8) ¾-16x3.50 Bolts (P/N: 5431)</td>
<td>Will-Burt</td>
<td>Included with Internal Mounting Kit. Included hardware is sized for a ¼ inch (6.35 mm) roof. If a thicker roof is present, the customer must supply appropriate hardware.</td>
</tr>
<tr>
<td>(16) ¾x1.0 Flat Washers (P/N: 2054)</td>
<td>Will-Burt</td>
<td></td>
</tr>
<tr>
<td>(8) ¾-16 Nyloc Nuts (P/N: 2763)</td>
<td>Will-Burt</td>
<td></td>
</tr>
<tr>
<td>Non-Rotatable Base Plate (To the Mounting Surface)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6) ¾-16x1-½ Inch Bolts (P/N: 901594)</td>
<td>Will-Burt</td>
<td>Found in the Hardware Bag</td>
</tr>
<tr>
<td>(6) Flat Washers (P/N: 2054)</td>
<td>Will-Burt</td>
<td>Found in the Hardware Bag</td>
</tr>
<tr>
<td>(6) Lock Washers (P/N: 0801)</td>
<td>Will-Burt</td>
<td>Found in the Hardware Bag</td>
</tr>
<tr>
<td>(6) Nuts (P/N: 901593)</td>
<td>Will-Burt</td>
<td>Found in the Hardware Bag</td>
</tr>
</tbody>
</table>

* Unless otherwise indicated, the mounting hardware must include proper means to resist vibration loosening such as thread-locking compound or locking hardware. Torque all hardware as appropriate for its size and grade. Torque values in these instructions assume the use of the Will-Burt provided hardware. Depending on the specific installation application, all hardware may not be used. Additional hardware may be required for additional accessories, or customer-specific applications.
2.4 Lift the Mast System
During installation, it will be necessary to lift the mast. The process described in this manual represents a possible method of lifting the mast. Depending on the environment and equipment available, other methods may work better. Use the best and safest method for your circumstances.

![WARNING]

Safety Instruction – Observe Proper Procedures! Use extreme caution while lifting the Mast System and when Mast System is suspended to avoid injury and equipment damage. Be certain the Mast System is properly secured. All operators should be aware of and follow the applicable local, regional, and national standards and codes of practice for slinging and transporting equipment. Never lift Mast System over people. Ensure lifting equipment including, but not limited to, lifting straps and hoist, are capable of handling the forces generated from lifting the system. Observe manufacturer instructions on lifting equipment. Death or serious injury could result if proper procedures are not followed.

![CAUTION]

Equipment Damage – Forces! Before unloading the system, be certain the unloading region is capable of resisting forces generated from unloading the system including but not limited to system weight. Ensure the unloading region is level and has sufficient room and strength to hold the system. If the unloading region is incapable of meeting the requirements of the system, damage to the system and/or unloading region could occur.

2.5 Unpack the Mast System

![CAUTION]

Lifting Hazard – Manually Lifting! Manually lifting over 55 lb. (25 kg) 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 system as follows:

1. Carefully open the shipping crate.
2. Inspect for any shipping damage. Notify the carrier if damage is evident.
3. Remove all loose components, the 2 x 4 inch (38 x 89 mm) block at the top end of the mast, and the top half of the wooden mast saddles (Figure 2-1).

![Mast Saddle](image1)

**Figure 2-1 Shipping Crate**

4. Using the center of gravity (COG) label as a reference, outfit the mast with a sling capable of supporting the mast weight (Figure 2-2). The sling must support the mast from at least two points. Attach the sling so 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.

![COG Label](image2)

**Figure 2-2 Hoist the Mast**

The Will-Burt Company recommends keeping the shipping crate for transporting the mast, for example if shipping the mast back to the factory for refurbishment.
2.6 Installation Specifications

This section describes installation specifications as follows:

- Mast Installation Specifications (Section 2.6.1)
- Non-Rotating Base Plate Installation Specifications (Section 2.6.2)
- Support Bracket Assembly Installation Specifications (Section 2.6.3)

Dimensions and specifications provided are for reference only, and are not intended for vehicle design purposes. Depending on the Mast System and components being used, the exact design of components may vary. Masts with other heights, capacities, and finishes are available. For more information on additional mast sizes, capabilities, and finishes, see www.willburt.com.

2.6.1 Mast Installation Specifications

<table>
<thead>
<tr>
<th>P/N*</th>
<th>MODEL</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>inch</td>
<td>mm</td>
<td>inch</td>
</tr>
<tr>
<td>710991201</td>
<td>8-39 (2.4-12 m)</td>
<td>95</td>
<td>2413</td>
<td>74 11/16</td>
</tr>
<tr>
<td>710905700</td>
<td>11.3-59 (3.4-18 m)</td>
<td>135</td>
<td>3450</td>
<td>108 3/4</td>
</tr>
<tr>
<td>710992000</td>
<td>9.8-65.6 (3-20 m)</td>
<td>118</td>
<td>2997</td>
<td>91 3/4</td>
</tr>
<tr>
<td>710908000</td>
<td>14.3-80 (4.4-24 m)</td>
<td>172</td>
<td>4363</td>
<td>153.74</td>
</tr>
</tbody>
</table>

* Part Numbers for standard catalog masts only. Additional finishes and options are available.
Figure 2-3 Mast Installation Specifications
2.6.2 Non-Rotating Base Plate Installation Specifications

The Non-Rotating Base Plate:

- Weighs approximately 9 lb. (4 kg)
- Has the dimensions shown in Figure 2-4

Non-Rotating Base Plate P/N: 4995301 has a clear anodize finish. Additional finishes are available.
2.6.3 External Support Bracket Installation Specifications

Figure 2-5 describes the dimensions for the External Support Bracket (P/N: 4989201).

External Support Bracket P/N: 4989201 has a black powder coat finish. Additional finishes are available.
2.6.4 Internal Mounting Kit Installation Specifications

Figure 2-6 describes the dimensions for the Internal Mounting Kit (P/N: 54761xx).

Eight Ø 0.406 inch holes equally spaced on the BCD

Ø 15.25 inches BCD

Ø 13.5 inches

Ø 16.5 inches

1.75 inches

0.25 inches

Hardware Stack-Up

Space for Roof

Figure 2-6 Internal Mounting Kit Installation Specifications (P/N: 5476101 Shown)
2.7 Mast Installation: External Mount

This section describes installation of an externally mounted mast (Figure 2-7). The external mounting instructions assume the use of an External Support Bracket. For information on mounting the mast internally, see Section 2.8.

2.7.1 External Mount: Quick Summary

The following is a quick summary of installation of an externally mounted mast. Detailed steps follow the quick summary (Section 2.7.2).

Install an externally mounted mast as follows:

1. Select a Suitable Mounting Location (Section 2.7.2.1)
2. Attach the Base Plate to the Mast (Section 2.7.2.2)
3. Position the Mast (Section 2.7.2.3)
4. Install the External Support Bracket (Section 2.7.2.4)
5. Secure the Base Plate to the Mounting Surface (Section 2.7.2.5)
6. Finalize Installation of the Mast System (Section 2.7.2.6)
2.7.2 External Mount: Detailed Instructions

The following are detailed steps of installation of an externally mounted mast. The exact installation procedures may vary based on the configuration of the Mast System being used and the installation environment.

2.7.2.1 Select a Suitable Mounting Location

When selecting a suitable mounting location, consider the following:

- The mounting area must have sufficient room to mount the Mast System. It is recommended that the External Support Bracket be positioned at least 1 inch (25 mm) below the Base Tube Collar, but no lower than 12 inches (304 mm) below the Base Tube Collar. This measurement goes from the bottom of the Base Tube Collar to the top of the External Support Bracket. Lowering the External Support Bracket any further may impact the wind performance. Consult the factory. Do no cover the Drain Hole. The exact dimensions of the Mast System will vary based on the components included. Refer to Section 2.6 for dimension information.

- The mounting structure must be level, solid, and capable of holding the forces required by the bolts. Check the strength and rigidity of the mounting structure (e.g. vehicle body) where the Mast System is to be attached. Reinforce as necessary.

High forces to the mounting structure may result, depending on the payload, wind load, and if the mast is guyed or not. The support bracket mounting should be designed to take a minimum 4,500 pound load in any direction combined with a moment of 200 ft.-lb. (271.2 N m). At these loads, a maximum of ¼ inch (3 mm) displacement is acceptable.

The mounting surface to which the Base Plate is secured will also see high downward forces and moments. A typical unguayed mast can cause a 500 ft.-lb. (677.9 N m) torque. A typical guyed mast will produce 3,500 lb. (1587.6 kg) of downward force onto the Base Plate. Will-Burt engineering should be consulted for specific payload and mounting requirements.

- The area underneath the mast must be free of obstructions to allow for accessibility to Base Plate fasteners.

- The mounting location must have sufficient access for the Pneumatic System.

- As mast tubes extend, they force water out of the weep holes. Keep any personnel or sensitive equipment away from the weep hole direction.

- If the Mast System is mounted in a well, provide adequate drainage. A minimum of four 1 inch (25.4 mm) drain holes (one per corner) are recommended.

2.7.2.2 Attach the Base Plate to the Mast

To install a Non-Rotatable Base Plate:

1. If necessary, use a hoist to lift the mast so the bottom of the mast can be accessed.

2. Position the Base Plate against the base of the mast so the mounting holes align. Ensure the countersunk holes are facing away from the mast.
3. Secure the Base Plate to the mast with the (4) ½-13x1.25 flathead screws (P/N: 5402) from the Hardware Bag. Apply Loctite® 242/243 (Blue) or equivalent. Torque to 450-520 in.-lb.

2.7.2.3 Position the Mast

To position the mast:

1. Carefully move the mast into the desired mounting location.

2. Lower the mast the rest of the way to the mounting surface.

3. Carefully move the mast into position ensuring the mast is level. It is necessary to check the mast in two places 90° apart when leveling. Be certain to orient the mast so the operator has a clear view of the hazard labels.

   Note: Additional labels are provided with the operator's manual and should be applied where the operator will have a clear view of them while operating the masts.

2.7.2.4 Install the External Support Bracket

This section describes installation of the External Support Bracket. To allow for slight variation between mast tubes, the External Support Bracket has been designed to allow for adjustment of the tightness of the Support Bracket Clamp. When properly installed, the External Support Bracket should snugly secure the mast without bending the External Support bracket or mast. To adjust the External Support Bracket, anywhere from zero to three Shims may be installed between the Support Bracket Weldment and Support Bracket Clamp. Any Shims not used, will be stored between the Support Bracket Clamp and the Washer Plate. The Washer Plate is installed between the Support Bracket Clamp and the hardware on the left (shimming) side of the External Support Bracket and is used to distribute the forces generated over the Support Bracket Clamp Flange.

