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.
## Document History

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<thead>
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<th>Document Numbers</th>
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<td>Updated Figure 1-6. Updated sections 1.5.1.4, 4.3, and 4.6.</td>
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</tr>
</tbody>
</table>
# Table of Contents

## Section 1 Introduction

1.1 Safety Precautions .......................................................... 1-2
1.2 How this Manual is Organized ........................................... 1-2
1.3 Specifications ............................................................... 1-3
1.4 Definitions of Terms and Abbreviations ................................. 1-4
1.5 Major Components .......................................................... 1-8

### 1.5.1 Telescoping Mast

- 1.5.1.1 Hardware Bag (P/N: 902853) .................................... 1-9
- 1.5.1.2 Drain Kit (P/N: 902982) ........................................... 1-10
- 1.5.1.3 Magnet Warning Kit (P/N: 5170701) ............................ 1-11
- 1.5.1.4 Identification Plate (P/N: 902851) ............................. 1-12
- 1.5.1.5 Label Kit (P/N: 913918) .......................................... 1-13

### 1.5.2 Pneumatic System Options

- 1.5.2.1 Compressor (P/N: Varies) ........................................ 1-15
- 1.5.2.2 Filter Regulator Lubricator (P/N: 900484) ..................... 1-15
- 1.5.2.3 Filter Lubricator (P/N: 900634) ............................... 1-16
- 1.5.2.4 Solenoid Air Valve Kit (P/N: Varies) ......................... 1-16
- 1.5.2.5 Hand Pump (P/N: 5050101) ...................................... 1-17

### 1.5.3 Mounting Hardware Options

- 1.5.3.1 Base Plate (P/N: Varies) ......................................... 1-17
- 1.5.3.2 Support Bracket .................................................... 1-18
- 1.5.3.3 Shelf Bracket (P/N: Varies) ...................................... 1-19

### 1.5.4 Additional Accessories Options

- 1.5.4.1 Nycoil® (P/N: Varies) ............................................. 1-21
- 1.5.4.2 D-TEC II® (P/N: Varies) ....................................... 1-22

## Section 2 Installation

2.1 Pre-Installation Check .................................................... 2-1
2.2 Installation Tools .......................................................... 2-2
2.3 Components .................................................................. 2-3
2.4 Unpack ........................................................................ 2-3
2.5 Installation Dimensions .................................................... 2-4
2.6 Mast Installation: Internal Mount ....................................... 2-10

#### 2.6.1 Internal Mount Quick Summary

2.7 Mast Installation: External Mount ....................................... 2-13

#### 2.7.1 External Mount Quick Summary

2.8 Drain Kit Installation ........................................................ 2-16

## Section 3 Operation

3.1 Pre-Operation Check ........................................................ 3-1
3.2 Operation Tools ................................................................. 3-3
3.3 Prepare the System ............................................................. 3-3
3.4 Extend the Mast ................................................................. 3-3
3.5 Lower the Mast ................................................................. 3-3
3.6 Transportation ................................................................ 3-4

Section 4 Maintenance and Adjustments .................................. 4-1
  4.1 Pre-Maintenance Check ...................................................... 4-1
  4.2 Periodic Maintenance ......................................................... 4-2
  4.3 Replacement Parts ............................................................ 4-2
  4.4 Maintenance Tools ........................................................... 4-3
  4.5 Reference Dimensional Information .................................... 4-4
  4.6 Mast Cleaning and Lubrication ........................................... 4-6
  4.7 Weatherizing .................................................................. 4-7
  4.8 Can Lock Wedge Adjustment ............................................. 4-8
  4.9 Can Lock Base Adjustment ............................................... 4-8
  4.10 Corrective Maintenance .................................................... 4-9
    4.10.1 Disassemble the Mast ................................................ 4-9
    4.10.2 Replace Seals and Expanders ..................................... 4-11
    4.10.3 Replace Collar Bearing Strips ..................................... 4-11
    4.10.4 Replace Wear Rings .................................................. 4-12

Section 5 Troubleshooting ......................................................... 5-1

Table of Figures

Figure 1-1 Nested .................................................................... 1-4
Figure 1-2 Fully Extended ......................................................... 1-4
Figure 1-3 Bearing Strip and Collar (P/N: 5099109 Shown) .......... 1-5
Figure 1-4 Can Lock and Can Lock Wedge ............................... 1-5
Figure 1-5 Mast Parts ............................................................... 1-6
Figure 1-6 Weep Hole ............................................................... 1-7
Figure 1-7 Inside and Outside Diameters ................................. 1-7
Figure 1-8 Telescoping Mast ..................................................... 1-9
Figure 1-9 Hardware Bag Contents ......................................... 1-11
Figure 1-10 Drain Kit ............................................................... 1-12
Figure 1-11 Identification Plate ................................................. 1-13
Figure 1-12 Label Kit ............................................................... 1-14
Figure 1-13 Filter Regulator Lubricator .................................... 1-15
Figure 1-14 Filter Lubricator ..................................................... 1-16
Figure 1-15 Hand-Held Remote Controller .............................. 1-16
Figure 1-16 Hand Pump (P/N: 5050001) .................................... 1-17
Figure 1-17 Non-Rotating Base Plate ....................................... 1-18
Figure 1-18 Internal Support Bracket ....................................... 1-19
Figure 1-19 External Support Bracket ...................................... 1-20
Figure 1-20 Shelf Bracket (P/N: 4454001 Shown) ...................... 1-20
Table of Tables

Table 1-1 Mast Specifications ................................................................. 1-3
Table 1-2 Functional Specifications ....................................................... 1-3
Table 1-3 D-TEC II® Specifications ....................................................... 1-23
Table 2-1 Tools and Materials Recommended for Installation ................... 2-2
Table 2-2 Mast Installation Dimensions ............................................... 2-5
Table 2-3 Non-Rotatable Base Plate Dimensions ..................................... 2-6
Table 2-4 Internal (Roof) Support Bracket Mounting Information .............. 2-7
Table 2-5 External Support Bracket Mounting Information ....................... 2-8
Table 2-6 Shelf Bracket Mounting Information ....................................... 2-9
Table 3-1 Tools and Materials Recommended for Operation .................... 3-3
Table 4-1 Tools and Materials Recommended for Maintenance .................. 4-3
Table 4-2 Tube Diameters ..................................................................... 4-4
Table 4-3 Collar Information .................................................................. 4-5
Table 5-1 Troubleshooting ..................................................................... 5-1

Figure 1-21 Nycoil® Cable ........................................................................ 1-21
Figure 1-22 D-TEC II® ............................................................................ 1-22
Figure 2-1 Shipping Crate ......................................................................... 2-3
Figure 2-2 Hoist the Mast ......................................................................... 2-4
Figure 2-3 Mast Installation Dimensions ................................................ 2-5
Figure 2-4 Non-Rotatable Base Plate Dimensions ..................................... 2-6
Figure 2-5 Internal (Roof) Support Bracket Mounting Information .......... 2-7
Figure 2-6 External Support Bracket Mounting Information .................... 2-8
Figure 2-7 Shelf Bracket Mounting Information ....................................... 2-9
Figure 2-8 External Mount Installation .................................................... 2-13
Figure 2-9 Drain Kit Installation ............................................................... 2-16
Figure 2-10 General Pneumatic System Layout ....................................... 2-18
Figure 2-11 Magnetic Switch Assembly Attached to Base Tube ............... 2-19
Figure 2-12 Wire the Magnetic Switch Assembly Kit ............................... 2-19
Figure 2-13 Relay and Magnetic Switch Assembly Wiring ...................... 2-20
Figure 2-14 Countersunk Holes on Bottom of Can Lock Platform ............. 2-21
Figure 4-1 Tube Diameters ....................................................................... 4-4
Figure 4-2 OD on Non-Locking Collar ................................................... 4-5
Figure 4-3 Can Lock and Can Lock Wedge ............................................. 4-8
Figure 4-4 Can Lock ................................................................................ 4-8
Figure 4-5 Ceramic Ring Magnet Assembly (P/N: 5200601) ..................... 4-10
Figure 4-6 Bearing Strip and Keyway ..................................................... 4-11
Figure 4-7 Replacing Bearing Strips ....................................................... 4-12
Figure 4-8 Replacing Wear Rings ............................................................ 4-13
Safety Summary

This section describes safety information for the Low Profile Non-Locking Pneumatic Mast. Be sure to read and understand the entire manual before performing any procedure outlined in this manual.

SIGNAL WORD DEFINITIONS

**WARNING**

Warnings highlight an essential operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, could result in injury to, or death of, personnel or long-term health hazards.

**CAUTION**

Cautions highlight an essential operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, could result in damage to, or destruction of, equipment or loss of mission effectiveness.

**Note:** Notes highlight an essential operating or maintenance procedure, condition, or statement.

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, and maintenance. Additional precautions that apply to specific procedures and steps may be listed with the procedure or step to which they apply.

**WARNING**

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

**WARNING**

Shock Hazard! Hazardous voltages are present in this equipment and may also be present in any associated items. Observe general safety precautions for handling equipment using high voltage. Always disconnect power before performing repair or test operations. Contact with high voltage will result in death or serious injury.

