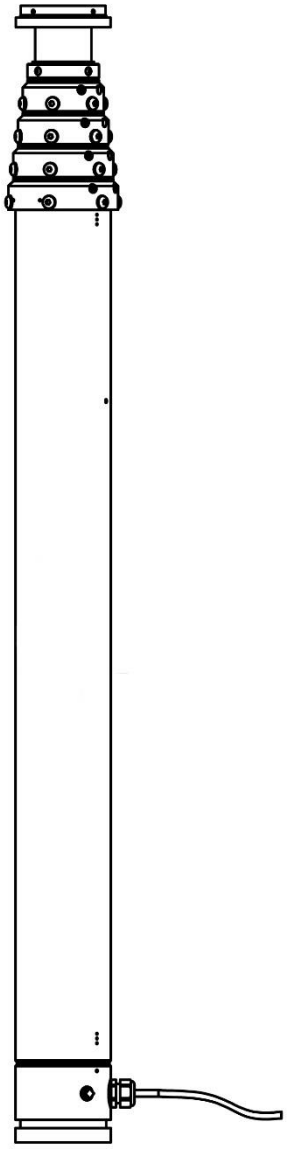
# INTERNALLY WIRED PNEUMATIC MAST
# OPERATOR'S MANUAL



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Original Instructions

# Internally Wired Pneumatic Mast Warranty

Will-Burt warrants its Internally Wired Pneumatic masts to be free from defects in material and workmanship for a period of two (2) years, with such time period 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

| Document | Dates | Remarks |
|---|---|---|
| Revision 5 | February 2015 | |
| TP-5443101-F | January 24, 2017 | Update to Section 1.4. Added Section 5. Updated formatting and minor changes throughout. |
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# Safety Summary

## Signal Word Definition

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

**⚠ DANGER**

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 PRECAUTIONS

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

**⚠ 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. 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 - 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**

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

**⚠ 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**

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

**⚠ 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.

# SPECIFIC SAFETY PRECAUTIONS

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

**⚠ WARNING**

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

**⚠ WARNING**

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

**⚠ WARNING**

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

**⚠ WARNING**

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

**⚠ WARNING**

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

**⚠ WARNING**

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

**⚠ WARNING**

**Mast Extension Hazard!** Extending mast into obstructions could result in death or serious injury and could render the mast inoperable and partially extended. Before applying power and operating the mast,

be certain there is sufficient clearance above and to all sides of the expected location of the fully extended mast and payload. Keep all persons clear of mast and mast extension. Do not lean directly over the mast.

**⚠ WARNING**

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

**⚠ WARNING**

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

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

**⚠ CAUTION**

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

**⚠ CAUTION**

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

**⚠ CAUTION**

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

**⚠ CAUTION**

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

**⚠ CAUTION**

**Lifting Hazard!** Manually lifting over 55 lb. (25 kg) is prohibited. In the UK, all lifting equipment must be thoroughly examined annually by a competent person according to the Lifting Operations

**⚠ CAUTION**

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

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

and Lift Equipment Regulations 1998. Equivalent regulations exist in other EU states.

**⚠ CAUTION**

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

# Section 1 Introduction

## 1.1 Safety Precautions

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

## 1.2 Introduction

This manual covers the installation, operation, and maintenance for The Will-Burt Company internally wired pneumatic masts. Mast models covered include Standard (5-inch diameter base) duty non-locking, and Entry Level (4-inch diameter base) non- locking masts. The pneumatic mast system is comprised of a telescoping mast, a hardware bag, a drain kit, and a mast extension magnetic warning kit. Additionally, a non-rotatable base plate, a rotatable base plate, a support bracket assembly, an internal mounting kit, an external shelf bracket assembly or a pneumatic system may also be included.

## 1.3 Description

### 1.3.1 Telescoping Mast

The telescoping mast is the structure used to raise the payload to an operational level. It consists of several concentric, nesting mast sections, fabricated from aluminum tubes, that extend and retract pneumatically. The non-locking telescoping mast must remain pressurized to support the payload at an extended height. The base mast section is constructed from the tube with the largest diameter and the top mast section is constructed from the tube with the smallest diameter. The intermediate mast sections are any mast section in between the base and top mast sections.