To secure the mast in the External Support Bracket:

1. Determine the desired location for the External Support Bracket. The External Support Bracket must be at least 1 inch (25 mm) above the Drain Hole and at least 1 inch (25 mm) below the Base Tube Collar. Do not cover the Drain Hole. The exact dimensions of the Mast System will vary based on the components included. Refer to Section 2.6 for dimension information.

2. Remove the Support Bracket Clamp. Set the hardware from the right side of the External Support Bracket to the right, and the hardware from the left side of the External Support Bracket to the left. Note that the screws on the left (shim) side of the External Support Bracket are longer than the screws on the right side.

3. As you face the mast and the support structure, position the External Support Bracket around the Base Tube so that the Shims will be on the left side of the mast. Ensure the mast is properly oriented to allow for access to the Drain Cock, Air Inlet Port, and locking mechanisms. Once the External Support Bracket is clamped down, it will not be possible to rotate the mast.
4. Secure the External Support Bracket around the Base Tube as follows:
   
   a. Secure the mast temporarily in position to prevent it from leaning or falling throughout installation of the Support Bracket Clamp. Ensure the mast is level and snug against the back of the External Support Bracket. If the mast is not snug against the External Support Bracket, the Support Bracket Clamp may not be adjusted properly. It is necessary to check the mast in two places 90° apart when leveling.
   
   b. Secure the right side of the Support Bracket Clamp to the Support Bracket Weldment with the hardware from the right side (Figure 2-8). Align from outside in as follows:
      
      i. ⅜-16 x 1.50 Cap Screw
      
      ii. Flat Washer
      
      iii. Support Bracket Clamp
      
      iv. Support Bracket Weldment
      
      v. Flat Washer (Hidden)
      
      vi. Lock Washer (Hidden)
      
      vii. Hex Nut
      
      Torque hardware as appropriate for its material and size.

   c. On the left side of the External Support Bracket, align the hardware from outside in as follows (Figure 2-9):
      
      i. ⅜-16 x 2.00 Cap Screw
      
      ii. Flat Washer
      
      iii. Washer Plate
      
      iv. Support Bracket Clamp
      
      v. Support Bracket Weldment
d. The Washer Plate should be aligned so that its outside edge is flush with the outside edge of the Support Bracket Clamp (Figure 2-10). If the outside edge sticks out beyond the edge of the Support Bracket Clamp (Figure 2-11), it is installed backwards and needs flipped.

![Correct Washer Plate Alignment](image1)

![Incorrect Washer Plate Alignment](image2)

Figure 2-10 Correct Washer Plate Alignment
Figure 2-11 Incorrect Washer Plate Alignment

---

e. Press with your hand against the left Support Bracket Clamp Flange and push it towards the Support Bracket Weldment (Figure 2-12). Looking at the gap between the Support Bracket Weldment and the Support Bracket Clamp, estimate how many of the Shims can fit in the gap while allowing the External Support Bracket to snugly secured to the mast, but without bending the Support Bracket Clamp.

![Press the Support Bracket Clamp Flange Towards the Support Bracket Weldment](image3)

Figure 2-12 Press the Support Bracket Clamp Flange Towards the Support Bracket Weldment
f. Release the Support Bracket Clamp and insert the estimated number of Shims between the Support Bracket Clamp and the Support Bracket Weldment (Figure 2-13). Do not pull out on the Support Bracket Clamp. If a Shim does not easily fit between the Support Bracket Clamp and Support Bracket Weldment, that Shim is not necessary, and should not be used. Any unused Shims should be inserted between the Support Bracket Clamp and the Washer Plate. The Shims should be inserted so that the bottom of the Shims hangs down below the bottom of the Support Bracket Clamp.

![Figure 2-13 Shims Inserted (Shown with Two Shims Used and One Spare)]

- Support Bracket Weldment
- Support Bracket Clamp Flange
- Washer Plate
- Two Shims Used
- One Spare Shim

![Figure 2-14 Hardware Left Side]

- ⅜-16 x 2.00 Cap Screw
- Flat Washer
- Washer Plate
- Support Bracket Clamp
- Support Bracket Weldment
- Flat Washer (Hidden)
- Lock Washer (Hidden)
- Hex Nut

g. Loosely secure the left side of the Support Bracket Clamp to the Support Bracket Weldment with the remaining hardware. Align from outside in as follows:
h. Tighten the left side. Ensure the External Support Bracket snugly secures the mast without bending the Support Bracket Clamp. If necessary, adjust the Shims.

Note: If it is necessary to adjust the Shims, they can be removed without completely loosening the hardware. To adjust the location of a Shim:

i. Push up on the Shim from the bottom until the bottom of the grooves in the Shim touch the bolts (Figure 2-15).

![Figure 2-15 Push Up Shim](image)

ii. Pull out the Shim (Figure 2-16).

![Figure 2-16 Remove Shim](image)

iii. Relocate and insert the Shim to its new position.

iv. Push the Shim down into position.

i. Torque all hardware as appropriate for its material and size.
5. If necessary, use the External Support Bracket as a template to drill holes in the desired support structure. Ensure the Mast System is level in all directions during drilling.

6. Ensure the Mast System is level in all directions. If necessary, spacers may be added between the External Support Bracket and the support structure to keep the correct alignment between the External Support Bracket and the support structure.

7. Secure the External Support Bracket to the support structure with (6) sets of ¾ inch hardware. The bolts should be sized to length to allow for the thickness of the External Support Bracket, support structure, any spaces, and all mounting hardware (e.g. flat washers, lock washers, and nuts). The mounting hardware must include a proper means to resist vibration loosening such as thread-locking compound or locking hardware. Torque all hardware as appropriate for its size and grade.

2.7.2.5 Secure the Base Plate to the Mounting Surface

To secure the Base Plate to the mounting surface:

1. If necessary, use the Base Plate as a template to drill holes through the mounting surface.

2. Ensure the Base Plate and mast are level in all directions. It is necessary to check the mast in two places 90° apart when leveling.

3. Secure the Base Plate to the mounting surface with appropriate hardware. To secure the Base Plate, the Hardware Bag contains:
   a. (6) ⅜-16 x 1-½ inch Bolts (P/N: 901594)
   b. (6) Flat Washers (P/N: 2054)
   c. (6) Lock Washers (P/N: 0801)
   d. (6) Nuts (P/N: 901593)

Depending on the customer-specific mounting application, other (customer-supplied) hardware may be required. The mounting hardware must include proper means to resist vibration loosening such as thread-locking compound or locking hardware. Torque to 190-240 in.-lb.

2.7.2.6 Finalize Installation of the Mast System

Once the mast is installed, see Section 2.9 for information on the installation of the following components:

- Drain Kit Installation (Section 2.9.1)
- Pneumatic System Installation (Section 2.9.2)
- Magnetic Warning Kit Installation (Section 2.9.3)
2.8 Mast Installation: Internal Mount

This section describes installation of an internally mounted mast (Figure 2-17). These internal mounting instructions assume the use of an Internal Mounting Kit (Section 1.5.3.2). For information on mounting the mast externally, see Section 2.7.

2.8.1 Internal Mount: Quick Summary

The following is a quick summary of the installation of an internally mounted mast. Detailed steps follow the quick summary (Section 2.8.2).

Install an internally mounted mast as follows:

1. Select a Suitable Mounting Location (Section 2.8.2.1)
2. Begin Installation of the Internal Mounting Kit (Section 2.8.2.2)
3. Lower Mast through the Internal Mounting Kit (Section 2.8.2.3)
4. Attach the Base Plate to the Mast (Section 2.8.2.4)
5. Position the Mast (Section 2.8.2.5)
6. Secure the Base Plate to the Mounting Surface (Section 2.8.2.6)
7. Complete Installation of the Internal Mounting Kit (Section 2.8.2.7)
8. Finalize Installation of the Mast System (Section 2.8.2.8)
2.8.2 Internal Mount: Detailed Instructions
The following are detailed steps describing the installation of an internally mounted mast. The exact installation procedures may vary based on the configuration of the Mast System being used and the installation environment.

2.8.2.1 Select a Suitable Mounting Location
To select a suitable mounting location, consider the following:

- The mounting area must have sufficient room to mount the Mast System. The roof area must be as flat as possible at the location of the mast. The roofline must lie between the Drain Hole and Base Tube Collar. Mounting hardware must be at least 1 inch (25 mm) above the Drain Hole, and at least 3 inches (76 mm) below the Base Tube Collar. The exact dimensions of the Mast System will vary based on the components included. Refer to Section 2.6 for dimension information.

- The mounting structure must be level, solid, and capable of holding the forces required by the bolts. Check the strength and rigidity of the mounting structure (e.g. vehicle body) where the Mast System is to be attached. Reinforce as necessary.

- The area underneath the mast must be free of obstructions to allow for accessibility to Base Plate fasteners, and if present and used, the Bottom Air Inlet Port.

- The mounting location must have sufficient access for the Pneumatic System.

- Before cutting the hole in the roof, it is advised to hang a plumb-bob from the roof to find the Base Plate location and ensure proper alignment between the roof hole and intended Base Plate location. This is particularly helpful when attempting to hit specific structural members beneath a vehicle.

- As mast tubes extend, they force water out of the weep holes. Keep any personnel or sensitive equipment away from the weep hole direction.

2.8.2.2 Begin Installation of the Internal Mounting Kit
To begin installation of the Internal Mounting Kit:

1. Remove any roof liner or ceiling panels from the roof.

2. Cut a round hole in the roof ¼ inch (6.35 mm) larger than the diameter of the Base Tube (Section 1.4). Cut the same size hole in any roof liner or ceiling panels ensuring the hole will properly align with the hole in the roof when the roof liner or ceiling panels are reinstalled.
3. Center the Ceiling Plate from the Internal Mounting Kit (Figure 2-18) over the hole and use it as a template to drill bolt holes for attachment.

4. If necessary, use washers or short spacers made of ¼ inch (6.35 mm) pipe to level out any irregularities that exist in the roof.

5. Apply a bead of silicone sealant to both sides of one Gasket.

6. Line up the holes in the roof, Gasket, and Roof Ring (Figure 2-18). Ensure the Gasket is between the roof and Roof Ring. Leave the Retaining Ring and O-Ring off. These will be installed later.

7. Replace any roof liner or ceiling panel.

8. Fit the other Gasket (Figure 2-18) against the inside of the roof. This Gasket does not need sealant. It will be held in place by the Ceiling Plate. Fit the Ceiling Plate in place and ensure all holes align.