**WARNING**

Resuscitation! 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

Safety Equipment! Helmets or hard hats, eye protection, gloves, and safety shoes or combat boots 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! Do not operate in high winds. Operate on level ground only. Stand clear of mast and mast payload during operation. Be certain mast is level and secure before and during installation, operation and maintenance. Mast tip over could result in death or serious injury.

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

Trained Personnel Only! Installation, operation, and maintenance to be performed by trained and authorized personnel only. Death or serious injury could result if proper installation, inspection, operation, and maintenance procedures are not observed.

WARNING

Pinch Point Hazard! Keep clear of moving parts. Be sure to stay clear of mast during operation. Moving parts can crush and cut resulting in serious injury.

WARNING

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

WARNING

Burst Hazard! Do not exceed maximum operating pressure of 35 psi for heavy-duty masts. Keep personnel clear of safety valve exhaust direction. Over pressurizing mast will trip safety valve and could result in death or serious injury.

WARNING

Lifting Hazard! 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.
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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.

This manual describes installation, operation, maintenance, and troubleshooting for the Low Profile Heavy-Duty Non-Locking (HDNL) Pneumatic Mast.

The low profile HDNL pneumatic mast comprises of:

- A telescoping mast
- A pneumatic system
- Mounting hardware

The mast is designed to:

- Minimize the nested height
- Minimize mast twist while extended
- Stabilize the payload while in transit

The mast has:

- Internal, non-locking collars
- A can lock which also serves as the payload platform

The low profile HDNL pneumatic mast does not currently support the following:

- Internally wired options

The low profile HDNL pneumatic mast is available in the following models:

- 7-27 (P/N: 710303004)
- 6-29 (P/N: 710303005)
- 5.3-32 (P/N: 710303200)
- 7-42 (P/N: 710304202)
- 6-42 (P/N: 710304204)
- 7.3-50 (P/N: 710305202)
1.1 Safety Precautions

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

1.2 How this Manual is Organized

This manual is organized into the following sections:

- Section 1 Introduction
- Section 2 Installation
- Section 3 Operation
- Section 4 Maintenance
- Section 5 Troubleshooting
1.3 Specifications

This section details specifications as follows:

- Table 1-1 Mast Specifications
- Table 1-2 Functional Specifications

<table>
<thead>
<tr>
<th>Table 1-1 Mast Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated Payload Capacity</strong></td>
</tr>
<tr>
<td>7-27</td>
</tr>
<tr>
<td>6-29</td>
</tr>
<tr>
<td>5.3-32</td>
</tr>
<tr>
<td>7-42</td>
</tr>
<tr>
<td>6-42</td>
</tr>
<tr>
<td>7.3-50</td>
</tr>
</tbody>
</table>

Note:

- Payload capacity will be affected by wind sail area; consult factory
- Tube Diameter listed as: Base Tube Diameter–Top Tube Diameter
- Dimensions and specifications provided are for reference only, and are not intended for vehicle design purposes
- Specifications may be subject to change without notice

<table>
<thead>
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<th>Table 1-2 Functional Specifications</th>
</tr>
</thead>
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<td><strong>Specification</strong></td>
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<tr>
<td>Survival Wind Speed Capabilities</td>
</tr>
<tr>
<td>Operational Wind Speed Capabilities</td>
</tr>
<tr>
<td>Deployment Wind Speed Capabilities</td>
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</tbody>
</table>
1.4 Definitions of Terms and Abbreviations

Throughout this manual, the following terms and abbreviations are used.

General Terms:

- Mast refers to the telescoping low profile HDNL pneumatic mast.
- System refers to the entire low profile HDNL pneumatic mast system (telescoping mast, pneumatic system, mounting hardware, and accessories).
- Payload refers to the object or equipment being raised by the mast to an operational height.

Mast Positions:

- Nested (Figure 1-1) refers to the position of the mast where no tubes of the mast have risen. The mast remains retracted. This position is sometimes referred to as “stowed”.
- Extended (Figure 1-2) 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 mast tubes have risen.
Mast Terms:

- Bearing Strips (Figure 1-3) refer to plastic strips located in the collars where tubes make contact with each other. Bearing strips are sometimes referred to as collar inserts or Delrins.

- Collars (Figure 1-3) attach to the top of each mast tube except the top tube. When the mast is nested, each collar is stored inside the next larger collar to minimize the nested height.

![Bearing Strip and Collar](Figure 1-3 Bearing Strip and Collar (P/N: 5099109 Shown))

- Can Lock (Figure 1-4) refers to the system used to lock the nested mast in place. The can lock is attached to the top of the top tube. The top of the can lock also serves as the payload platform.

- Can Lock Wedge (Figure 1-4) refers to the wedges that secure the can lock in position when the mast is nested.

![Can Lock and Can Lock Wedge](Figure 1-4 Can Lock and Can Lock Wedge)
• Backwashers (Figure 1-5) fit inside the expanders.
• Expanders (Figure 1-5) fit inside the seals and over the backup washers.
• Orifice Bolts (Figure 1-5) attach the backwashers, expanders, and seals to the tube butt plates.
• A Pipe Plug (Figure 1-5) is located at the bottom of the mast. A second pipe plug is located at the bottom side of the base tube (not shown).
• Seals (Figure 1-5) fit over the expanders.
• Wear Rings (Figure 1-5) are preformed split synthetic bearings that fit in the wear ring groove around the butt plate above the seal on each interior mast tube. The wear rings guide the bottom of the tube through the next larger tube.

![Diagram of mast parts](image)

• Weep Holes (Figure 1-6) refer to holes on each mast tube except the top tube which are designed to facilitate the drainage of water during periods of extension. Weep holes are sometimes referred to as drain holes.
Abbreviations:

- ID stands for Inside Diameter (Figure 1-7) or the diameter to the inside edge of a circle.
- OD stands for Outside Diameter (Figure 1-7) or the diameter to the outside edge of a circle.
- NPT stands for National Pipe Thread, a United States standard for thread specifications on pipes and fittings.
- 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.
- BAR is a metric unit of pressure approximately equal to the atmospheric pressure at sea level.
1.5 Major Components

The major components of the mast system include:

- Telescoping Mast (P/N: Varies)
  - Hardware Bag (P/N: 902853)
  - Drain Kit (P/N: 902982)
  - Magnet Warning Kit (P/N: 5170701)
  - Identification Plate (P/N: 902851)
  - Label Kit (P/N: 913918)

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

- Mounting Hardware Options (Sold Separately)
  - Base Plate (P/N: Varies)
  - Support Bracket
    - Internal (roof) (P/N: Varies)
    - External (P/N: Varies)
  - Shelf Bracket (P/N: Varies)

- Additional Accessories Options (Sold Separately)
  - Nycoil® (P/N: Varies)
  - D-TEC II® (P/N: Varies)
1.5.1 Telescoping Mast

The telescoping mast (Figure 1-8):

- Is the structure used to raise the payload to an operational height
- Extends and retracts pneumatically
- Is constructed with concentric nesting mast tubes
- Is made from aluminum tube
- Must remain pressurized to support the payload at an extended height
- Has a can lock which also serves as the payload platform

![Diagram of Telescoping Mast]

The mast tubes are as follows:

- Base Tube which is the tube with the largest diameter
- Top Tube which is the tube with the smallest diameter
- Intermediate Tubes which are the tubes between the base tube and top tube

To establish azimuth (rotational) integrity between tubes, each mast tube, except the base tube, has (2) rectangular keys along the length of the tube. The keys match with keyways on the larger, adjacent mast tube’s collar.
Items shipping with the mast include:

- Hardware Bag
- Drain Kit
- Magnet Warning Kit
- Identification Plate (ships installed on mast)
- Label Kit (ships installed on mast)

1.5.1.1 Hardware Bag (P/N: 902853)

The system includes a 4 x 6 in. (102 x 152 mm) plain cloth hardware bag. The contents of the hardware bag are used to secure the mast to the base plate, to mount the mast, to protect the mast from over pressurization, to drain water, and to connect to the air supply line.

The hardware bag includes (Figure 1-9):

- (1) Safety Valve ¼ in. (6.35 mm) NPT, 55 PSI (P/N: 913962)
- (2) Close Nipple ¼ in. (6.35 mm) Brass (P/N: 900508)
- (1) Cross Brass (P/N: 900516)
- (1) Air Cock #64-T (P/N: 900382)
- (1) ¾ x ¼ in. (9.5 x 6.35 mm) Bushing, Reducing, 125 LB Red Brass, NPT (P/N: 900522)
- (4) Bolt ¾-16 x 1-½ in. (9.5-406.4 x 38 mm), Stainless Steel (P/N: 901594) (used to mount the mast)
- (4) Flat Washer, ¾ in. (9.5 mm), Stainless Steel (P/N: 2054) (used to mount the mast)
- (4) Lock Washer, ¾ in. (9.5 mm), Stainless Steel (P/N: 0801) (used to mount the mast)
- (4) Nut ¾-16 in. (9.5-406.4 mm), Hex, Heavy-Duty, Stainless Steel (P/N: 901593) (used to mount the mast)
- (4) Screw ¾-16 x 1 (9.5-406.4 x 25.4 mm) Flathead Stainless Steel (P/N: 2772) (used attach the base plate to the mast)
- (1) Bushing Threaded Hex ¼-½ in. (6.35-12.7 mm) NPT Brass (P/N: 912293)
- (1) Parts Bag (P/N: 17337) (not shown)
1.5.1.2 Drain Kit (P/N: 902982)

The drain kit outfits the mast with a means to drain water which has entered the top and intermediate mast tubes which may cause damage. The fittings are used to attach one end of the tube to the weep hole in the base mast tube and route the other end of the tube outside the mounting structure or vehicle to drain water. The air cock (Figure 1-9) from the hardware bag drains water from the base mast tube.