Aluminum collars are fitted to the top end of each mast section, except for the top mast section, which is fitted with a top tube stop. When the telescoping mast is completely retracted, the collars nest on top of each other. Each mast section, except the base mast section, has two rectangular keys along the length of the tube. The keys match with keyways on the larger, adjacent mast section's collar. The keys and keyways are used to establish azimuth (rotational) integrity between the sections. Identification plates are secured to the collar on the base mast section. Refer to Section 5 for a mast drawing.

The internal coil cord exits both the top and the bottom of the mast assembly through a liquid tight strain relief. The strain relief grips the cord and provides for an air tight seal. Masts with 5-inch diameter base tubes are equipped with a cord consisting of (10) 14 AWG wires, (2) 18 AWG wires and (2) 20 AWG wires. This cord is capable of connecting a remote-controlled positioner (RCP) on the mast to the control system at the base. See the Night Scan Vertical manual (TP-4836201) for detail on the RCP and its operation. Masts with 4-inch diameter base tubes contain a coil cord with (3) 14 AWG wires. The wires are intended for use with a manually adjustable light bar not exceeding 15 amperes operating current.

## 1.3.2 Hardware Bag

The hardware bag is a plain cloth bag that includes screws for attaching mast mounting hardware to the mast. Because of the varied installation circumstances, the hardware required to attach the mast to a vehicle or structure must be supplied by the installer. The hardware bag also contains a safety valve, for protection from over pressurization, and brass fittings for water drainage and connecting the mast to the air supply line. Do not operate the mast until the safety valve has been properly installed.

## 1.3.3 Weep Hole Drain Kit

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

## 1.3.4 Mast Extension Magnetic Warning Kit

The warning kit includes items to install a system for warning against moving a vehicle while the telescoping mast is partially or completely extended. The clamp is a thin strip of coiled metal used to brace the switch assembly against the mast base tube. The rare-earth magnet is assembled in the base of the top tube and aligned with one of the keys on it. For 4-inch diameter base tube masts, the magnet is opposite the air/cord inlets found at the base. For 5-inch diameter base tubes the magnet is in line with the tube key that is oriented between the air and coil cord inlets at the base of the mast. The switch assembly is attached to a small, rectangular aluminum casing.

## 1.3.5 Mast Lubricant

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

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

The mast lubricant is a blue-colored oil specifically designed for telescoping masts and their operating environment that is contained in a 16 oz. capped plastic bottle. Refer to Section 4.3.1 for recommended use.

## 1.3.6 Non-Rotatable Base Plate

The non-rotatable (NR) base plate is a square aluminum plate used to stabilize the mast and to provide a means of securing the mast to a mounting structure. Countersunk holes in the NR base plate match threaded holes on the base mast section. Flat head screws included in the hardware bag can be used to attach the NR base plate to the base mast section.

## 1.3.7 Rotatable Hardware Kit

The rotatable hardware kit is used to stabilize the mast and to provide a means of, not only securing the mast to a mounting structure, but also enabling the mast to be rotated. For masts having 5-inch base tubes, the kit includes a rotatable base plate assembly, a turning handle assembly, bolts, nuts and an instruction sheet. The rotatable (R) base plate assembly consists of a painted weldment, a bearing, bolts and nuts. The weldment, typically painted white, is made of a steel ring welded to a square steel plate with (4) thru holes in the corners of the plate. The mast is to be positioned inside the ring on the weldment. Bolts (2), threaded into the weldment ring, can be tightened once the mast is in place to restrict mast rotational movement. A hole in the center of the plate allows the option of routing air to the bottom of the base mast section. The turning handle assembly wraps around, and is secured to, the base mast section with the bolts and nuts included in the kit. Once the turning handle assembly is fitted to the base section, the operator can grip the handles and rotate the mast into position. For masts having 4-inch base tubes, the kit includes a rotatable base plate and bearing. The rotatable base plate is attached to either a shelf bracket or to a non-rotatable base plate for vehicle mounting. To attach it to a non-rotatable base plate, use the flat head screws provided in the hardware bag. For external mounting, attach the rotatable base plate directly to the shelf bracket using the hex bolts provided in the hardware bag. No turning handles are required for these masts as they are light weight and easily turned by hand.

## 1.3.8 Support Bracket Assembly

The support bracket assembly, used to brace a 5-inch diameter base mast against a mounting structure, is constructed from a steel stand-off, two aluminum support brackets, a plastic bearing and fasteners to secure the assembly together. The stand-off is a formed sheet metal piece that positions the support brackets away from the mounting structure. The C-shaped support brackets close around the base mast section and are bolted together to hold the mast against the mounting structure. The plastic bearing, attached to the inside of the support brackets, protects the base mast section from being scraped by the support brackets and allows the mast to be rotated. A similar assembly is used to brace 4" diameter base masts.