9. Temporarily secure this assembly together. Do not torque hardware. Hardware will be torqued during final assembly.

10. Clean off any silicone sealant that may have squeezed out into the hole cut for the mast.

11. Slide the Retaining Ring and O-Ring over the bottom of the Base Tube and up the mast past the Drain Hole towards the collar. If they are difficult to maneuver, put soapy water on the mast to allow them to slide more freely. Ensure the O-Ring is below the Retaining Ring. Temporarily secure the Retaining Ring and O-Ring in place so they cannot slide down the mast during transportation.
2.8.2.3 Lower Mast through the Internal Mounting Kit
To lower the mast through the Internal Mounting Kit:

1. Use a hoist to slowly lift the mast above the roof.
2. Align the base of the mast with the center hole of the Internal Mounting Kit.
3. Carefully lower the mast partially through the roof. The mast should be held securely in position partially through the roof so that the installer has safe access to the base of the mast to install the Base Plate.

2.8.2.4 Attach the Base Plate to the Mast
This section describes attaching the Base Plate to the mast. When installing the Base Plate to the base of the mast, ensure the mast is securely held in position.

**WARNING**

Crush Hazard – Hoist Failure! Use extreme caution while installing the Base Plate to the mast. Be certain mast is properly secured during installation of Base Plate. Death or serious injury could occur if hoist fails or mast slips suddenly.

To install a Base Plate:

1. Position the Base Plate against the base of the mast so the mounting holes align. Ensure the countersunk holes are facing away from the mast.
2. Secure the Base Plate to the mast with the (4) ⅜-16x1 flathead screws (P/N: 2772) from the Hardware Bag. Apply Loctite® 242/243 (Blue) or equivalent. Torque to 190-240 in.-lb.

2.8.2.5 Position the Mast
To position the mast:

1. Lower the mast the rest of the way to the floor.
2. Carefully, move the mast into position ensuring the mast is level. It is necessary to check the mast in two places 90° apart when leveling. Be certain to orient the mast so the operator has a clear view of the hazard labels.

Note: Additional labels are provided with the operator's manual and should be installed where the operator will have a clear view of them while operating the mast.

2.8.2.6 Secure the Base Plate to the Mounting Surface
To secure the Base Plate to the mounting surface:

1. Use the Base Plate as a template to drill holes through the mounting surface.
2. Ensure the Base Plate and mast are level in all directions. It is necessary to check the mast in two places 90° apart when leveling.
3. Secure the Base Plate to the mounting surface with appropriate hardware. To secure the Base Plate, the Hardware Bag contains:
   a. (4) ⅜-16x1-½ Inch Bolts (P/N: 901594)
   b. (4) Flat Washers (P/N: 2054)
   c. (4) Lock Washers (P/N: 0801)
   d. (4) Nuts (P/N: 901593)

Depending on the customer-specific mounting application, other (customer-supplied) hardware may be required. The mounting hardware must include proper means to resist vibration loosening such as thread-locking compound or locking hardware. Torque to 190-240 in.-lb.

2.8.2.7 Complete Installation of the Internal Mounting Kit

To complete installation:

1. Remove the hardware securing the Roof Ring ensuring the Ceiling Plate and Gasket underneath the roof do not fall.
2. Slide the Retaining Ring and O-Ring down the mast.
3. Press the O-Ring into the notch around the Roof Ring.
4. Position the Retaining Ring into place ensure all the holes of the Internal Mounting Kit align with the holes in the roof.
5. Fasten this assembly (Figure 2-19) together using:
   a. (8) ¼ Inch (M6) Bolts
   b. (8) ¼ Inch Lock Washers
   c. (8) ¼ Inch Nuts

The mounting hardware must include proper means to resist vibration loosening such as thread-locking compound or locking hardware. Torque all hardware as appropriate for its size and grade.

2.8.2.8 Finalize Installation of the Mast System

Once the mast is installed, see Section 2.9 for information on the installation of the following components:

- Drain Kit Installation (Section 2.9.1)
- Pneumatic System Installation (Section 2.9.2)
- Magnetic Warning Kit Installation (Section 2.9.3)
2.9 Finalize Mast System Installation

The procedures and images shown in this section describe a possible method of installing the:

- Drain Kit (Optional for External Mount Applications)
- Pneumatic System
- Magnetic Warning Kit

Depending on the environment, other methods of installation may work better. Use the best and safest method for your circumstances. Complete mast installation before installing these components. See Figure 2-20 and Figure 2-21 for the general layout of the system.

---

Figure 2-20  Internal Mount General Layout (Not to Scale)

Figure 2-21  External Mount General Layout (Not to Scale)
2.9.1 Install the Drain Kit

The Drain Kit is intended to protect the interior of a vehicle from damage due to water drainage, and is optional for externally mounted masts. However, the elbow from the kit may be used to shield the Drain Hole from blowing sand, dust, and other debris.

Keeping water out of the mast is very important to avoid potential delays in operations and damage to the mast. Water can enter the mast through condensation in the Air Supply, or by rain running down the tubes and entering at the collars. Water that freezes in the mast can cause the mast to work erratically, or not at all.

The Drain Hole on the Base Tube and Weep Holes on the Intermediate Tubes are located to facilitate the drainage of water during periods of extension. The Drain Kit is designed to route water from inside the mast to outside of the vehicle or enclosure. The Drain Kit is intended to protect the interior of a vehicle or other water sensitive area from damage due to water drainage. Drain Kit installation is not required for externally mounted masts.

A Drain Cock, provided in the Hardware Bag, should also be connected to the Air Inlet near the base of the mast and located at the lowest point. The Drain Cock shall be opened when the mast is not in use, or when a locking mast is deployed and depressurized, to empty water that may accumulate inside the Base Tube, particularly after the mast has been exposed to rain. Installation of the Drain Cock is described as part of installation of the Pneumatic System (Section 2.9.2).

**Safety Instruction – Follow Procedures!** 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.

To install the Drain Kit:

1. Be certain the locknut and washer are threaded over the end of the ¼ inch (6.35 mm) Hose Adaptor (Figure 2-22).
2. Fasten the Hose Adaptor to the Drain Hole (Figure 2-23). Apply PTFE Tape to all threaded joints. Turn the Hose Adaptor in ONLY 1 ½ to 2 times after initial engagement of the threads. Turning further will damage the mast. Tighten the locknut to secure the Hose Adaptor in place. Overtightening could cause the Hose Adaptor to contact the moving Intermediate Tube.

3. Drill a hole in the vehicle or enclosure to route the water outside.

4. Fasten the Bulkhead Fitting (Figure 2-23) to the hole.

5. Attach the Polyethylene Tube to the Hose Adaptor and the Bulkhead Fitting (Figure 2-23). As necessary, the Polyethylene Tube may be cut shorter to fit the customer-specific application. Apply PTFE Tape to all threaded joints.
2.9.2 Install the Pneumatic System

This section describes general principles to keep in mind during installation of the Pneumatic System. Depending on the components of the Mast System and the environment, the exact configuration of the Pneumatic System may vary. Use the best and safest method for your circumstance.

Air to operate the mast may be provided by an Air Compressor or other source of clean dry air. The Pneumatic System should be regulated to not exceed the maximum operating pressure of 35 psi (241 kPa) at any time.

2.9.2.1 General Concepts

When installing the Pneumatic System, keep in mind the following:

- **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 inside the workspace (e.g. the workspace of a vehicle).

- **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 the 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. A qualified electrician should perform installation and adjustments.

- **Air Supply:** The Air Supply should have adequate ventilation to provide at least 10 SCFM (283.16 LPM) of clean, dry air at the air intake at all times. The recommended temperature range for inlet air is 32°F to 95°F (0°C to 35°C), so it works best when located in a heated compartment. The Air Supply should not be operated without the air filters in place.

- **Air Control Valve:** An Air Control Valve should be installed to direct airflow in and out of the mast. The Air Control Valve should be positioned to avoid unintentional operation. Mast movement should stop when the controller or switch is released (hold-to-run type). If the controller is not a hold-to-run type, an emergency stop must be provided. The Air Control Valve should be operable by a person wearing gloves and mounted so it can be used with the mast in full view. The Air Control Valve should be suitable for outdoor use, and marked “Up”, “Down”, or similar.

  Note: For some Pneumatic Systems, an Air Control Valve may not be necessary.

- **Drain and Relief Fittings:** A Drain Cock and Safety Valve must be installed to an Air Inlet Port at the base of the mast. The Drain Cock empties water that may have accumulated inside the mast. The Drain Cock shall be opened to drain the mast when not in use, or when a locking mast is extended and depressurized. The Drain Cock should be left open once the mast is fully retracted. The Safety Valve prevents the mast from being over-pressurized.
Plumbing: A length of Air Hose with an ID of \(\frac{3}{8}\) inch (9.5 mm), plus additional loose fittings, are supplied with a Will-Burt Pneumatic System if purchased. The Air Hose can be cut to the required length at installation. A Drain Hose should be attached to the exhaust port of the Air Control Valve to drain condensation or oil mist that may exhaust from the mast. Do not remove any hose without first completely exhausting all air from the mast and then disconnecting the power supply.

2.9.2.2 General Procedures

This section describes general procedures and concepts to use when installing the Pneumatic System. Depending on the components and configuration of your system, the exact steps and procedures may vary. Use the best and safest method for your system.

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

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

**Safety Instruction – Air Control Valve!** Improper positioning and operation of Air Control Valve can result in moderate injury or equipment damage. Air Control Valve must be mounted in a location where the operator has full view of the mast, but does not make contact with the mast during operation. Only use a Hold-To-Run type Air Control Valve or switch. The Air Control Valve shall be normally open when the mast is in transit or not in use.

Figure 2-24 shows the general layout of a pneumatic system. The exact configuration will vary based on the components being used in the specific system.

![General Pneumatic System Layout](image-url)
To install the Pneumatic System:

1. Locate the Hardware Bag (Section 1.5.1.1). Components from the Hardware Bag will be used during installation of the Pneumatic system.

2. Locate the Air Inlet Port to be used. When installing the Pneumatic System only use one Air Inlet Port.
   - To use the Air Inlet Port with the plastic plug:
     a) Remove the plastic plug. This plug is for thread protection only and the mast should never be pressurized with this plug installed.
   - To use the Air Inlet Port with the stainless steel plug:
     a) Remove the plastic plug.
     b) Remove the stainless steel plug.
     c) Install the stainless steel plug in the Air Inlet Port that is not going to be used to attach the Pneumatic System. Pipe thread sealant or PTFE tape should be applied to minimize leakage.

Note: The plastic plug is for thread protection only. The mast should never be pressurized with the plastic plug installed. Ensure any unused Air Inlet Port is plugged with a stainless steel plug.

3. Attach the Brass Cross to the desired Air Inlet Port with a Close Nipple, ⅜ x ¼ Bushing, and ½ x ⅜ Bushing (Figure 2-25). Apply PTFE Tape to all threaded joints. If necessary, Air Hose may be used to connect between the Air Inlet Port and the Brass Cross, however, the Brass Cross should be installed as close to the mast as possible to ensure proper drainage.