The drain kit includes (Figure 1-10):

- (1) Washer ¾ in. (9.5 mm), ID x ¾ (19 mm), OD x 1/16 (1.9 mm) Thick (P/N: 900555)
- (1) Locknut ¼ in. (3.2 mm) Brass (P/N: 900556)
- (1) ¼ in. (6.35 mm) Hose Adaptor (P/N: 900564)
- (1) ¼ in. (6.35 mm) Bulkhead Fitting (P/N: 900565)
- 8 ft. (2.4 m), ¼ in. (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)
1.5.1.3 Magnet Warning Kit (P/N: 5170701)

The magnet warning kit is a system designed to warn against moving a vehicle while the telescoping mast is partially or fully extended. The magnet warning kit is packaged in a brown cardboard box.

The magnet warning kit includes:

- (1) Hose Clamp 7-¼-10 (P/N: 900725)
- (1) Reed Switch (P/N: 5060601)
- (1) Notice Label (P/N: 900747)
- (1) Flasher (P/N: 900405)
- (2) Lights (P/N: 900408)
- (1) Relay (P/N: 901065)
- (1) Carton (P/N: 34240)
- (1) ATC Inline Fuse Holder (P/N: 299084)
- (1) Fuse 3A, 32 Violet ATC (P/N: 221017)
- (2) MTG. BRKT MAG Warning Kit GRI Switch (P/N: 5057801)
- (2) Screw Cap #8-32x1.000 (P/N: 1860)
- (2) Nylock Hex Nuts (P/N: 2465)
1.5.1.4 Identification Plate (P/N: 902851)
An identification plate is secured to the can lock base and centered to the front can lock cap screw. The identification plate is engraved with information pertaining to the mast (Figure 1-11).

![Identification Plate](image)

1.5.1.5 Label Kit (P/N: 913918)
The label kit is used to identify potential hazards within the system. These labels come installed on the system.

The label kit includes (Figure 1-12):

- (2) Pinch Point Hazard Labels (P/N: 900878)
- (1) Sales and Service Label (P/N: 911956)
- (1) Electrocution Hazard Label (P/N: 900711)
- (1) Read Manual Hazard Label (P/N: 900710)
- (1) Burst Hazard Label (P/N: 900763)
- (1) CE Mark (P/N: 913869)
- (1) Center of Gravity (P/N: 913865)
- (1) Frozen Water Hazard Label (P/N: 4007401)
- (2) Combination Hazard Labels (P/N: 4022201)

Additional labels are provided with the operator's manual. These labels can be applied where the operator deems appropriate.
Figure 1-12 Label Kit
1.5.2 Pneumatic System Options

The pneumatic system refers to a means of safely controlling the pressurization and depressurization of the mast. Components in the hardware bag and a port near the bottom of the base tube are provided to connect an air supply to the mast.

Possible options for the pneumatic system include:

- Compressor
- Filter Regulator Lubricator
- Filter Lubricator
- Solenoid Air Valve Kit
- Hand Pump

1.5.2.1 Compressor (P/N: Varies)

Will-Burt offers a variety of low-maintenance oil-less air compressor systems.

Compressors are available for input power of:

- 12 VDC
- 24 VDC
- 110 VAC (60 Hz)
- 220 VAC (50 and 60 Hz)

For more information on the compressors, see www.willburt.com.

1.5.2.2 Filter Regulator Lubricator (P/N: 900484)

A filter regulator lubricator (Figure 1-13) is available for use with the following compressors:

- P/N: 912361 (220 VAC)
- P/N: 902404 (220 VAC)

![Filter Regulator Lubricator](image-url)
1.5.2.3 Filter Lubricator (P/N: 900634)

A filter lubricator (Figure 1-14) is available for use with the following compressors:

- P/N: 912361 (220 VAC)
- P/N: 902404 (220 VAC)

![Filter Lubricator](image)

Figure 1-14 Filter Lubricator

1.5.2.4 Solenoid Air Valve Kit (P/N: Varies)

Will-Burt offers a variety of solenoid air valve kits. A hand-held remote controller (HHRC) (P/N: 912247) (Figure 1-15) is available with the solenoid air valve kit.

Solenoid air valve kits are available for input power of:

- 12 VDC
- 24 VDC
- 110 VAC
- 220 VAC (50 Hz)

![Hand-Held Remote Controller](image)

Figure 1-15 Hand-Held Remote Controller

For more information on the solenoid air valve kits, see [www.willburt.com](http://www.willburt.com).
1.5.2.5 Hand Pump (P/N: 5050101)
The hand pump (Figure 1-16) 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 ft. (1.8 m) of Air Hose (P/N: 108768)
- (2) Push Connector Fittings (P/N: 4024001)

1.5.3 Mounting Hardware Options
Mounting hardware is used to secure the mast in place.

Possible options for the mounting hardware include:

- Base Plate
- Support Bracket
- Shelf Bracket
1.5.3.1 Base Plate (P/N: Varies)
The base plate is used to stabilize and secure the mast to the mounting structure and is designed for non-rotating masts. A base plate for a rotating mast is planned for future release.

The non-rotating base plate (Figure 1-17) is a square aluminum plate with countersunk holes that match threaded holes on the base mast tube. Screws, included in the hardware bag, can be used to attach the non-rotating base plate to the base mast tube. Bolts, nuts, and washers, included in the hardware bag, are sized for the through-holes in the corners of the non-rotating base plate so the mast can be secured to a mounting structure. A hole in the center of the plate allows the option of routing air to the bottom of the base tube.

![Non-Rotating Base Plate](image)

**Figure 1-17 Non-Rotating Base Plate**

1.5.3.2 Support Bracket
Support brackets can be for internal or external mounting to position and support the mast.

**Internal (roof) (P/N: Varies)**
The internal mounting (Figure 1-18) kit contains the hardware used to position and support an internally mounted mast.

The kit includes:

- (1) Weather Bonnet
- (2) Gaskets
- (1) Bearing Strip
- (1) Ceiling Plate
- (1) Roof Flange
- (1) O-Ring
Bolts, lock washers, and hex nuts, ¼ in. (M6), not provided, can be used as fasteners. Bolt length will depend on the specific application and is to be determined by the customer.

![Internal Support Bracket (P/N: 905733 Shown)](image)

**External (P/N: Varies)**

External mounting is used to brace masts against a mounting structure.

The external support bracket (Figure 1-19) includes:

- (1) Stand-Off which is a steel sheet metal that positions the support brackets away from the mounting structure.
- (2) Aluminum Support Brackets which are C-shaped support brackets that are bolted together around the base mast tube to hold the mast against the support structure.
- (1) Bearing Strip which attaches inside the support brackets to protect the mast from being scraped by the support brackets.
- Fasteners which secure the assembly together.
1.5.3.3 Shelf Bracket (P/N: Varies)

The shelf bracket (Figure 1-20) is a painted, steel weldment that can be bolted into a mounting structure and used to position and support an externally mounted mast.

Shelf brackets for rotating masts will become available when rotating mast options are released.
1.5.4 Additional Accessories Options

Additional accessories are available for the system.

Possible accessories include:

- Nycoil®
- D-TEC II®

For additional options, see www.willburt.com.

1.5.4.1 Nycoil® (P/N: Varies)

The Nycoil® cable conduit (Figure 1-21) is an external coiled hose used to house electrical wiring, antenna RF, and positioner cables.

![Figure 1-21 Nycoil® Cable](image)

Features:

- Compactly retracts when mast is nested.
- Extends neatly with mast.

Available Sizes of Cable:

- ½ in. (12.7 mm) cable ID, 9 in. (229 mm) coil OD
- ¾ in. (19 mm) cable ID, 13 in. (330 mm) coil OD
- 1 in. (25.4 mm) cable ID, 16.5 in. (419 mm) coil OD
- 1 ¼ in. (31.8 mm) cable ID, 21.5 in. (546 mm) coil OD

The Nycoil® length should be (2) times the difference between the mast extended and nested heights. Depending on the system being used, some restrictions on the size of the Nycoil® may occur. Consult engineering on specific applications.

For more information on the Nycoil®, see www.willburt.com.
1.5.4.2 D-TEC II® (P/N: Varies)

The D-TEC II® (Figure 1-22) safety system provides overhead power line and obstacle detection, and above the mast illumination. The built-in anti-collision system automatically stops mast extension providing added protection for the operator and equipment from overhead hazards.