## 1.3.9 Internal Mounting Kit

The internal mounting kit contains the hardware used to position and support an internally mounted mast. The kit includes a two-piece roof ring, O-ring, two gaskets and a ceiling plate. Bolts, lock washers and hex nuts, ¼-inch or M6, not provided, can be used to secure the assembly to the roof. Bolt length will depend on the specific application and is to be determined by the installer.

## 1.3.10 External Shelf Bracket Assembly

The external shelf bracket assembly is a painted weldment that can be bolted into a mounting structure and used to position and support an externally mounted mast.

### 1.3.11 Pneumatic System

The pneumatic system refers to a means of safely controlling the pressurization and depressurization of the telescoping mast. Components in the hardware bag and a port near the bottom of the base mast section are provided to connect an air supply to the telescoping mast. See Section 2.4.4 for additional information on a pneumatic system.

## 1.4 Reference Data

*Table 1-1 Standard IWM Part & Model Numbers*

| Part Number | Model Number |
|---|---|
| 4825401 | 3.3-10 |
| 4825301 | 4.3-15 |
| 914431 | 5.4-17 |
| 914428 | 6-20 |
| 914429 | 7-25 |
| 914430 | 8-30 |

*Table 1-2 Reference Data – Standard Duty IWM Mast*

| | Payload Capacity | Extended Height | Nested Height | Approx. Mast Weight | No. of Sections | Section Diameter | Max Operating Pressure |
|---|---|---|---|---|---|---|---|
| **3.3-10** | 100 lb. | 8.4 ft. | 3.3 ft. | 35 lb. | 5 | 5 – 3 inches | 20 PSIG |
| | 45.4 kg | 2.6 m | 1 m | 15.9 kg | | 127 – 76 mm | 1.4 bar |
| **4.3-15** | 100 lb. | 13.4 ft. | 4.3 ft. | 45 lb. | 5 | 5 – 3 inches | 20 PSIG |
| | 45.4 kg | 4.1 m | 1.3 m | 20.4 kg | | 127 – 76 mm | 1.4 bar |
| **5.4-17** | 100 lb. | 17 ft. | 5.3 ft. | 50 lb. | 5 | 5 – 3 inches | 20 PSIG |
| | 45.4 kg | 5.2 m | 1.6 m | 22.7 kg | | 127 – 76 mm | 1.4 bar |
| **6-20** | 100 lb. | 20.4 ft. | 6 ft. | 55 lb. | 5 | 5 – 3 inches | 20 PSIG |
| | 45.4 kg | 6.2 m | 1.8 m | 25 kg | | 127 – 76 mm | 1.4 bar |
| **7-25** | 100 lb. | 25.4 ft. | 7 ft. | 60 lb. | 5 | 5 – 3 inches | 20 PSIG |
| | 45.4 kg | 7.7 m | 2.1 m | 27.2 kg | | 127 – 76 mm | 1.4 bar |
| **8-30** | 100 lb. | 30.4 ft. | 8 ft. | 65 lb. | 5 | 5 – 3 inches | 20 PSIG |
| | 45.4 kg | 9.3 m | 2.4 m | 29.5 kg | | 127 – 76 mm | 1.4 bar |

Note:
- Payload Capacity assumes a 12 Inch Maximum Offset Payload and a Mast Deployment Angle 0° to 5°
- Payload Capacity will be affected by wind sail area; consult factory. Payload Capacity includes cable weight.
- Section Diameter listed as Base Mast Section Diameter – Top Mast Section 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