![Figure 2-25 Pneumatic System Installation](image-url)
4. Attach the Safety Valve to the Brass Cross. Apply PTFE Tape to all threaded joints.

5. Attach the Drain Cock to the Brass Cross. Apply PTFE Tape to all threaded joints.

   Note: The Drain Cock should be located at the lowest point. When the mast is not in use, or when a locking mast is deployed and depressurized, the Drain Cock shall be left open.

6. If necessary, mount the Air Supply to the mounting structure with appropriate hardware. The mounting hardware must include proper means to resist vibration loosening such as thread-locking compound or locking hardware. Torque all hardware as appropriate for its size and grade.

   Note: The Air Supply should not be operated without air filters in place.

7. Connect the Air Supply to the Brass Cross with Air Hose and a Close Nipple. Apply PTFE Tape to all threaded joints.

   Note: Depending on the Air Supply used, it may be necessary to install an Air Control Valve in-line between the Air Supply and the Brass Cross.

8. If necessary, connect the Power Supply to the Air Supply. Be certain to observe any local codes or regulations.

2.9.3 Install the Magnetic Warning Kit

When installing the Mast System on a vehicle, the Magnetic Warning Kit shall be installed to provide a warning against moving the vehicle while the mast is partially or fully extended. When correctly installed, flashing lights will indicate partial or full extension of the mast when the ignition is on. When the mast is properly 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 so the lights will only illuminate when the mast is extended and the ignition is on. The operator should always visually confirm that the mast is entirely retracted before moving the vehicle. Be certain to observe any local codes or regulations.

To install the Magnetic Warning Kit:

1. Tie one end of a piece of rope or wire to the top of the Magnet through the eyebolt (Figure 2-26).

2. Carefully lower the Magnet into the top of the Top Tube.

Figure 2-26 Magnet
3. Using the rope, lower the Magnet to the bottom of the Top Tube. It is important that the Magnet is resting on the bottom end of the Top Tube. Cut off the excess rope.

4. Assemble the Magnetic Switch Assembly and the stainless steel band.

5. Attach the Magnetic Switch Assembly loosely around the Base Tube approximately 6 to 20 inches (15 to 51 cm) above the Base Plate (Figure 2-27). The Magnetic Switch Assembly can be located anywhere around the perimeter of the Base Tube.

![Magnetic Switch Assembly Attached to Base Tube](image)

6. Mount the Relay. Do not mount the Relay any closer than 6 inches (15 cm) from the Magnetic 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 in the Magnetic Switch Assembly if the Relay is mounted too close.

7. Mount the Flasher keeping in mind that wire will eventually need to be routed from the Magnetic Switch Assembly to the Relay and then to the Flasher.

8. Mount the Lights, keeping in mind that wire will eventually need to be routed from the Flasher to the Lights. One flashing Light should be mounted to the vehicle dash in full view of the driver.
9. Use 16 AWG stranded wire (customer-supplied) to connect the Flasher, Lights, and Relay to the wires exiting the Magnetic Switch Assembly (Figure 2-28 and Figure 2-29).

10. Use customer-supplied 16 AWG stranded wire to connect the Magnetic Switch Assembly to vehicle power through the ignition.
11. Ensure:
   a. The mast is fully nested
   b. The Flasher and Lights are installed and connected to the ignition through the battery
   c. The ignition is on

   Note: The Light should be flashing unless the switch is in contact with the magnet assembly.

12. Slide the Magnetic Switch Assembly up and down the lower two feet (60 cm) of the Base Tube to locate the Magnet Assembly inside the tube. When the Magnet Assembly is located, the Lights will stop flashing. The vertical sensing range should be about 1 to 3 inches (2.5 to 7.5 cm).

13. Tighten the band to clamp the Switch Assembly within the sensing range ensuring it is not lower than 1 inch (2.5 cm) above the lower limit of the sensing range. The 1 inch (2.5 cm) allows for seasonal variations in the Top Tube position.

14. Attach the “NOTICE” label in a visible area on the Base Tube (Figure 2-28).

15. Attach the “MAGNETIC EXTENSION WARNING KIT” label to the Magnetic Switch Assembly (Figure 2-28).

16. Extend the mast 1 to 2 feet (31 to 61 cm) and then nest the mast. Repeat several times to test the Magnetic Warning Kit. For information on operating the Mast System, see Section 3.3.

### 2.10 Additional Accessory Installation

Depending on the configuration of the Mast System, optional components selected, or the installation environment, additional accessories such as positioners may need to be installed. Install any additional accessories as appropriate. Contact The Will-Burt Company with any questions before performing any installation procedures.
2.11 Test the Installation

Follow all precautions while testing the Mast System installation.

To test the installation:

1. Review the Pre-Operation Check.
2. Prepare the Mast System for operation.
3. Extend the mast.
4. Lower the mast.

Note: The Drain Cock shall remain open to drain water when the mast is not in use. The Drain Cock shall be opened while a locking mast is deployed and depressurized to drain water. It is not uncommon to have mast grease exit the drain or exhaust valve on initial mast use.

See Section 3 for additional details on these procedures.

2.12 Install Payload

**WARNING**

Safety Instruction – Mounting Instructions! Before operation, be certain the mounting structure is capable of resisting forces generated from all loading and environmental conditions including, but not limited to payload size and weight, sail size, and wind and ice loading. The mounting hardware must include proper means to resist vibration loosening such as thread-locking compound or locking hardware. Mounting the payload into a structure unable to resist the forces generated from the customer-specific loading scenario could result in death or serious injury, and could damage the mast and mounting structure.

**CAUTION**

Safety Instruction – Mast Access! The operator must provide safe means to access the top of the mast during installation and removal of the payload.

The exact installation procedures for payload will vary based on the customer-specific payload. For optimal performance, center the payload as best as possible. If offsetting any payload greater than 600 lb. (272 kg), the payload offset direction must be in-line with the tube keys, and nor perpendicular to the keys. Contact The Will-Burt Company with any questions before performing any installation procedures.

In general, to install the payload:

1. Ensure the Air Supply is disconnected and the Drain Cock is opened while installing the payload to eliminate the possibility of inadvertent mast extension.
2. If necessary, remove the Mast Top Cover.
Note: If the payload is removed, the Mast Top Cover should be put back on.

3. Carefully move the payload into position.

4. Properly secure the payload to the mast. The mounting hardware must include proper means to resist vibration loosening such as thread-locking compound or locking hardware. Torque all hardware as appropriate for its size and grade.

Note: If securing a payload part-way along a mast tube, be sure not to overtighten the tube, or damage to the mast could occur. See www.willburt.com for additional information.
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Section 3 Operation

This section describes the operation of the Mast System. Use care to understand and follow all precautions while operating.

3.1 Pre-Operation Check

Before operating the Mast System, ensure:

- All operators read and understand the entire operation procedure and are properly trained.
- The Mast System is undamaged. If damage is apparent, do not use the Mast System, and have it serviced prior to use.
- All electrical cables are undamaged and properly terminated.
- The area is free of power lines or other overhead obstructions. The Mast System location should be no closer than a horizontal distance equal to the extended height of the mast away from power lines.
- Any objects that might obstruct motion of the Mast System, cause binding, or hinder Mast System function are removed.
- The Mast System and payload are properly installed.
- When using a vehicle, the vehicle is not moving. The mast is on level terrain. Masts extended up to 60 feet (18.2 m) can be operated on terrain having a slope up to:
  - 5° of vertical for payloads 200 lb. (90.7 kg) or less
  - 4° of vertical for payloads 200 lb. to 800 lb. (90.7 kg to 362.9 kg)
  - 2° of vertical for payloads 800 lb. to 1,200 lb. (362.9 kg to 544.3 kg)
Masts extended 60 ft. to 80 ft. (18.2 m to 24.4 m) can be operated on terrain having a slope up to:
  - 4° of vertical for payloads 600 lb. (272.2 kg) or less
  - 1° of verticals for payloads 600 lb. to 1,200 lb. (272.2 kg to 544.3 kg)
- Any transit tie-downs have been removed.
- The Mast System area is free of personnel.
- The operator has full view of the Mast System during use.
- Ensure the following precautions are understood and followed:

⚠️ 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**

**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**

**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. Do not install mast on a vehicle without installing the Magnetic Warning Kit.

**WARNING**

**Safety Instruction – Operation!** At all times prior to mast operation, ensure:

- The mast area is free of personnel and mechanical obstruction
- All electrical cables are undamaged and properly terminated
- The operator has full view of the mast during use
- Any transit tie-downs on the payload have been removed
- The vehicle is not moving
- The Magnetic Warning Kit is installed on a vehicle
- The area above the mast is free of mechanical obstructions and electrical power lines
- Before operating, the Base Tube for masts extended up to 60 feet (18.2 m) shall be within:
  - 5° of vertical for payloads 200 lb. (90.7 kg) or less
  - 4° of vertical for payloads 200 lb. to 800 lb. (90.7 kg to 362.9 kg)
  - 2° of vertical for payloads 800 lb. to 1,200 lb. (362.9 kg to 544.3 kg)
- Before operating, the Base Tube for masts extended 60 to 80 feet (18.2 to 24.4 m) shall be within:
  - 4° of vertical for payloads 600 lb. (272.2 kg) or less
  - 1° of verticals for payloads 600 lb. to 1,200 lb. (272.2 kg to 544.3 kg)

**WARNING**

**Lifting Hazard – Intended Use!** 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. Large payload wind sail areas can reduce payload capacity. Consult Will-Burt engineering.
**Crush Hazard – Mast Failure!** 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.

**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 Ultra-Heavy-Duty masts. Keep personnel clear of safety valve exhaust direction.

**Impact Hazard!** The mast should operate smoothly during extension and retraction. If erratic mast motion is observed during extension or retraction that results in impact loading between the tube and the tube collar (mechanical travel stop), cease use of the mast and contact Will-Burt service. Operating a mast with erratic mast tube motion over time could result in mast separation and could cause damage to the mast or result in death or serious injury.

**Safety Instruction – Potential Air Contaminants!** If internally mounted, air from the mast will discharge into the vehicle while the Drain Cock is open.

**Safety Instruction – Operation!** For outdoor use only. Do not use in areas that have been classified as hazardous as defined in Article 500 of the National Electric Code.

**Safety Instruction – Keep Clear!** Keep personnel clear of the Mast System during operation.

**Safety Instruction – Rapid Release of Air Pressure!** If the Mast System air pressure is not fully discharged prior to removing the Air Hoses, a rapid release of air pressure will occur causing a need for hearing and eye protection.

**Equipment Damage – Obstruction!** Check for and remove any objects that might obstruct motion, cause binding, or hinder function of the Mast System. Hitting obstructions will cause damage to the mast.

**Equipment Damage – Deviation!** Deviation from standard operating conditions and procedures could cause system failure.
Entanglement Hazard! Tangled cables can cause equipment damage. Ensure control cables and Guy Lines are not tangled and are free to pay out as mast is extended.