The D-TEC II® comes in (2) packages:

- D-TEC II® Package with Rack Mount (P/N: 4370401) includes sensor, rack mount, installation kit, and mounting bracket.
- D-TEC II® Package with Wall Mount (P/N: 4370402) includes sensor, wall mount, installation kit, and mounting bracket.

Features:

- (4) detection modes that operate simultaneously:
  - Electric Field (E-Field) detection to sense the presence of nearby high voltage AC.
  - Magnetic Field (H-Field) detection to sense the presence of nearby high current AC.
  - Ultrasonic detection to sense the presence of nearby and overhead physical obstructions.
  - Inclinometer to sense the orientation of the device and ensure proper operation of the aforementioned modes.
• A look-up light with (2) ultra-bright white LEDs
• An ambient light sensor to ensure the look-up light only illuminates when it is dark
• An (8) character alphanumeric LED display
• Audible alarms and messages
• Built-in emergency bypass
• Weather resistant enclosures

Table 1-3 lists specifications for the D-TEC II®.

<table>
<thead>
<tr>
<th>Functional Characteristics</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature limits</td>
<td>-40°F to 185°F (-40°C to 85°C)</td>
</tr>
<tr>
<td>Duty Cycle</td>
<td>100%</td>
</tr>
<tr>
<td>Power Supply</td>
<td>11 to 33 VDC, 5 Amp</td>
</tr>
<tr>
<td>Allowable Vertical Tilt</td>
<td>±10°</td>
</tr>
<tr>
<td>Minimum Voltage Detection</td>
<td>2.3 Kilovolts / Meter</td>
</tr>
<tr>
<td>Distance of Ultrasonic Detection</td>
<td>10 ft. (3 m)</td>
</tr>
</tbody>
</table>

For more information on the D-TEC II®, see www.willburt.com.
(This page is intentionally left blank.)
Section 2 Installation

This section describes the installation of your system and provides the general procedures that must be followed to ensure a successful installation.

2.1 Pre-Installation Check

Before installing the system, ensure:

- All installers read and understand the entire installation procedure
- Only a properly trained and qualified certified electrician performs electric installations and maintenance
- All components are included (Section 2.3)
- All required tools are readily available (Table 2-1)
- That when installing in a vehicle, the vehicle is on a flat surface
- The following precautions are understood and followed:

  WARNING

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

  WARNING

Safety Instruction – Hose Installation! At all times while using hose during installation:

- Hose should be routed, mounted, and restrained to protect from damage
- Second-hand hose should not be used for installation
- Hose should not be bent at a radius less than specified by the manufacturer
- Hose should be marked to avoid hazards from incorrect connections
- The exhaust should be fitted with a silencer and directed away from personnel
- Hose should be routed and installed in such a way as to minimize torsion on the joints
- Hose mounting should be accomplished only by the use of tools to prevent readily disconnecting hose from the mast
Trained Personnel Only! Only trained and qualified personnel should perform installation, adjustments, and servicing. Only a properly trained and qualified certified electrician should perform electric installations and service. Death or serious injury could result if proper installation, inspection, operation, and maintenance procedures are not observed.

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

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

2.2 Installation Tools
Table 2-1 lists tools and materials recommended for installation.

<table>
<thead>
<tr>
<th>Tools and Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Glasses</td>
</tr>
<tr>
<td>Safety Gloves</td>
</tr>
<tr>
<td>Safety Shoes or Combat Boots</td>
</tr>
<tr>
<td>Hard Hat or Helmet</td>
</tr>
<tr>
<td>Hearing Protection</td>
</tr>
<tr>
<td>Wrenches</td>
</tr>
<tr>
<td>Screwdrivers</td>
</tr>
<tr>
<td>Thread Tape</td>
</tr>
<tr>
<td>Sling/Strap</td>
</tr>
<tr>
<td>Measuring Tape</td>
</tr>
<tr>
<td>Silicone Sealant</td>
</tr>
<tr>
<td>Plumb-Bob</td>
</tr>
<tr>
<td>Hoist</td>
</tr>
<tr>
<td>Torque Wrench</td>
</tr>
<tr>
<td>Hammer</td>
</tr>
<tr>
<td>Level</td>
</tr>
<tr>
<td>Saw</td>
</tr>
<tr>
<td>Drill</td>
</tr>
<tr>
<td>Air Supply</td>
</tr>
<tr>
<td>Sockets</td>
</tr>
<tr>
<td>Appropriate Hardware (Section 2.5)</td>
</tr>
</tbody>
</table>
2.3 Components

When unpacking, check to ensure all ordered components have arrived. The components your system includes will vary based upon your order.

Possible components include:

- Telescoping Mast
- Hardware Bag
- Drain Kit
- Magnet Warning Kit
- Some combination of the following:
  - Pneumatic System
  - Mounting Hardware
  - Nycoil®
  - D-TEC II®
- Low Profile HDNL Pneumatic Mast Operator’s Manual (this manual)

2.4 Unpack

Unpack the system as follows:

1. Carefully open shipping crate. Remove all loose parts, the 2 x 4 in. (38 x 89 mm) block at the top end of the mast, and the top half of the wooden mast saddles (Figure 2-1).

2. Inspect for any shipping damage. Notify carrier if damage is evident.
3. Using the center of gravity 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 (2) points. Attach the sling such that horizontal balance and control can be maintained while positioning the mast. Hoist and slowly lift the mast until just free of the mast saddles. Lower the mast and adjust the sling as necessary to balance the mast. Hoist the mast free from the crate and carefully move the mast into the desired position.

2.5 Installation Dimensions

This section lists installation dimensions as follows:

- Table 2-2  Mast Installation Dimensions
- Figure 2-3  Mast Installation Dimensions
- Table 2-3  Non-Rotatable Base Plate Dimensions
- Figure 2-4  Non-Rotatable Base Plate Dimensions
- Table 2-4  Internal (Roof) Support Bracket Mounting Information
- Figure 2-5  Internal (Roof) Support Bracket Mounting Information
- Table 2-5  External Support Bracket Mounting Information
- Figure 2-6  External Support Bracket Mounting Information
- Table 2-6  Shelf Bracket Mounting Information
- Figure 2-7  Shelf Bracket Mounting Information
Table 2-2  Mast Installation Dimensions

<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>in.</td>
<td>cm</td>
<td>in.</td>
</tr>
<tr>
<td>710303004</td>
<td>7-27</td>
<td>78.7</td>
<td>199.9</td>
<td>61.9</td>
</tr>
<tr>
<td>710303005</td>
<td>6-29</td>
<td>71.9</td>
<td>182.6</td>
<td>55.0</td>
</tr>
<tr>
<td>710303200</td>
<td>5.3-32</td>
<td>63.6</td>
<td>161.5</td>
<td>41.2</td>
</tr>
<tr>
<td>710304202</td>
<td>7-42</td>
<td>82</td>
<td>208</td>
<td>59.8</td>
</tr>
<tr>
<td>710304204</td>
<td>6-42</td>
<td>75.25</td>
<td>191.2</td>
<td>53.0</td>
</tr>
<tr>
<td>710305202</td>
<td>7.3-50</td>
<td>87</td>
<td>221</td>
<td>64.6</td>
</tr>
</tbody>
</table>

Figure 2-3  Mast Installation Dimensions
Table 2-3 Non-Rotatable Base Plate Dimensions

<table>
<thead>
<tr>
<th>Base Tube</th>
<th>A</th>
<th>B</th>
<th>ØC</th>
</tr>
</thead>
<tbody>
<tr>
<td>in.</td>
<td>mm</td>
<td>in.</td>
<td>mm</td>
</tr>
<tr>
<td>6.75</td>
<td>171</td>
<td>5.75</td>
<td>146</td>
</tr>
<tr>
<td>9</td>
<td>229</td>
<td>8</td>
<td>203</td>
</tr>
</tbody>
</table>

Figure 2-4 Non-Rotatable Base Plate Dimensions
Table 2-4  Internal (Roof) Support Bracket Mounting Information

<table>
<thead>
<tr>
<th>Base Tube</th>
<th>A</th>
<th>B</th>
<th>ØC</th>
</tr>
</thead>
<tbody>
<tr>
<td>in.</td>
<td>mm</td>
<td>in.</td>
<td>mm</td>
</tr>
<tr>
<td>6.75</td>
<td>9.75</td>
<td>248</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>11.88</td>
<td>301</td>
<td>8</td>
</tr>
</tbody>
</table>

Figure 2-5  Internal (Roof) Support Bracket Mounting Information
<table>
<thead>
<tr>
<th>Base Tube</th>
<th>OD A</th>
<th>A</th>
<th>B</th>
<th>Est. Wt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>in.</td>
<td>in.</td>
<td>mm</td>
<td>mm</td>
<td>lb.</td>
</tr>
<tr>
<td>6.75</td>
<td>7.75</td>
<td>197</td>
<td>8.25</td>
<td>210</td>
</tr>
<tr>
<td>9</td>
<td>10.5</td>
<td>267</td>
<td>9.75</td>
<td>248</td>
</tr>
</tbody>
</table>

**Figure 2-6** External Support Bracket Mounting Information
Table 2-6  Shelf Bracket Mounting Information

<table>
<thead>
<tr>
<th>Base Tube</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in</td>
<td>mm</td>
<td>in</td>
<td>mm</td>
<td>in</td>
<td>mm</td>
<td>in</td>
</tr>
<tr>
<td>6.75</td>
<td>9.8</td>
<td>249</td>
<td>14.3</td>
<td>363</td>
<td>7.75</td>
<td>197</td>
<td>10.94</td>
</tr>
<tr>
<td>9</td>
<td>10.0</td>
<td>254</td>
<td>15.8</td>
<td>401</td>
<td>8.00</td>
<td>203</td>
<td>13.25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Base Plate</th>
<th>U</th>
<th>V</th>
<th>W</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in</td>
<td>mm</td>
<td>in</td>
<td>mm</td>
<td>in</td>
<td>mm</td>
</tr>
<tr>
<td>6.75</td>
<td>Non-rotating</td>
<td>3.75</td>
<td>95</td>
<td>4.38</td>
<td>111</td>
<td>3.78</td>
</tr>
<tr>
<td>9</td>
<td>Non-rotating</td>
<td>5.25</td>
<td>133</td>
<td>5.22</td>
<td>133</td>
<td>5.25</td>
</tr>
</tbody>
</table>

**NOTE:**

FOR ø11 3/4 BASE PLATE:
øT IS 0.56 [14].