Frozen Water Hazard! Water freezing inside mast or air fittings may render mast inoperable and cause major equipment damage. Open Drain Cock, when mast is not in operation. The Drain Cock shall be installed at the lowest position in the Pneumatic System. Cover locking masts when not in use. Non-locking masts stored outdoors should be covered if possible. Will-Burt P/N: 5063501 is available from Will-Burt.

Safety Instruction – Guy Anchors! When using guy lines, the installer shall verify the guy anchor point strength is adequate to support the guy line forces.

3.2 Operation Equipment

Table 3-1 lists recommended equipment for operation.

<table>
<thead>
<tr>
<th>Recommended Equipment*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal Protective</strong></td>
</tr>
<tr>
<td>Safety Glasses</td>
</tr>
<tr>
<td>Hearing Protection</td>
</tr>
</tbody>
</table>

* Depending on the local, regional, and national standards and codes of practice, and the environment, additional personal protective equipment may be necessary.

3.3 Mast Operation

This section describes operation of the Mast System. The exact operating procedures will vary based on the configuration of your Mast System. Follow the appropriate operation procedures for your Mast System.

Operation of the Mast System is described as follows:

- Prepare the Mast System for Operation (Section 3.3.1)
- Extend the Mast (Section 3.3.2)
- Lower the Mast (Section 3.3.3)
3.3.1 Prepare the Mast System for Operation

To prepare the Mast System for operation:

- Ensure the Mast System is stationary on level, stable ground.
- Perform the Pre-Operation Check (Section 3.1)
- Prepare the Pneumatic System for operation. As part of this:
  - Close the Drain Cock
  - Connect the Air Supply to the mast
  - If necessary, connect power to the Air Supply
- If necessary, secure any cables to the mast
- If necessary, secure the payload to the mast (Section 2.12)
- Ensure the proper personnel are available to operate the mast. For applications using Guy Lines, a minimum of:
  - (2) People are necessary to operate the Guy Lines (Guy Lines must be operated opposite of each other)
  - (1) Person must observe the mast to ensure it is standing straight and not leaning in any direction. For taller masts, binoculars may be required.
  - (1) Person must operate the Pneumatic System. It may be possible for the person observing the mast to also operate the Pneumatic System.
- Ensure the mast is only being operated in safe wind speeds. Deployment and retraction wind speeds are payload dependent, however the mast can typically be deployed and retracted in winds speeds up to 25 mph (40 km/h) assuming:
  - 12 Inch Maximum Offset Payload from Mast Centerline
  - Mast deployment angle for masts extended up to 60 feet (18.2 m) shall be within:
    - 5° of vertical for payloads 200 lb. (90.7 kg) or less
    - 4° of vertical for payloads 200 lb. to 800 lb. (90.7 kg to 362.9 kg)
    - 2° of vertical for payloads 800 lb. to 1,200 lb. (362.9 kg to 544.3 kg)
  - Mast deployment angle for masts extended 60 to 80 feet (18.2 to 24.4 m) shall be within:
    - 4° of vertical for payloads 600 lb. (272.2 kg) or less
    - 1° of verticals for payloads 600 lb. to 1,200 lb. (272.2 kg to 544.3 kg)
  - Sail area could impact the mast deployment angle if the wind is blowing in the direction of the tilt. Consult factory.
  - Operating Temperature -20°C to 60°C (-4°F to 140°F)

Check with Will-Burt Engineering for additional wind information for customer-specific loading scenarios.
3.3.2 Extend the Mast

This section describes extending the mast. Depending on the system configuration, it is possible to extend the mast with either powered or manual operation. When manually operating the mast, ensure all electrical circuits are de-energized and properly tagged to prevent injury during operation.

As mast tubes extend, they force water out of the weep holes. Keep any personnel or sensitive equipment away from the weep hole direction while extending the mast.

To extend the mast:

1. Prepare the Mast System for Operation (Section 3.3.1).
2. Remove the Mast Top Cover.
3. Secure the payload to the mast (Section 2.12).
4. If Guy Lines are used, attach the Guy Lines to the color-coded lugs on the collars. If Cable Guides are used, ensure the Guy Lines are outside the Cable Guides for the collars below where they attach.
5. Prior to extending the mast, Will-Burt recommends laying out any Guy Lines so they do not become tangled during extension (Figure 3-1).

Figure 3-1 Sample of Laying Out Guy Lines (Mast with 4 Way 5 Level Guying Shown)
6. If Guy Lines are used, find the ground anchor locations and install the ground anchors.

7. Ensure the payload will have enough clearance as the mast is extended.

8. With the mast depressurized, lightly pull down the top T-Handle attached to the smallest collar. Do not pull hard, tug, or jerk on the T-Handle, or damage to the mast locks could occur. Typically, only approximately 5 to 10 lb. (2.3 to 4.5 kg) of pressure will be necessary.

Note: The mast tubes of a mast with T-Handle Yoke Assemblies are extended from smallest to largest mast tube.

9. Pressurize the mast while continuing to hold down the T-Handle. While pressurizing the mast, you should feel the locks unlatch without needing to apply substantial pressure. Observe the Latch Levers (Figure 3-2) to confirm they have unlatched. When unlocked, they should both be pointing down at about a 45° angle from the collar ears. It is possible for the Latch Levers to be at a slight angle and still be latched.

Continue holding down the T-Handle until the mast tube is fully extended.

![Latch Levers](image)

**Figure 3-2 Latch Lever Positions**

Maintain visual contact throughout extension to avoid overhead obstructions and to ensure none of the cables become tangled or snag on anything. Do not over-pressurize the mast. Over-pressurizing the mast could cause locks to jam. Do not exceed the maximum recommended operating pressure of 35 psi (241 kPa) at any time.

10. When the mast tube is fully extended, release the T-Handle and stop pressurizing the mast. The spring-loaded Latch Pins will lock this tube in the extended position.

11. Exhaust all air from the mast to confirm the mast tube is locked. If the tube comes down, repeat steps 8 to 11.
12. Repeat the same procedure for each subsequent mast tube going from smallest to largest. Stop extending the mast when the desired height is achieved. Any combination of tubes can be extended if the full height of the mast is not required.

Note: When leaving a mast partially extended in potentially freezing conditions, follow the *Weatherizing Instructions for Pneumatic Masts* (TP-4744301).

13. Exhaust all air.

14. If Guy Lines are used, properly secure and tension the Guy Lines immediately after raising the mast. All Guy Lines should be equally tensioned. Beginning at two locations opposite each other, gradually tension each Guy Line. Vertical alignment of the mast is accomplished by observing the mast perpendicularly to the two Guy Lines being tensioned to ensure the mast is standing straight, and is not bending too far towards one side (Figure 3-3). Adjust the appropriate Guy Line as necessary to keep the mast plumb vertically. Check one day after initial install. Check periodically afterwards.

![Figure 3-3 Vertically Align the Mast (Sample Shown with 6 Level Guying)](image)

15. Open the Drain Cock for prolonged deployment to release air pressure and allow for drainage of water which may enter the mast. The Drain Cock shall be opened while a locking mast is deployed and depressurized to drain water.

3.3.3 Lower the Mast

**WARNING**

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

**CAUTION**

**Frozen Water Hazard!** Water freezing inside mast or air fittings may render mast inoperable and cause major equipment damage. Open Drain Cock, when mast is not in operation. The Drain Cock shall be installed at the lowest position in the Pneumatic System. Cover locking masts when not in use. Non-locking masts stored outdoors should be covered if possible. Will-Burt P/N: 5063501 is available from Will-Burt.

To lower the mast:

1. Ensure the payload will have enough clearance when nested.
2. Close the Drain Cock.

3. If Guy Lines are used, decrease the tension on Guy Lines until there is slack in the lines. Never attempt to unlock a mast collar with tension on the Guy Lines above it. When decreasing tension on the Guy Lines, begin at two locations opposite of each other, and gradually decrease tension on each Guy Line while observing to ensure the mast is not bending too far towards one side.

   Note: Do not leave Mast Systems that requiring Guy Lines unguyed. If the Mast System has not been lowered, and personnel will not be available to operate the Guy Lines, re-guy the mast.

4. Pressurize the mast to lift the payload weight off the Latch Pins. The Latch Pins should move freely with proper pressure. Do not over-pressurize the mast. Over-pressurizing the mast could cause locks to jam.

5. While pressurizing the mast, lightly pull down the bottom T-Handle attached to the largest collar. Do not pull hard, tug, or jerk on the T-Handle, or damage to the mast locks could occur. Typically, only approximately 5 to 10 lb. (2.3 to 4.5 kg) of pressure will be necessary.

   You should feel the locks open without needing to apply substantial pressure. Observe the Latch Levers to confirm they have unlocked. When unlocked, they should both be pointing down at about a 45° angle from the collar ears.

6. Exhaust air from the mast while continuing to hold down the T-Handle until the internal tube is retracted. 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.

   For systems using Guy Lines, gently pull Guy Lines away from the mast as it is lowered. Keeping Guy Lines organized will facilitate coiling the Guy Lines for storage, or preparing the Guy Lines for the next mast extension.

7. When the internal tube is retracted, stop exhausting air from the mast, and release the T-Handle. The spring-loaded Latch Pins will lock this tube in the nested position.

8. Repeat the same procedure for each subsequent tube going from largest to smallest until the mast is completely nested.

9. Periodically open the Drain Cock when exhausting the mast to drain off any accumulated water.

10. Disconnect the Air Supply while the mast is not in use to eliminate the possibility of inadvertent mast extension.

11. Remove the Guy Lines.

12. Remove the payload.

13. Fit the Mast Top Cover over the mast and secure it in place to protect the mast from water and debris.

14. Open the Drain Cock when the mast is not in use.

Note: The operator should always visually confirm the mast is entirely retracted before moving the vehicle. For further information on transporting the Mast System, see Section 4.
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Section 4 Transportation

Before transporting the Mast System, the Mast System needs to be secured. The exact procedures for transportation will vary based on the Mast System configuration. The process described in this manual represents a possible method of transporting the mast. Depending on the environment and equipment available, other methods may work better. Use the best and safest method for your circumstances.

⚠️ WARNING

Safety Instruction – Rapid Release of Air Pressure! If the Mast System air pressure is not fully discharged prior to removing the Air Hoses, a rapid release of air pressure will occur causing a need for hearing and eye protection.

4.1 General Transportation

To prepare the Mast System for transportation:

1. Ensure the mast is fully nested (Section 3.3). Do not transport the Mast System with the mast and payload extended. Always visually confirm the mast is fully retracted before moving the mast.

2. Ensure the Air Supply is disconnected and the Drain Cock is open to eliminate the possibility of inadvertent mast extension.

3. If possible, remove and secure the payload. The payload should be removed, and the Mast Top Cover fitted over the mast and secured in place.

4. If necessary, secure any additional components in the Mast System.

Note: The operator should always visually confirm the mast is entirely retracted before moving the vehicle.
4.2 Shipping

When shipping the Mast System, The Will-Burt Company recommends shipping the mast in the original shipping crate. If the original shipping crate is not available, contact The Will-Burt Company to order a replacement.

When shipping:

1. As necessary, remove the payload.
2. As necessary, prepare the Mast System for transportation (Section 4.1).
3. As necessary, uninstall the Mast System from the mounting structure (Section 2).
4. Secure the Mast System in the shipping crate:
   a. Carefully position the mast in the crate.
   b. When shipping by air, ensure the Air Inlet Port is open.
   c. Secure the block at the top of the mast to prevent the mast from shifting in the shipping crate during transportation.
   d. Secure the top half of the wooden mast saddles.
   e. As necessary, carefully pack any additional components in the shipping crate.
   f. Secure the lid on the shipping crate.
Section 5 Maintenance

This section describes maintenance procedures required to keep the Mast System operational. Use care to understand and follow all precautions while performing these procedures. If the system does not perform as required, see Section 7.

5.1 Pre-Maintenance Check

Before performing maintenance procedures, ensure:

- All operators read and understand the entire maintenance procedure and are properly trained.
- The payload is removed prior to performing maintenance on the system.
- The system is level and secure.
- The following precautions are understood and followed:

  **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**

  **Health and Safety Hazard!** Solvent used to clean parts is potentially dangerous. Follow solvent manufacturer’s safety procedures and recommendations. Avoid inhalation of fumes and also prolonged contact to skin. Death or serious injury could occur if solvents are not handled properly.

  **WARNING**

  **Safety Instruction – Rapid Release of Air Pressure!** If the Mast System air pressure is not fully discharged prior to removing the Air Hoses, a rapid release of air pressure will occur causing a need for hearing and eye protection.

  **WARNING**

  **Safety Instruction – Observe Proper Procedures!** Use extreme caution while lifting the Mast System and when Mast System is suspended to avoid injury and equipment damage. Be certain the Mast System is properly secured. All operators should be aware of and follow the applicable local, regional, and national standards and codes of practice for slinging and transporting equipment. Never lift Mast System over people. Ensure lifting equipment including, but not limited to, lifting straps and hoist, are capable of handling the forces generated from lifting the system. Observe manufacturer instructions on lifting equipment. Death or serious injury could result if proper procedures are not followed.
Safety Instruction – Power! Make sure all power has been disconnected prior to performing maintenance.

CAUTION

Equipment Damage – Qualified Personnel! All persons installing and maintaining this equipment should be suitably qualified and work to local, regional, and national standards and codes of practice.

CAUTION

Equipment Damage – Forces! Before unloading the system, be certain the unloading region is capable of resisting forces generated from unloading the system including but not limited to system weight. Ensure the unloading region is level and has sufficient room and strength to hold the system. If the unloading region is incapable of meeting the requirements of the system, damage to the system and/or unloading region could occur.

CAUTION

Lifting Hazard – Manually Lifting! Manually lifting over 55 lb. (25 kg) 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

Pressurized Device Hazard! Mast disassembly prior to depressurization may release pressurized air jet. Completely lower the mast, depressurize and shut down power before disassembly. Ensure the over-pressurization safety valve is installed in the system.

CAUTION

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

Table 5-1 lists recommended equipment for maintenance.

<table>
<thead>
<tr>
<th>Recommended Equipment*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal Protective</strong></td>
</tr>
<tr>
<td>Safety Glasses</td>
</tr>
<tr>
<td>Hearing Protection</td>
</tr>
<tr>
<td><strong>Hand Tools</strong></td>
</tr>
<tr>
<td>Chisel</td>
</tr>
<tr>
<td>Flat Punch</td>
</tr>
<tr>
<td>Level</td>
</tr>
<tr>
<td>Rubber Mallet</td>
</tr>
<tr>
<td>Sockets</td>
</tr>
<tr>
<td>Wrenches</td>
</tr>
<tr>
<td><strong>Equipment</strong></td>
</tr>
<tr>
<td>Compressed Air Supply</td>
</tr>
<tr>
<td>Sling / Strap</td>
</tr>
<tr>
<td><strong>Expendables</strong></td>
</tr>
<tr>
<td>Acetone, Alcohol, or other solvent</td>
</tr>
<tr>
<td>Rags (Clean and Dry)</td>
</tr>
<tr>
<td>Loctite® 380 Black Max</td>
</tr>
<tr>
<td>Silicone Sealant</td>
</tr>
<tr>
<td>Pneumatic Mast Grease Kit (P/N: 5448701)</td>
</tr>
</tbody>
</table>

* Note:
- Depending on the local, regional, and national standards and codes of practice, and the environment, additional personal protective equipment may be necessary.
- When disposing of any disposables or components, do so according to any applicable local, regional, and national standards and codes of practice.

5.3 Spare Parts

To order spare or replacement parts, always refer to the mast model number and serial number. The model number, serial number, and additional information is engraved on the mast Identification Plate (Section 1.5.1.5). Throughout this manual, “P/N” followed by a number represent the part number for that component. To order spare parts, or for the part numbers for additional components, contact The Will-Burt Company.
5.4 Periodic Maintenance
This section describes periodic maintenance of the system.

5.4.1 Inspections
Table 5-2 lists inspections to be done periodically.

<table>
<thead>
<tr>
<th>Action</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect for damage. If damage is apparent, do not use the Mast System, and have it serviced prior to use.</td>
<td>As needed.</td>
</tr>
<tr>
<td>Inspect to ensure the Mast System is kept clean and free from foreign material. If necessary, clean the Mast System (Section 5.4.2)</td>
<td>As you work and as needed. In salt water environments, clean the mast at least every 3 months.</td>
</tr>
<tr>
<td>Inspect to ensure the Drain Cock is left open when the mast is not in use, or when a locking mast is deployed and depressurized.</td>
<td>As every use.</td>
</tr>
<tr>
<td>Visually inspect to ensure all hardware is in place. If hardware is found loose, retighten.</td>
<td>Monthly.</td>
</tr>
<tr>
<td>Visually inspect to ensure all cables and hoses are undamaged and properly terminated.</td>
<td>Monthly.</td>
</tr>
<tr>
<td>Visually observe tube motion during extension and retraction to ensure the tubes move smoothly and do not cause excessive impact loads when each tube fully extends or retracts. Cease all mast use and contact Will-Burt Service immediately if excessive impacts are observed.</td>
<td>Monthly.</td>
</tr>
<tr>
<td>Cycle mast completely reaching both fully extended and fully nested.</td>
<td>Every 6 months. Every 3 months in salt water environments.</td>
</tr>
<tr>
<td>Weatherizing the mast (Section 5.4.3).</td>
<td>In potentially freezing conditions.</td>
</tr>
</tbody>
</table>
5.4.2 Cleaning and Lubrication

Will-Burt pneumatic masts come from the factory pre-lubricated. Under normal operating conditions, the grease applied at the factory is sufficient for five years and no scheduled maintenance is required. In extremely harsh environmental conditions, maintenance of the mast may be required.

An optional Mast Lubricant (P/N: 900600) may be added to ensure smooth operation and prolong the useful life of the mast in harsh environmental conditions. The Mast Lubricant is a blue-colored mineral oil specifically designed for telescoping masts and their operating environment. Mast Lubricant comes in a 16 oz. capped plastic bottle.

Signs cleaning and lubrication might be needed can be:

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

To clean the mast:

1. Will-Burt recommends removing the payload from the mast. On locking masts, the sequence of extension can be controlled by locking and unlocking the collars.

2. When a regulator exists in the Pneumatic System, reduce its pressure to between 5-10 psig (0.34-0.69 bar).
   
   Note: A pressure of 10 psig (0.69 bar) should be sufficient to extend all tubes without a payload. If any tube will not extend with 10 psig (0.69 bar), the mast may require an overhaul. Consult the factory.

3. One person, operating the Air Control Valve or switch, should slowly pressurize the mast just enough to extend the Top Tube. Close the Air Control Valve or switch as soon as the Top Tube is extended.

4. Dampen a rag with a non-abrasive cleaner or solvent such as lacquer thinner to wipe down the extended tube. Do not allow the cleaning fluid or solvent to run down inside the collar.
5. If not lubricating the mast, repeat this procedure for each tube from smallest to largest.

If lubricating the mast (optional, but helpful in extremely harsh conditions):

a. Inject approximately ½ oz. of Mast Lubricant (P/N: 900600) into the weep hole of the exposed tube. The weep holes are located between 1 and 3 feet (30 and 91 cm) below the collar on each tube except the Top Tube. Do not lubricate the exterior of the mast. This attracts dust and contaminants from the air.

b. Repeat 3, 4, and 5a for each of the remaining tubes. The larger diameter tubes should be injected with approximately 1 oz. of lubricant.

c. 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 tube.

d. Extend the mast again, one tube at a time from smallest to largest. Wipe off any excess lubricant that flows out of the weep holes.

5.4.3 Weatherizing

For weatherizing your mast in extremely harsh environmental conditions, The Will-Burt Company recommends following the Weatherizing Instructions for Pneumatic Masts (TP-4744301). See www.willfurt.com for these instructions. These instructions assume the use of the Pneumatic Mast Antifreeze Kit (P/N: 4725801).

The Pneumatic Mast Antifreeze Kit includes:

- (1) Flush Caution Label
- (1) Gallon Will-Burt Non-Toxic Pneumatic Mast Antifreeze with MSDS
- (1) Will-Burt Non-Toxic Pneumatic Mast Antifreeze Application Bottle
- (1) Mast Lubricant with MSDS and Service Sheet
- (1) Copy of the Weatherizing Instructions for Pneumatic Masts (TP-4744301)

Will-Burt Non-Toxic Pneumatic Mast Antifreeze (P/N: 473801) can also be purchased by the gallon.
5.5 Corrective Maintenance

This section describes corrective maintenance for the system. Depending on the Mast System configuration and the conditions of the Mast System, all corrective maintenance procedures may not be required. Follow the appropriate instructions for your Mast System.

Prior to performing corrective maintenance, remove the:

- Payload from the mast
- Mast from the mounting structure.

For reference information on tube diameters and collar dimensions, see Section 8.2.

5.5.1 Replace Seals, Expanders, and Yoke Assemblies

Disassemble the mast starting with the Top Tube and working towards the Base Tube. Remove any plugs from the Air Inlet Ports.

To disassemble the mast:

1. Place the mast horizontally on a pair of sawhorses or similar supports. Secure the Base Tube to the supports so the mast does not roll off. Use care to follow all applicable lifting precautions whenever lifting the mast or components of the mast.