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

Figure 2-7  Shelf Bracket Mounting Information
2.6 Mast Installation: Internal Mount

This section describes installation of an internally mounted mast. Internal mounting uses an internal support bracket (Section 1.5.3.2).

2.6.1 Internal Mount Quick Summary

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

1. Select a Suitable Mounting Location.
2. Prepare the Roof.
3. Install the Internal Support Bracket.
4. Lower the Mast Through the Hole.
5. Position the Mast.
6. Secure the Base Plate.
7. Position the Weather Bonnet.

2.6.2 Internal Mount Detailed Installation

The following are detailed steps of installation of an internally mounted mast.

Select a Suitable Mounting Location

To select a suitable mounting location, consider the following:

- The mounting area must have sufficient room to mount the system. Roof area must be as flat as possible at the location of the mast. The roofline must lie between the weep hole and the can lock wedge. Mounting hardware must be at least 1 in. (25 mm) above the weep hole and 3 in. (76 mm) below the bottom of the can lock wedge. The exact dimensions of your system will vary based on the components included. Refer to the following for dimension information:
  - Table 1-1 (for base tube dimensions)
  - Table 2-2 (for mast dimensions)
  - Figure 2-3 (for mast dimensions)
  - Table 2-3 (for non-rotatable base plate dimensions)
  - Figure 2-4 (for non-rotatable base plate dimensions)
  - Table 2-4 (for internal support bracket dimensions)
  - Figure 2-5 (for internal support bracket dimensions)
- The mounting surface must be level, solid, and capable of holding the forces required by the bolts. Check the strength and rigidity of the mounting surface (e.g. vehicle body) where the mast 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 used, the bottom air inlet port.

• 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 base plate location. This is particularly helpful when attempting to hit specific structural members beneath a vehicle.

Prepare the Roof

To prepare the roof for installation:

1. Remove any roof liner or ceiling panels.

2. Cut a round hole in the roof ¼ in. (6.35 mm) larger than the diameter of the mast base tube. Cut the same size hole in the roof liner or ceiling panels so that the hole properly aligns with the roof hole when reinstalled.

3. Center the ceiling plate (Figure 1-18) 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 in. (6.35 mm) pipe to level out any irregularities that exist in the roof.

Install the Internal Support Bracket

To install the internal support bracket (Figure 1-18):

5. Size the bolts, ¼ in. (M6), to length allowing for the thickness of any bolt fasteners and the internal mounting kit hardware. Bolts and fasteners are not provided.

6. Apply a bead of silicone sealant to both sides of (1) gasket.

7. Line up all holes and fit the gasket between the roof flange and the roof.

8. Replace any roof liner or ceiling panel.

9. Fit the other gasket against the inside of the roof. This gasket does not need sealant. It will be held in place by the ceiling plate.

10. Line up all holes, and fasten this assembly together using appropriately sized fasteners. Securely tighten all nuts. Clean off any silicone sealant that may have squeezed out into the hole cut for the mast.

Lower the Mast Through the Hole

To lower the mast through the roof hole:

11. Slide the weather bonnet (Figure 1-18) over the bottom of the mast base tube and up the mast past the weep hole towards the collar. If the weather bonnet is difficult to maneuver, put soapy water or oil on the mast to allow it to slide more freely.

12. Lower the mast partially through the roof.
13. Attach the base plate (Figure 1-17) to the mast. Hardware to attach the base plate to the mast can be found in the hardware bag (section 1.5.1.1). Torque all hardware as appropriate for its material and size.

14. Lower the mast the rest of the way to the floor.

**Position the Mast**

To position the mast:

15. Move the mast into position ensuring the mast is level. It is necessary to check the mast in (2) places 90° apart when leveling. Be certain to orient the mast so that the operator has a clear view of the mast hazard labels. Additional labels are provided with the operator’s manual and can be applied where the operator deems appropriate.

**Secure the Base Plate**

To secure the base plate (Figure 1-17):

16. Use the base plate as a template to drill holes through the mounting structure.

17. Secure the base plate to the mounting structure with appropriate hardware (Table 2-3). Ensure the base plate is level in all directions. Torque all hardware as appropriate for its material and size.

**Position the Weather Bonnet**

To position the weather bonnet (Figure 1-18):

18. After the mast is secured to the base plate, and the base plate is secured to the mounting structure, slide the weather bonnet down the mast and over the roof flange. If the weather bonnet is difficult to maneuver, put soapy water or oil on the mast to allow it to slide more freely.

**Install the Drain Kit**

Install the drain kit (Figure 1-10) provided with the mast. See Section 2.8 for information on installation of the drain kit.

**Install the Pneumatic System**

Air to operate the mast may be provided by an air compressor or other source of clean, dry air (Section 1.5.2). The air system must be regulated not to exceed the maximum operating pressure of the mast being used (Table 1-1). See Section 2.9 for information on installation of the pneumatic system.

**Install the Magnet Warning Kit**

Install the magnetic warning kit. See Section 2.10 for information on installation of the magnetic warning kit.
2.7 Mast Installation: External Mount

This section describes installation of an externally mounted mast.

2.7.1 External Mount Quick Summary

The following is a quick summary of installation of an externally mounted mast (Figure 2-8). Detailed steps follow the quick summary.

1. Select a Suitable Mounting Location.
2. Install a Shelf Bracket (optional).
3. Attach the Base Plate.
4. Attach the External Support Bracket.
5. Secure the External Support Bracket.

![Figure 2-8 External Mount Installation]
2.7.2 External Mount Detailed Installation

The following are detailed steps of installation of an externally mounted mast (Figure 2-8).

Select a Suitable Mounting Location

When selecting a suitable mounting location, consider the following:

- The mounting area must have sufficient room to mount the system. The exact dimensions of your system will vary based on the components included. Refer to the following for dimension information:
  - Table 1-1 (for base tube dimensions)
  - Table 2-2 (for mast dimensions)
  - Figure 2-3 (for mast dimensions)
  - Table 2-3 (for base plate dimensions)
  - Figure 2-4 (for base plate dimensions)
  - Table 2-5 (for external support bracket dimensions)
  - Figure 2-6 (for external support bracket dimensions)
  - Table 2-6 (for shelf bracket dimensions)
  - Figure 2-7 (for shelf bracket dimensions)

- The mounting surface must be level, solid, and capable of holding the forces required by the bolts. Check the strength and rigidity of the mounting surface (e.g. vehicle body) where the mast 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 used, the bottom air inlet port.

Install a Shelf Bracket (optional)

To install a shelf bracket (Figure 1-20) (if used):

1. Position the shelf bracket.
2. Use the shelf bracket as a template to drill holes through the mounting surface.
3. Securely attach the shelf bracket to the mounting surface with appropriate hardware (Table 2-6). Ensure the shelf bracket is level in all directions. Torque all hardware as appropriate for its material and size.

Attach the Base Plate

To install the base plate (Figure 1-17):

4. Position the base plate on the shelf bracket or other mounting surface.
5. If necessary, use the base plate as a template to drill holes through the mounting surface.

6. Attach the base plate to the shelf bracket or other mounting surface with appropriate hardware (Table 2-3). Ensure the base plate is level in all directions. Torque all hardware as appropriate for its material and size.

**Attach the External Support Bracket**

To attach the external support bracket (Figure 1-19):

7. Attach the external support bracket around the mast base tube with the provided hardware. The external support bracket should be at least 1 in. (25.4 mm) above the base tube weep hole and close to, but at least 1 in. (25.4 mm) below the bottom of the can lock wedge. Do not cover the weep hole. Do not overtighten the external support bracket. The stand-off should be facing the support structure.

**Secure the External Support Bracket**

To secure the external support bracket:

8. Position the external support bracket so that the stand-offs are against the support structure.

9. Use the external support bracket as a template to drill holes through the support structure.

10. Attach the external support bracket to the wall structure appropriate hardware (Table 2-5). Ensure the base external support bracket is level in all directions. If necessary, spacers may be added between the external support bracket and the wall to keep the correct alignment between the external support bracket and the shelf bracket. Torque all hardware as appropriate for its material and size.