2. Start disassembly from the top by pulling the Top Tube several inches away from the collar. On locking collar models, it is necessary to retract the Latch Pins to allow the tube to be pulled out.
3. For masts that do not need corrective maintenance done to the locks, skip to step 4.

   For masts that do need corrective maintenance done to the locks:
   a. Remove the set screw from the end of each Latch Pin Lug (the ears on each side of the collar) (Figure 5-2).

   b. Slide the Latch Pin Spring from the end of each lug. It may be necessary to roll the mast over and use gravity to allow the Latch Pin to come out.

   c. Using a hammer and a punch, drive out the roll pin on each lug just far enough to remove the Yoke Assembly.

   d. 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.

4. Remove the collar bolts and slide the collar over the end of the tube. On locking collar models, retract the Latch Pins fully to allow the collar to slide off the end of the tube.

5. Pull out the Top Tube and set it aside. Use care not to drop the tube as it comes out. Tubes can be very heavy. Two or three people or the use of a hoist is required. Use care to follow all applicable lifting precautions whenever lifting the mast or components of the mast.
6. Remove the Orifice Bolt, lock washer, Backup Washer, Expander, and Seal from the bottom of the tube. Note the Orifice Bolt ID and corresponding tube for use when reassembling (Figure 5-3).

7. Thoroughly clean and inspect all parts. The tube 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 tube. Tubes may need to be cleaned repeatedly before reassembly to remove all debris.

8. Repeat this procedure for each subsequent tube. Be careful not to damage or oblong collar bolt holes when removing the tubes.

9. As necessary, refer to the appropriate section(s) for replacement steps for the following:
   a. Replace Collar Bearing Strips (Section 5.5.2)
   b. Replacement of the Wear Rings (Section 5.5.3)
   c. Replacement of the Internal Bumpers (Section 5.5.4)
   d. Replacement of the External Bumpers (Section 5.5.5)

10. Reassemble the Orifice Bolt, lock washer, Backup Washer, new Expander, and new Seal on the bottom of the tube. Match Orifice Bolts with the correct tube by using the Orifice Bolt ID and tube OD. The ID of the Orifice Bolts should decrease as the tube OD decreases. For example, the Top Tube will have the smallest tube diameter and the Orifice Bolt with the smallest ID.

As the Orifice Bolt is being tightened, center the Seal, Expander, and Backup Washer on the Butt Plate. Torque the Orifice Bolt to 16 ft.-lb. Repeat this procedure for each tube.

11. Before reassembling the mast, use the Pneumatic Mast Grease Kit (P/N: 5448701) to lightly oil the lip of the Seal and the inside honed surface of each tube, except the Top Tube. When reassembling the mast, begin with the Base Tube and work towards the Top Tube.

12. Secure the Base Tube horizontally on saw horses or similar supports.
13. Using a second person or a brace to support the top end, hold the next tube so the top end of the tube is at a lower elevation than the Seal end. Rest the lip of the Seal on the inside of the receiving tube (Figure 5-4). Use care to follow all applicable lifting precautions whenever lifting the mast or components of the mast.

![Figure 5-4 Seal Replacement](image)

14. Slowly raise the lower end of the tube to horizontal while carefully pressing the lip of the Seal into the receiving tube. Use your thumbs and forefingers to press simultaneously on both sides of the Seal in an upward motion. Work this way until your fingers meet at the top.

   Note: Use care not to press too hard as this can bend the expander.

15. Ensure the Seal is in properly. If not, the mast will eventually leak air. If the Seal has not been inserted into the receiving tube correctly, remove the tube and repeat the process.

16. Once the Seal is inserted, guide the Wear Ring into position within its groove and slide in the tube. 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 tube.

17. Slide the tube in leaving several inches protruding. Rotate the tube so the “0” stamps on the tubes are aligned.

18. Replace the collar on the tube. Align the “0” stamp on the collar with the “0” stamp on the tube. On locking masts, retract the Latch Pins to allow the collar to slide onto the end of the tube. Ensure all bolt holes in the collar align exactly with the holes in the tube. Install and hand-tighten the collar bolts and lock washers. Ensure the collar bolts are wiped free of grease prior to installation. Torque the collar bolts to 100-120 in.-lb.

   Note: Ensure the collar bolts engage in the holes in the tube. If collar bolts do not engage the holes in the tube, the mast can separate during extension.
19. Replace the Yoke Assembly as follows:
   a. Replace the Latch Pins with the flats on the ends perpendicular to the key on the mast tube.
   b. Replace the Yoke Assembly. Ensure the hole in the Latch Lever lines up with the hole in the Latch Ear. Drive in the Roll Pin while holding it in place with a Punch. Ensure that the Latch Lever does not get jammed.
   c. Install the Latch Pin Spring and Set Screw. Turn the Set Screw all the way until it stops. Then back out the Set Screw approximately ¼ to ½ turn.
   d. Repeat this procedure for the other Latch Ear.
   e. 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.
   f. 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 for wear marks. If wear marks exist, the Latch Pin is causing friction, and the Set Screw must be loosened.

20. Repeat this procedure for each subsequent tube.

5.5.2 Replace Collar Bearing Strips and Wear Bands

Inspect the Bearing Strip or Wear band 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 Bearing Strips or Wear Bands are worn down to the metal collar, they should be replaced.

The mast has two types of locking collars. Follow the appropriate instructions for each collar.

5.5.2.1 Collar Bearing Strips for 11.25, 10.0, 9.12, and 8.25 Collars

To replace the Bearing Strips (Figure 5-5):

1. Remove the nylon screws from the collar.
2. Pull out the Bearing Strips and clean the collar.
3. Press the new Bearing Strips firmly into the groove.
4. Align the holes in the Bearing Strips with those in the collar.
5. Install and hand-tighten the new nylon screws through the collars into the threaded holes for the Bearing Strip. Apply Loctite® 495 Instant Adhesive or equivalent to the nylon screws before installation. Do not overtighten the nylon screws.
6. Cut off or file off the ends of the nylon screws protruding through the Bearing Strips until they are flush.
7. Carefully file off any excess Bearing Strip that may protrude into the keyway of the collar.
8. Before reassembling the mast, slide each collar over its mating tube. If the collar does not slide freely over the tube, it will be necessary to sand high spots on the Bearing Strip to fit. The high spots will be evident by shiny or gray marks on the white Bearing Strip.

9. Wipe the collars clean before reassembling the mast.

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**5.5.2.2 Collar Wear Bands for 13.5 and 12.375 Collars**

To replace the Bearing Strips (Figure 5-6):

1. Loosen the eight 5/16-18x0.75 bolts securing the collar together.
2. Remove and discard the External Bumper.
3. Make a note of the orientation of the Collar Retainer and remove the Collar Adjustment Retainer.
4. Lift out and discard the Collar Bearing Strips.
5. Do not remove the Collar Push Plates or Set Screws.
6. As necessary, clean the collar.
7. Insert the new Collar Bearing Strips.
8. Reposition the Collar Adjustment Retainer making sure to orient it in the same manner as it was originally secured. Apply Loctite® 243 to the hardware and torque to 75 to 85 in.-lb.

   Note: Ensure the bolts engage the holes in the locking collar and are properly secured. If the bolts are not secured, the mast can separate during extension.

10. Apply Loctite 380 Black Max or equivalent to the External Bumper and properly align it to the Collar Adjustment Retainer. As necessary, cut the External Bumper flush around the key slots as required.

11. Before reassembling the mast, slide each collar over its mating tube. If the collar does not slide freely over the tube, it will be necessary to sand high spots on the Bearing Strip to fit. The high spots will be evident by shiny or gray marks on the white Bearing Strip.

12. Wipe the collars clean before reassembling the mast.
5.5.3 Replace Wear Rings

Wear Rings are preformed split synthetic bearings that fit around the Butt Plate above the Seal on each interior tube. 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.

To replace the Wear Rings:

1. Clean the Butt Plate and Wear Ring groove (Figure 5-7).

   ![Figure 5-7 Replacing Wear Rings](image)

   0.25 Inches (6.35 mm)

   Butt Plate

   Wear Ring

   Tube Section

2. 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 ¼ inch (6.35 mm) clearance between the two ends (Figure 5-7). If necessary, cut enough off one end to get the required gap.

3. The Wear Ring must be held in place until this tube is inserted into the receiving tube. 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 tube from sliding inside the next tube, lightly grind the Wear Ring OD as necessary.

4. Before reassembling the tubes, slide each tube inside its mating tube. If the smaller tube does not slide freely inside the next largest tube, 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.

Note: On masts manufactured before 1986, Bearing Strips were cemented to the butt plates of the tubes. Wear Rings can be used to replace the old Bearing Strips in many of these masts. Consult the factory with your model and serial number for verification before ordering replacement Wear Rings.
5.5.4 Replace Internal Bumpers

On locking masts, the Internal Bumper, which looks like an O-ring, is located on the top edge of the Stop Panel on each internal tube. When the mast is disassembled, check the condition of the Internal Bumper. If the Internal Bumper has deteriorated, it should be replaced.

To replace the Internal Bumper:

1. Remove the old Internal Bumper.
2. Carefully stretch the new Internal Bumper over the end of the tube and insert it into the groove machined in the keys. The Internal Bumper should fit tightly against the tube immediately above the Stop Panel (Figure 5-8).

5.5.5 Replace External Bumpers

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.

To replace the External Bumpers:

1. Remove the old External Bumper.
2. Use acetone to clean off any old adhesive from the collar. Clean the replacement External Bumper with acetone. Allow it to dry thoroughly.
3. At room temperature, apply a light bead of Loctite® 380 Black Max or equivalent around the top of the collar. Follow the manufacturer's instructions.

Figure 5-8 Replacing Internal Bumpers
4. Place the External Bumper on the collar and align the inside diameter edges. Hold pressure on the External 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 5-9).

![Diagram of External Bumper and Collar with labels for Collar, Keyway, and External Bumper.]

*Figure 5-9 Replacing External Bumpers*
Section 6 Long-Term Storage

When putting the system into long-term storage, ensure the:

- Mast is fully nested (Section 3.3)
- Drain Cock is open to eliminate the possibility of inadvertent mast extension
- Mast is stored in a clean and dry environment
- Mast is stored vertically when storing for more than six months
- Mast is extended and lowered every six months (Section 3.3)
(This page is intentionally left blank.)
Section 7 Troubleshooting

This section describes troubleshooting for the Mast System. Use care to understand and follow all precautions while troubleshooting the Mast System.

Table 7-1 Troubleshooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause</th>
<th>Possible Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mast is frozen in the extended position.</td>
<td>Base Tube was not drained routinely. Typically freezes around collar area.</td>
<td>Wrap warming blankets around collar until ice melts. Use a heat gun or 500W quartz light.</td>
</tr>
<tr>
<td></td>
<td>There is ice buildup on the exterior of the mast.</td>
<td>Follow the Instructions for Clearing Ice Buildup on the Exterior of a Pneumatic Mast (TP-5253501)</td>
</tr>
<tr>
<td></td>
<td>Locks are stuck in the locked position due to lack of exercising.</td>
<td>Use Lock Pin Extractor Kit (P/N: 5448601)</td>
</tr>
<tr>
<td>Mast is frozen in nested position.</td>
<td>Base Tube was not drained routinely. Typically damages tubes.</td>
<td>Send to the manufacturer for repair or replacement.</td>
</tr>
<tr>
<td>Largest Intermediate Tube stuck</td>
<td>Support Bracket too tight.</td>
<td>Loosen shims. Shim as necessary between clamp halves.</td>
</tr>
</tbody>
</table>

Continued
Table 5-1 Troubleshooting Continued

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause</th>
<th>Possible Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mast will not lower without rocking.</td>
<td>Not enough weight.</td>
<td>See Section 5.4.2 for mast cleaning and lubrication.</td>
</tr>
<tr>
<td></td>
<td>Bent tube.</td>
<td>Add weight to Platform.</td>
</tr>
<tr>
<td></td>
<td>Broken Internal Bumper.</td>
<td>Check tube trueness. If bent, order replacement (Section 5.3).</td>
</tr>
<tr>
<td></td>
<td>Collar Inserts tight.</td>
<td>Depressurize mast. Remove the collar, and lift the tube to check the Internal Bumper (Section 5.5). If necessary, order replacement (Section 5.3).</td>
</tr>
<tr>
<td>Rotational movement in tubes.</td>
<td>Bearing Strips or inserts worn.</td>
<td>Depressurize and disassemble mast (Section 5.5). File or lightly grind to pre-fit Collar Inserts as necessary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Locking Strip Collar: Order new Bearing Strips (Section 5.3). Customer must pre-fit.</td>
</tr>
</tbody>
</table>

For additional information, please contact Will-Burt Customer Service at 330-684-5298.
Section 8 Reference

This section provides reference information for the system as follows:

- Extended Glossary of Terms (Section 8.1)
- Reference Dimensional Information (Section 8.2)
- Drawings (Section 8.3)

8.1 Extended Glossary of Terms

This section defines terms used within this manual as follows:

- General Terms and Abbreviations (Section 8.1.1)
- Mounting Position Terms (Section 8.1.2)

8.1.1 General Terms and Abbreviations

This section describes general terms and abbreviations used within this manual.

- “Amp” stands for ampere which is a unit of electric current
- “AWG” stands for American Wire Gauge
- “Bar” is a metric unit of pressure. One Bar is approximately equal to the atmospheric pressure at sea level.
- “Base Tube” refers to the tube with the largest diameter. When the mast is fully extended, this is the tube closest to the mounting surface.
- “BCD” stands for Bolt Circle Diameter
- “Bearing Strips” refer to plastic strips located in some collars where tubes make contact with each other.
- “Butt Plate” refers to the bottommost plate on each intermediate tube
- “CFM” stands for Cubic Feet per Minute
- “Collar Inserts” refer to machined pieces of plastic with a notch for the key located in some collars.
- “Collars” attach to the top of each tube except the Top Tube.
- “Drain Hole” refers to the threaded hole on the side of the Base Tube designed to facilitate the water drainage during periods of extension. A Drain Kit may be installed to the Drain Hole to route water away from the Mast System. The Base Tube has one Drain Hole.
• “Extended” refers to the partial- or full-raised position of the mast that the mast pneumatically goes to from the nested position. In the extended position, some or all the tubes have risen.

• “ft.-lb.” stands for foot-pounds, which is a unit of torque equal to the force in pounds multiplied by the distance in feet to the pivot point

• “Hz” stands for hertz and is defined as one cycle per second

• “ID” stands for Inside Diameter or the diameter to the inside edge of a circle

• “in.-lb.” stands for inch-pounds, which is a unit of torque equal to the force in pounds multiplied by the distance in inches to the pivot point

• “Intermediate Tubes” refer to the tubes between the Base Tube and the Top Tube.

• “LPM” stands for Liters per minute

• “Mast” to refer to the telescoping pneumatic mast

• “Mast System” to refer to the entire Pneumatic Mast System (telescoping mast, pneumatic system, mounting hardware, and additional accessories)

• “Nested” refers to the position of the mast were no tubes have risen. The mast remains retracted. This position is sometimes referred to as “stowed”.

• “N m” stands for newton-meter, which is a unit of torque

• “NPT” stands for “American National Standard Pipe Thread” or “National Pipe Thread” for short; a United States standard for thread specifications on pipes and fittings. NPT threads are tapered.

• “OD” stands for Outside Diameter or the diameter to the outside edge of a circle

• “Payload” to refer to the object or equipment being raised by the mast to an operational height

• “PSI” stands for pound-force per square inch

• “PSIG” stands for pound-force per square inch gauge. PSIG refers to a gauge that has been calibrated to read zero at sea level.

• “P/N” stands for Part Number. These are Will-Burt part numbers for various components in the Mast System.

• “SCFM” stands for standard cubic feet per minute, or CFM adjusted to 14.7 PSI (1 Bar) and 68°F (20°C)

• “Top Tube” refers to the tube with the smallest diameter. When the mast is fully extended, this is the tube furthest from the mounting surface.

• “Top Tube Stop” refers to the component at the top of the Top Tube. The Top Tube Stop prevents the Top Tube from sliding too far down into a nested mast.

• “Tube Head” refers to the component at the base of the Base Tube.

• “UHDL” stands for Ultra-Heavy-Duty Locking
• “Wear Rings” are preformed split synthetic bearings that fit in the Wear Ring Groove around the Butt Plate above the Seal on each interior tube. The Wear Rings guide the bottom of the tube through the next larger tube.

• “Weep Holes” refer to the holes on the Intermediate Tubes which are designed to facilitate the drainage of water during periods of extension. Each Intermediate Tube has four Weep Holes.

• “Ø” stands for diameter

8.1.2 Mounting Position Terms

For the purposes of this manual, regions of the mounting location are defined as follows:

• “Mounting Structure” is the overall structure where the Mast is mounted.
• “Mounting Surface” is the surface to which the Base Plate is secured. When installing inside a vehicle, this will likely be the floor.
• “Support Structure” is the vertical surface to which the External Support Bracket is secured. This term applies to external mount applications only.
8.2 Reference Dimensional Information

This section describes reference dimensional information as follows:

- Tube Diameter (Section 8.2.1)
- Collar Information (Section 8.2.2)

8.2.1 Tube Diameters

<table>
<thead>
<tr>
<th>Tube Diameter (ØA)</th>
<th>inch</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 ¼</td>
<td>5.25</td>
<td>133</td>
</tr>
<tr>
<td>6</td>
<td>6.0</td>
<td>152</td>
</tr>
<tr>
<td>6 ¾</td>
<td>6.75</td>
<td>171</td>
</tr>
<tr>
<td>7 ½</td>
<td>7.5</td>
<td>191</td>
</tr>
<tr>
<td>8 ¼</td>
<td>8.25</td>
<td>210</td>
</tr>
<tr>
<td>9 ⅛</td>
<td>9.125</td>
<td>232</td>
</tr>
<tr>
<td>10</td>
<td>10.0</td>
<td>254</td>
</tr>
<tr>
<td>11 3/16</td>
<td>11.188</td>
<td>284</td>
</tr>
<tr>
<td>12 ⅜</td>
<td>12.375</td>
<td>314</td>
</tr>
<tr>
<td>13 ½</td>
<td>13.5</td>
<td>343</td>
</tr>
</tbody>
</table>

*Table 8-1 Tube Diameters*

*Figure 8-1 Tube Diameters*
8.2.2 Collar Information

This section describes information pertaining to the collar dimensions as follows:

- Information for 11.25, 10.0, 9.12, and 8.25 Locking Collars (Section 8.2.2.1)
- Information from 13.5 and 12.375 Locking Collars (Section 8.2.2.2)

8.2.2.1 Information for 11.25, 10.0, 9.12, and 8.25 Locking Collars

<table>
<thead>
<tr>
<th>Tube</th>
<th>Locking OD</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>inch</td>
</tr>
<tr>
<td>6.0</td>
<td>6.75</td>
</tr>
<tr>
<td>6.75</td>
<td>7.50</td>
</tr>
<tr>
<td>7.5</td>
<td>8.25</td>
</tr>
<tr>
<td>8.25</td>
<td>9.00</td>
</tr>
<tr>
<td>9.12</td>
<td>9.75</td>
</tr>
<tr>
<td>10.0</td>
<td>10.75</td>
</tr>
<tr>
<td>11.25</td>
<td>11.75</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Collar</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>12.75</td>
</tr>
<tr>
<td>6</td>
<td>13.50</td>
</tr>
<tr>
<td>6</td>
<td>14.25</td>
</tr>
<tr>
<td>6</td>
<td>15.00</td>
</tr>
<tr>
<td>6</td>
<td>15.75</td>
</tr>
<tr>
<td>6</td>
<td>16.63</td>
</tr>
<tr>
<td>6</td>
<td>17.50</td>
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</table>

<table>
<thead>
<tr>
<th>inch</th>
<th>mm</th>
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<tbody>
<tr>
<td>324</td>
<td>824</td>
</tr>
<tr>
<td>343</td>
<td>870</td>
</tr>
<tr>
<td>362</td>
<td>920</td>
</tr>
<tr>
<td>381</td>
<td>968</td>
</tr>
<tr>
<td>400</td>
<td>1016</td>
</tr>
<tr>
<td>422</td>
<td>1072</td>
</tr>
<tr>
<td>445</td>
<td>1127</td>
</tr>
</tbody>
</table>

Figure 8-2 Collar Information
### 8.2.2.2 Information from 13.5 and 12.375 Locking Collars

**Table 8-3 Ultra-Heavy-Duty Collar Information**

<table>
<thead>
<tr>
<th>Tube Ø</th>
<th>A Ø</th>
<th>B Ø</th>
<th>C Ø</th>
<th>D Ø</th>
<th>Collar Bolts</th>
</tr>
</thead>
<tbody>
<tr>
<td>inch</td>
<td>mm</td>
<td>inch</td>
<td>mm</td>
<td>inch</td>
<td>mm</td>
</tr>
<tr>
<td>12.375</td>
<td>15.73</td>
<td>400</td>
<td>13.94</td>
<td>354</td>
<td>12.30</td>
</tr>
<tr>
<td>13.50</td>
<td>16.85</td>
<td>428</td>
<td>15.13</td>
<td>384</td>
<td>13.42</td>
</tr>
</tbody>
</table>

**Figure 8-3 Collar Information**

### 8.3 Drawings

Refer to the [www.willburt.com](http://www.willburt.com) for drawings of your Mast System.