**Drain Kit**

The drain kit (Figure 1-10) is intended to protect the interior of a vehicle or other water sensitive area from damage due to water drainage and is not required for externally mounted masts.

**Install the Pneumatic System**

Air to operate the mast may be provided by an air compressor or other source of clean, dry air (Section 1.5.2). The air system should be regulated not to exceed the maximum operating pressure of the mast being used (Table 1-1). See Section 2.9 for information on installation of the pneumatic system.

**Install the Magnet Warning Kit**

Install the magnetic warning kit. See Section 2.10 for information on installation of the magnetic warning kit.
2.8 Drain Kit Installation

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

Weep holes (Figure 1-8) on each mast tube except the top tube are located to facilitate the drainage of water during periods of extension. The drain kit (Figure 1-10) is designed to route water, from inside the mast, to outside a vehicle or enclosure.

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

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

**CAUTION**

**Equipment Damage!** Before installing the drain kit, read and understand the installation instructions. Failure to follow drain kit installation instructions could damage the mast and render the mast inoperable.

To install the drain kit (Figure 2-9):

1. Be certain the locknut and washer are thread over the end of the ¼ in. (6.35 mm) hose adaptor.

2. Fasten the hose adaptor to the mast base tube weep hole. Turn the hose adaptor in only (1 ½) to (2) turns after initial engagement of threads. Turning further will damage the mast. Tighten the locknut to secure in place.

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

4. Attach the drain tube to the hose adaptor and the bulkhead fitting.
2.9 Pneumatic System Installation

Air to operate the mast may be provided by an air compressor or other source of clean dry air. The air system should be regulated to not exceed the maximum operating pressure of the mast being used (Table 1-1).

**WARNING**

Safety Instruction! At all times while using hose during installation:

- Hose should be routed, mounted, and restrained to protect from damage
- Do not use second-hand hose for installation
- Do not bend air hose at a radius less than specified by the manufacturer
- Hoses should be marked to avoid hazards from incorrect connection
- The exhaust should be fitted with a silencer and be directed away from personnel
- Install hose in such a way as to minimize torsion on the joints
- Mounting air hose shall be accomplished only by the use of tools to prevent readily disconnecting air hose from mast

**CAUTION**

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

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 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 compressor should have adequate ventilation to provide at least 10 Standard Cubic Feet per Minute of clean, dry air at the air intake at all times. The recommended temperature range for inlet air is 32°F (0°C) to 95°F (35°C), so it works best when located in a heated compartment. The compressor should not be operated without the air filters in place.
- **Air Control Valve:** An air control valve should be installed to direct airflow in and out of the mast. The control valve should be positioned to avoid unintentional operation. Mast movement should stop when the controller is released (hold-to-run type). If the controller is not a hold-to-run type, an emergency stop must be provided. The control valve should be operable by a person wearing gloves and mounted so it can be used with the mast in full view. The control valve should be suitable for outdoor use, and marked “Up”, “Down”, or similar. A check valve or similar device should be installed directly to the mast through rigid piping that would prevent an extended mast from exhausting uncontrollably if there is a pneumatic failure such as a hose burst.

- **Drain and Relief Fittings:** A drain cock and safety valve should be installed at the air inlet port at the base of the mast. The drain cock empties water which may have accumulated inside the mast. The drain cock should be opened periodically to drain the mast, particularly after the mast has been operated in the rain. The drain cock 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 ⅜ in. (9.5 mm), plus additional loose fittings, are supplied with a Will-Burt pneumatic system if purchased. The hose can be cut to the required length at installation. A drain hose should be attached to the exhaust port of the control valve to drain condensation or oil mist which 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.

Figure 2-10 shows the general layout of a pneumatic system. The exact configuration will vary based on the components being used in the specific system.
2.10 Magnet Warning Kit Installation

As a warning against moving a vehicle while the telescoping mast is extended, the vehicle should be equipped with a mast warning kit (P/N: 5170701) system. The magnet assembly ships installed inside the mast.

To install the magnet warning kit:

1. Assemble the magnetic switch assembly and the stainless steel band. Attach the magnetic switch assembly around the base tube approximately 6-20 in. (152-508 mm) above the base plate (Figure 2-11).

![Diagram of Magnetic Switch Assembly Attached to Base Tube]

2. Use 16 AWG stranded wire (not provided) to connect the flasher, lights, and relay to the wires exiting the magnetic switch assembly (Figure 2-12 and Figure 2-13).

![Diagram of Wire the Magnetic Switch Assembly Kit]
3. With the mast fully nested and the flasher and lights installed and connected to the battery (the light should be flashing unless the switch is in contact with the magnet assembly), slide the magnetic switch assembly up and down the lower 2 feet (0.6 m) of the mast base tube to locate the magnet assembly inside the tube (by deactivating the flashing lights). The vertical sensing range should be about 1-3 inches (25-76 mm). Tighten the band to clamp the magnetic switch assembly in the sensing range, but not lower than 1 inch (25 mm) above the lower limit. The switch can be located anywhere around the perimeter of the base tube.

4. Pressurize the mast to extend 1-2 feet (0.3-0.6 m) several times to test the magnetic warning kit.

5. Attach the “NOTICE” label in a visible area on the base tube (Figure 2-12).
2.11 Install the Payload

**Safety Instruction – Mounting Instructions!** Before operation, be certain the mounting surface 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 surface 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 surface.

The payload mounting bolts must be installed from the bottom of the can with the nut and excess bolt length on the top. Mounting the payload bolts from the top down such that the bolt or nut contacts the mast collars in the nested or retracted position could result in death or serious injury, and could damage the mast.

Operating the mast without both wedges properly adjusted to contact the can on both sides of the mast could result in death or serious injury and could damage the mast.

To install the payload:

1. Ensure the air supply is disconnected or the drain cock is opened while installing the payload to eliminate the possibility of inadvertent mast extension.
2. Reference the installation drawing for your system for the mounting hole locations for the payload.
3. Raise the can lock enough to access the underside of the platform. Brace can lock in the lifted position during installation to prevent it from dropping.
4. Attach the payload to the can lock using appropriate hardware. Appropriate measures must be employed to prevent the mounting hardware from backing out due to dynamic loading conditions inherent in mast operation and transport. The bolt heads will fit into countersunk holes on the bottom of the can lock platform. The bolts must be installed from the bottom of the can lock platform (Figure 2-14). Torque all hardware as appropriate for its material and size.
5. The can lock and can lock wedges on both sides must be adjusted in height and azimuth rotation after the payload has been mounted or anytime the payload weight is altered. Follow the procedure outlined in Sections 4.8 and 4.9 to adjust the can and can wedges. The components are factory set with a 50 lb. (22.7 kg) payload installed and will need adjusted for each unique payload weight and configuration.
Section 3 Operation

This section describes the general operation of the system.

3.1 Pre-Operation Check

Before operating the system, ensure:

- All operators read and understand the entire operation procedure and are properly trained.
- The system is undamaged. If damage is apparent, do not use the system and have it serviced prior to use.
- All electrical cables are undamaged and properly terminated.
- Any objects which might obstruct motion of the mast, cause binding, or hinder mast function are removed.
- The mast area is free of personnel.
- The operator has full view of the mast during use.
- The area is free of power lines or other overhead obstructions. Mast location should be no closer than a horizontal distance equal to the extended height of the mast away from any overhead power lines.
- The mast is on level terrain.
- The system and payload are properly installed.
- That when using a vehicle, the vehicle is not moving.
- The following precautions are understood and followed:

**WARNING**

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

**WARNING**

Mast Extension Hazard! 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 the mast and mast extension. Do not lean over the mast. Extending the mast into obstructions could result in death or serious injury, and could render the mast inoperable and partially extended.
Mast Separation Hazard! The mast should operate smoothly during extension and retraction. If erratic mast motion is observed during extension or retraction which 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 resulting in death or serious injury, and could damage the mast.

Relocation Hazard! Do not relocate the system during operation or while mast is raised. Do not move vehicle until the mast has been securely nested. Operate the mast only if the vehicle is stationary and the vehicle engine is off. Relocating the mast during operation or after being raised could result in death or serious injury.

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 system during operation.

Equipment Damage! Check for and remove any objects which might obstruct motion, cause binding, or hinder function of the system. Hitting obstructions will cause damage to the system. Deviation from standard operating conditions and procedures could cause system failure.

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

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

Table 3-1 lists tools and materials recommended for operation.

<table>
<thead>
<tr>
<th>Tools and Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Glasses</td>
</tr>
<tr>
<td>Safety Gloves</td>
</tr>
<tr>
<td>Safety Shoes or Combat Boots</td>
</tr>
<tr>
<td>Hard Hat or Helmet</td>
</tr>
<tr>
<td>Hearing Protection</td>
</tr>
</tbody>
</table>

3.3 Prepare the System

To prepare the system for operation:

- If necessary, remove any transit tie-downs on the system
- If necessary, attach the pneumatic system to the mast (Section 2.9)
- If necessary, secure any cables to the mast
- If necessary, secure the payload to the mast (Section 2.11)

3.4 Extend the Mast

To extend the mast:

1. Ensure the payload will have enough clearance as the mast is extended.
2. Use the air control valve to pressurize the mast. Do not exceed the maximum recommended operating pressure of 35 psig (2.4 bar) of the mast at any time. Maintain visual contact throughout extension to avoid overhead obstructions and cable entanglements.
3. Close the air control valve when desired height is achieved. The mast must remain pressurized to maintain its height.

3.5 Lower the Mast

To lower the mast:

1. Ensure the payload will have enough clearance when nested.
2. Exhaust air from the mast using the air control valve. 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.
3. Periodically open the drain cock when exhausting the mast to drain off any accumulated water.
3.6 Transportation

Before transporting the system, the system needs to be secured. To prepare the system for transportation:

1. Lower the mast (Section 3.5). Do not transport the system with the mast and payload extended.
2. Disconnect the air supply or open the drain cock while the mast is not in use to eliminate the possibility of inadvertent mast extension.
3. If desired, remove the payload.
4. If necessary, secure any additional components in the system. Note that it is the responsibility of the customer to properly secure the payload for transportation.
5. Always visually confirm the mast is fully retracted before moving the mast.
6. Confirm the nest lock can wedges are contacting the can on both sides of the mast.
Section 4 Maintenance and Adjustments

This section describes maintenance and adjustment procedures required to keep your system operational.

4.1 Pre-Maintenance Check

Before performing maintenance operations, ensure:

- All operators read and understand the entire maintenance procedure and are properly trained.
- The following precautions are understood and followed:

⚠️ **WARNING**

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

⚠️ **WARNING**

**Fire Hazard!** 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. Cleaning solvent, used for maintenance, is flammable and can be explosive resulting in death or serious injury.

⚠️ **WARNING**

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

⚠️ **WARNING**

**Pressurized Device Hazard!** Completely lower the mast, depressurize, and shut down power before disassembly. Mast disassembly prior to depressurization may release pressurized air jet.
4.2 Periodic Maintenance
Maintain the system as follows:

- Visually inspect for damage. If damage is apparent, do not use the system and have it serviced prior to use.
- Visually inspect to ensure the system is kept clean.
- Periodically drain accumulated water from the base tube (Section 2.8).
- Inspect all collar bolts in all tube sections monthly to ensure they are not backing out. Add Loctite™ 263 and re-tighten to 60-65 in.-lb. installation torque if they are loose.
- Observe the mast tube motion monthly 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.
- Inspect all fasteners and welds to ensure the mast and payload is securely attached.
- Inspect to ensure the can lock wedges on both sides are properly positioned and in contact with the can.
- Inspect to ensure electrical cables are undamaged and properly terminated.
- Inspect to ensure hoses are undamaged.

4.3 Replacement Parts
To order spare or replacement parts, always refer to the mast model number and serial number. Model number, serial number, and additional information is engraved on the mast identification plate (Figure 1-11). The identification plate is fixed to the can lock base (Figure 1-8).
4.4 Maintenance Tools

Table 4-1 lists tools and materials recommended for maintenance.

<table>
<thead>
<tr>
<th>Tools and Materials</th>
<th>Safety Glasses</th>
<th>Safety Gloves</th>
<th>Safety Shoes or Combat Boots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Hat or Helmet</td>
<td>Safety Gloves</td>
<td>Hearing Protection</td>
<td>Rags (clean and dry)</td>
</tr>
<tr>
<td>Hoist</td>
<td>Screwdrivers</td>
<td>Sockets</td>
<td></td>
</tr>
<tr>
<td>Measuring Tape</td>
<td>Silicone Sealant</td>
<td>Drill</td>
<td></td>
</tr>
<tr>
<td>Non-Abrasive Cleanser</td>
<td>Sling</td>
<td>Ratchet Straps</td>
<td></td>
</tr>
<tr>
<td>Wrenches</td>
<td>Hammer</td>
<td>Thread Tape</td>
<td></td>
</tr>
<tr>
<td>Utility Knife</td>
<td>Loctite® 380 or Equal</td>
<td>Loctite® 495 or Equal</td>
<td></td>
</tr>
<tr>
<td>Loctite® 242/243 or Equal</td>
<td>Allen Wrenches</td>
<td>Flat Punch</td>
<td></td>
</tr>
<tr>
<td>Torque Wrench</td>
<td>Level</td>
<td>Acetone (or other solvent)</td>
<td></td>
</tr>
<tr>
<td>File</td>
<td>Chisel</td>
<td>Saw Horses</td>
<td></td>
</tr>
<tr>
<td>Air Supply</td>
<td>Mast Lubricant or Lightweight Machine Oil</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.5 Reference Dimensional Information

This section lists reference information for the tube and collars as follows:

- Table 4-2 Tube Diameters
- Figure 4-1 Tube Diameters
- Table 4-3 Collar Information
- Figure 4-2 OD on Non-Locking Collar

Table 4-2 Tube Diameters

<table>
<thead>
<tr>
<th>Tube</th>
<th>A (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 in.</td>
<td>3.00</td>
</tr>
<tr>
<td>3 ¾</td>
<td>3.75</td>
</tr>
<tr>
<td>4 ½</td>
<td>4.50</td>
</tr>
<tr>
<td>5 ¼</td>
<td>5.25</td>
</tr>
<tr>
<td>6</td>
<td>6.00</td>
</tr>
<tr>
<td>6 ¾</td>
<td>6.75</td>
</tr>
<tr>
<td>6 ¾</td>
<td>6.75</td>
</tr>
<tr>
<td>7 ½</td>
<td>7.50</td>
</tr>
<tr>
<td>8 ¼</td>
<td>8.25</td>
</tr>
<tr>
<td>9</td>
<td>9.00</td>
</tr>
</tbody>
</table>

* “B” designates a base tube

Figure 4-1 Tube Diameters
### Table 4-3 Collar Information

<table>
<thead>
<tr>
<th>Tube</th>
<th>Heavy Duty Collar</th>
<th>Non-Locking OD</th>
<th>Collar Bolts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>in.</td>
<td>mm</td>
</tr>
<tr>
<td>3 ¾</td>
<td>4.50</td>
<td>114</td>
<td>8</td>
</tr>
<tr>
<td>4 ½</td>
<td>5.20</td>
<td>132</td>
<td>8</td>
</tr>
<tr>
<td>5 ¼</td>
<td>6.00</td>
<td>152</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>6.75</td>
<td>171</td>
<td>8</td>
</tr>
<tr>
<td>6 ¾</td>
<td>7.50</td>
<td>191</td>
<td>8</td>
</tr>
<tr>
<td>7 ½</td>
<td>8.25</td>
<td>210</td>
<td>8</td>
</tr>
<tr>
<td>8 ¼</td>
<td>9.00</td>
<td>229</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>9.75</td>
<td>248</td>
<td>8</td>
</tr>
</tbody>
</table>

*Figure 4-2 OD on Non-Locking Collar (P/N: 5099101 Shown)*
4.6 Mast Cleaning and Lubrication

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

Will-Burt recommends removing the payload before performing the mast cleaning and lubrication procedure.

Signs cleaning and lubrication might be needed can be:

- A noticeable gritty film on the exterior surfaces of the mast tubes
- Erratic extension or retraction of the mast
- Noisy operation of the mast
- Sticking of (1) or more mast tubes when mast is extending or retracting

To clean and lubricate the mast:

1. When a regulator exists in the pneumatic system, reduce its pressure to between 5-10 psig (0.34-0.69 bar). A pressure of 10 psig (0.69 bar) should be sufficient to extend all tubes of the mast without a payload. If any tube will not extend with 10 psig (0.69 bar) the mast may require an overhaul. Consult the factory.
2. Remove the can lock wedges from the base tube.
3. Disconnect the can lock from the payload platform.
4. Lower the can lock.
5. Insert the tube selector.
6. Set the tube selector to prevent all tubes from rising except the top tube.
7. Use the air control valve to slowly pressurize the mast just enough to extend the top mast tube. Close the air control valve as soon as the mast tube is up.
8. Dampen a rag with a non-abrasive cleanser or solvent such as lacquer thinner to wipe down the extended mast tube. Do not allow the cleaning fluid or solvent to run down inside the collar.
9. Completely exhaust the mast.
10. Repeat steps 5 through 9 for the next larger mast tube.
11. Inject approximately ½ oz. of Mast Lubricant or a lightweight machine oil into the weep hole of the exposed mast tube. The weep holes are located 1-3 feet 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.

Mast Lubricant is specifically formulated for cold weather use, but is suitable for year around use. Regular winter maintenance and the frequent use of Mast Lubricant should significantly reduce the potential for mast freeze ups. Mast Lubricant is also intended for use in air in-line lubricators.
12. Repeat steps 5, 6, 7, and 11 for each of the remaining mast tubes. The larger diameter tubes should be injected with approximately 1 oz. of lubricant.

13. Lower the mast completely. Allow several minutes for the lubricant to settle and spread around the wear ring and seal at the bottom of each mast tube.

14. Extend the mast again (1) tube at a time in the same sequence (smallest to largest). Wipe off any excess lubricant that flows out of the weep holes. Do not lubricate the exterior of the mast. This attracts dust and contaminants from the air.

15. Lower the mast.

16. Remove the tube selector.

17. Reattach the can lock to the payload platform ensuring it aligns properly with the location the can lock wedges attach. Use Loctite® 242/243 on the bolts.

18. Reattach the can lock wedges. Use Loctite® 242/243 on the bolts.

19. Adjust the can lock wedges (Section 4.8).

### 4.7 Weatherizing

The Will-Burt Company recommends following the *Weatherizing Instructions Pneumatic Masts* (TP-4744301). The weatherizing instructions use the optional Pneumatic Mast Antifreeze Kit (P/N: 4725801).

The Pneumatic Mast Antifreeze Kit includes:

- (2) Flush Caution Labels (P/N: 4770001)
- (1) Gallon Will-Burt Non-Toxic Pneumatic Mast Antifreeze (P/N: 4735801)
- (1) Will-Burt Non-Toxic Pneumatic Mast Antifreeze Application Bottle (P/N: 4726101)
- (1) Will-Burt Antifreeze MSDS (P/N: 4746201)
- (1) Will-Burt Lubricant, MSDS, and Service Sheet (P/N: 900600)
- The Weatherizing Instructions for the Locking and Non-Locking Pneumatic Masts (TP-4744301)
4.8 Can Lock Wedge Adjustment

To adjust the can lock wedges:

1. Nest the mast ensuring the mast is depressurized. The payload should be left on the mast when adjusting the can lock wedges to ensure the mast is fully compressed when nested.

2. Loosen the bolts holding the can lock wedges in place (Figure 4-3).

3. Slide the can lock wedges up snugly against the can lock (Figure 4-3). The can lock wedges should touch both sides. The top of the wedge will have a small gap.

4. Secure the can lock wedges with the bolts. Use Loctite® 242/243 on the bolts. Torque to 74-80 in.-lb.

4.9 Can Lock Base Adjustment

The can lock base has slot holes to allow for adjustment. To adjust the can lock base:

1. Adjust the can lock wedges (Section 4.8).

2. Loosen the cap screws securing the can lock base to the payload platform (Figure 4-4). It is not necessary to completely remove the cap screws to adjust the can lock base.
3. Adjust the can lock base as necessary. Ensure the flat washers do not stick above the payload platform. Torque the cap screw to 62-70 in.-lb.

   Note: If the hardware securing the can lock base was completely removed, secure by ordering the hardware as follows:
   a. Flat Washer (closest to can lock base)
   b. Lock Washer
   c. Cap Screw

4. Cycle the mast up and down once to ensure the can lock wedges and can lock base align properly. There should be no relative movement between the can lock assembly and the mast base tube. As necessary, repeat this procedure.

4.10 Corrective Maintenance
This section discusses corrective maintenance for the mast.

4.10.1 Disassemble the Mast
Disassemble the mast starting with the top section and working towards the base section.

To disassemble the mast:

1. Place the mast horizontally on a pair of sawhorses or similar supports. Secure the mast base tube to the supports so the mast does not roll off.

2. Remove the top tube by pulling firmly on the can lock until the collar bolts on the next tube are exposed.

3. Remove the collar bolts and pull the tube out with the collar. Be careful not to drop it as it comes out.

4. Remove the orifice bolt, lock washer, backup washer, expander, and seal.

5. Thoroughly clean and inspect all parts. The mast 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 mast tube. Mast tubes may need cleaned repeatedly before reassembly to remove all debris.

6. Repeat steps 2 through 5 for each subsequent mast tube. Be careful not to damage or oblong collar bolt holes when removing the mast tubes.

7. As necessary, refer to the appropriate section for replacement steps for the following:
   a. Replace Seals and Expanders (Section 4.10.2)
   b. Replace Collar Bearing Strips (Section 4.10.3)
   c. Replace Wear Rings (Section 4.10.4)
8. Reassemble the orifice bolt, lock washer, backup washer, expander, and seal on the bottom of the mast tube. As the orifice bolt is being tightened, center the seal, expander, and backup washer on the butt plate. Use Teflon Tape. Torque the orifice bolt to 16 ft.-lb. Repeat this procedure for each mast tube.

Note that the orifice bolt for the top tube screws into the ceramic ring magnet assembly (P/N: 5200601) (Figure 4-5) which may have come loose during disassembly. If the ceramic ring magnet assembly is loose:

a. Check the O-ring (P/N: 5521) on the ceramic ring magnet assembly. Replace the O-ring if damaged.

b. Using Teflon Tape on the bolt threads, secure the ceramic ring magnet assembly to the butt plate. Torque the orifice bolt to 16 ft.-lb.

9. Before reassembling the mast, lightly oil the lip of the seal and the inside honed surface of each mast tube with Mast Lubricant or lightweight machine oil. When reassembling the mast, begin with the base tube and work towards the top tube.

10. Secure the base tube horizontally on saw horses.

11. Using a second person or a brace to support the top end, hold the next mast tube so that 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.

12. Slowly raise the lower end of the tube to horizontal while carefully pressing the lip of the seal into the receiving tube. Press on both sides of the seal to simultaneously push both side of the seal in an upward motion. Use caution as pressing too hard will bend the expander. Work this way until your fingers meet at the top. 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.

13. 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.

14. Slide the tube in leaving several inches protruding. The “0” stamps on the tubes should be aligned.
15. Replace the collar on the mast section. Align the “0” stamp on the collar with the “0” stamp on the tube. Install and hand-tighten the collar bolts and lock washers. Ensure the collar bolts are wiped free of grease prior to installation. Use Loctite® 242/243 on the collar bolts. Torque the collar bolts to 60 in.-lb.

16. Repeat steps 9 through 15 for each subsequent mast section.

4.10.2 Replace Seals and Expanders
Inspect the seals and expanders for wear. If necessary, replace the seals and expanders.

4.10.3 Replace Collar Bearing Strips
Inspect the bearing strip (Figure 4-6) 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 are worn down to the metal collar, they should be replaced.

To replace the collar bearing strips:

1. Remove the old bearing strips by removing the nylon screws from the collar. Pull out the bearing strips and clean the collar.

2. Press the new bearing strips firmly into the groove. Align the holes in the bearing strip with those in the collar (Figure 4-7). Install new nylon screws through the collars into the threaded holes in the bearing strip. Apply Loctite® 495 adhesive or equivalent to the nylon screws before installation. Do not over-tighten the nylon screws.

3. Cut off or file off the ends of the nylon screws protruding through the bearing strip until they are flush.

4. Before reassembling the mast, slide each collar over its mating mast 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.
5. Wipe the collars clean before reassembling the mast (Figure 4-7).

![Diagram of mast showing parts](image)

*Figure 4-7  Replacing Bearing Strips (Number of collar bolts will vary)*

### 4.10.4 Replace Wear Rings

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 (Figure 4-8):

1. Clean the butt plate and wear ring groove.
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 in. (6.3 mm) clearance between the (2) ends. If necessary, cut enough off (1) end to get the required gap.
3. The wear ring must be held in place until this mast tube is inserted into the receiving mast 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 mast tube from sliding inside the next tube, grind the wear ring OD as necessary.
4. Before reassembling the mast tube, slide each mast tube inside its mating mast tube. If the smaller mast tube does not slide freely inside the next largest mast 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.
Figure 4-8 Replacing Wear Rings
(This page is intentionally left blank.)
Section 5 Troubleshooting

Table 5-1 describes the troubleshooting procedures for your system.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mast Tube(s) Stuck</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mast frozen in nested position</td>
<td>Mast base tube not drained routinely. Potential for tube damage.</td>
<td>Send to manufacturer for repair or replacement.</td>
</tr>
<tr>
<td>Mast frozen in extended position</td>
<td>Mast base tube not drained routinely. Typically freezes around collar area.</td>
<td>Wrap warming blankets around collar until ice melts. Use heat gun or 500w quartz light.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Depressurize mast. Inject 1 oz. Will-Burt Anti-Freeze, suited for aluminum engines, where top of collar and Intermediate tube meet.</td>
</tr>
<tr>
<td>Mast Rocks While Lowering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mast will not lower without rocking</td>
<td>Not enough weight.</td>
<td>Add weight to platform or stub adaptor.</td>
</tr>
<tr>
<td></td>
<td>Bent tube.</td>
<td>Check tube trueness. Order replacement if bent.</td>
</tr>
<tr>
<td></td>
<td>Bearing strips tight.</td>
<td>Depressurize. Disassemble. File and grind to pre-fit bearing strips as necessary.</td>
</tr>
<tr>
<td>Rotational Movement in Mast Sections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotational movement occurs in mast tubes.</td>
<td>Bearing strips are worn.</td>
<td>Order new bearing strips. Customer must pre-fit.</td>
</tr>
<tr>
<td>Weather Bonnet Does Not Slide Over Base Tube</td>
<td>Bonnets are designed tight.</td>
<td>Use soapy water as described in Section 2.6.2 step 11. Oil O-ring and use mallet to tap evenly around diameter of the bonnet.</td>
</tr>
</tbody>
</table>

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