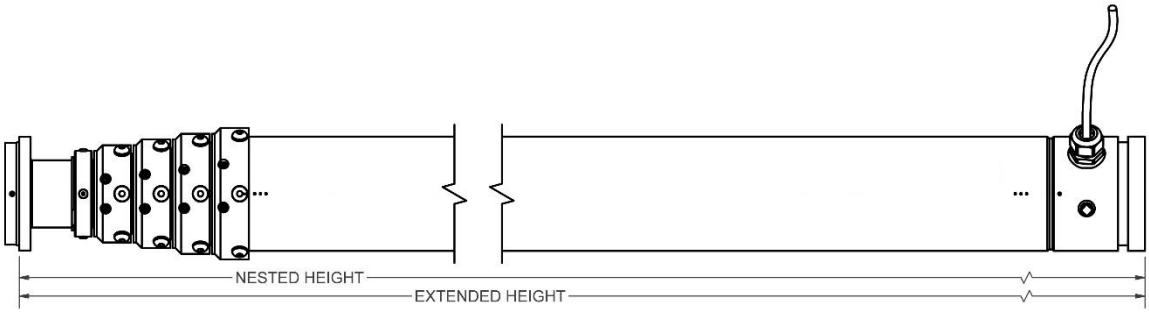


*Figure 1-1 Standard IWM Mast*

*Table 1-3 Entry Level IWM Part & Model Numbers*

| Part Number | Model Number |
|---|---|
| 913835 | 4.7-10 |
| 914382 | 5.7-13 |
| 914383 | 6.7-16 |

*Table 1-4 Reference Data – Entry Level Duty IWM Mast*

| | Payload Capacity | Extended Height | Nested Height | Approx. Mast Weight | No. of Sections | Section Diameter | Max Operating Pressure |
|---|---|---|---|---|---|---|---|
| **4.7-10** | 100 lb. | 10.2 ft. | 4.7 ft. | 27 lb. | 3 | 4 – 3 inches | 20 PSIG |
| | 45.4 kg | 3.1 m | 1.4 m | 12.3 kg | | 102 – 76 mm | 1.4 bar |
| **5.7-13** | 100 lb. | 13.3 ft. | 5.7 ft. | 32 lb. | 3 | 4 – 3 inches | 20 PSIG |
| | 45.4 kg | 4 m | 1.7 m | 14.6 kg | | 102 – 76 mm | 1.4 bar |
| **6.7-16** | 100 lb. | 16.3 ft. | 6.7 ft. | 37 lb. | 3 | 4 – 3 inches | 20 PSIG |
| | 45.4 kg | 5 m | 2 m | 16.8 kg | | 102 – 76 mm | 1.4 bar |

Note:
- Payload Capacity assumes a 12 Inch Maximum Offset Payload and a Mast Deployment Angle 0° to 5°
- Payload Capacity will be affected by wind sail area; consult factory. Payload Capacity includes cable weight.
- Section Diameter listed as Base Mast Section Diameter – Top Mast Section Diameter.
- Dimensions and specifications provided are for reference only, and are not intended for vehicle design purposes
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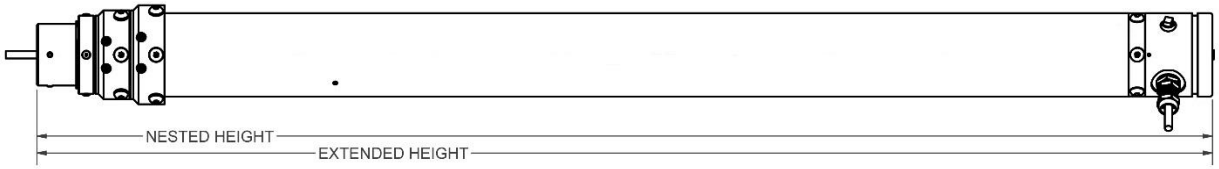


*Figure 1-2 Entry Level IWM*

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# Section 2 Installation

## 2.1 Introduction

This section provides instructions for installing a IWM Pneumatic Mast.

## 2.2 Tools and Materials Required for Installation

*Table 2-1 Tools and Materials Required for Installation*

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

## 2.3 Unpacking

**⚠ CAUTION**

**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.

Unpack the Pneumatic Mast as follows:

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

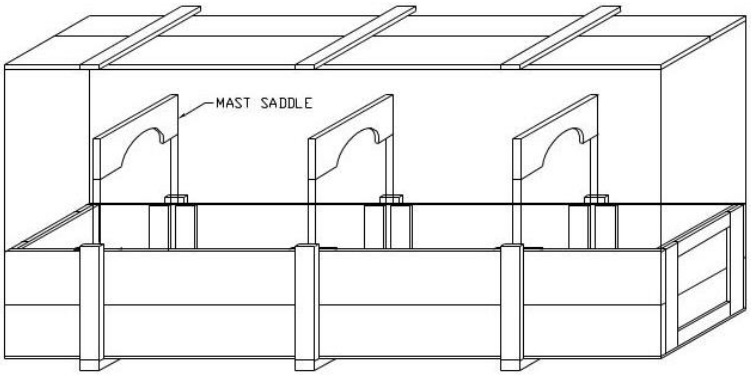


*Figure 2-1 Shipping Crate*

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

# 2.4 Installation

## 2.4.1 Mast Installation – Internal Mounting

**⚠ WARNING**

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

**⚠ CAUTION**

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

1. To select a suitable location for the mast in a vehicle consider the following:
    a. Roof must be as flat as possible at the location of the mast. The roofline must lie in between the weep hole and base tube collar. Mounting hardware should be at least 1 inch (25 mm) above the weep hole and 3 inch (76 mm) below the collar.
    b. The floor must be level and solid. If not, it must be reinforced.
    c. The area underneath the floor must be free of obstructions to allow for accessibility to base plate fasteners and the bottom air inlet port, if used.
    d. For manually rotatable models only, the location of the mast must allow enough clearance from the wall to accommodate the turning handles and the air hose if the air is routed to the side port. Swivel fittings (Will-Burt part numbers 900481 and 900483) for the bottom air inlet are available.
2. Remove any roofline or ceiling panels. Cut a round hole in the roof ¼-inch larger than the diameter of the mast base section. See Section 1.4 for mast base section diameter. Cut the same size hole in the roof liner or ceiling panel. Center the ceiling plate over the hole. Use it as a template to drill bolt holes for attachment.
3. If irregularities exist in the roof, washers or short spacers made of ¼-inch pipe can be used. Size ¼-inch or M6 bolts, not provided, to length allowing for the thickness of any bolt fasteners (not provided) and the mounting kit hardware. To assemble the roof mounting hardware, apply a bead of silicone sealant to both sides of one rubber gasket. Line up all holes and fit the gasket between the roof flange and the roof. The other gasket needs no sealant and fits against the inside of the roof. It is held in place by the ceiling plate. Line up all holes and fasten this assembly together using the appropriately sized fasteners. Securely tighten all nuts. Clean off any silicone sealant that may have squeezed out into the hole cut for the mast. Replace the roof liner or ceiling panel before installing the mast.

4. To locate the base plate for the mast, first make sure the floor of the vehicle is level. Find the base plate location by using a plumb bob supported from the center of the roof hardware or by using a carpenter's level held against the base tube of the mast. In the latter case, slide the weather bonnet over the bottom of the mast base section and up the mast past the weep hole towards the collar. If the weather bonnet is difficult to maneuver, put soapy water or oil on the mast to allow it to slide more freely. Lower the mast partially through the roof and attach the base plate before lowering the mast to the floor. It is necessary to check the mast in two places 90° apart when using a level. Be certain to orient the mast so the operator has a clear view of the mast hazard labels. Additional labels are provided with the operator's manual that can be applied where the operator deems appropriate. Once located, the base plate may be used as a template to drill holes through the floor. Secure the base plate to the floor.
5. After the mast is secured to the base plate and the base plate is fastened to the vehicle, slide the weather bonnet down the mast and over the roof flange. If the weather bonnet or roof ring is difficult to maneuver, put soapy water or oil on the mast to allow it to slide more freely.
6. 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 20 psi. Refer to Section 2.4.4 for installation instructions of the pneumatic system.
7. Install the weep hole drain kit provided with the mast.
8. For rotatable masts, locate the turning handles at the desired height. Tighten the turning handle bolts just enough to allow the turning handles to rotate the mast without slipping. Tightening the turning bolts too much can deform the base tube and impede the movement of the next internal mast section. Lock the mast in place by tightening the locking screws located on the base plate assembly at all times unless the mast is to be rotated. See Section 3 for instructions on rotating the mast.

## 2.4.2 Mast Installation – External Mounting

**⚠ WARNING**

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

**⚠ CAUTION**

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

1. When selecting the location for the mast on the vehicle, check the strength and rigidity of the body where the mast is to be externally attached.
2. Make sure the vehicle is on a flat level area.

3. If using the external shelf bracket, securely attach it to the vehicle. Be certain the shelf bracket is level.
4. Attach the base plate to the external shelf bracket or other mounting structure.
5. Attach the external support bracket around the mast base section. The support bracket should be positioned at least 1 inch (25 mm) above the base mast section weep hole and close to, but at least 1 inch (25 mm) below, the base mast section collar. Do not cover the weep hole.
6. Secure the support bracket to the wall structure. Spacers may be added between the support bracket and the wall as needed to keep the correct alignment between the support bracket and the shelf bracket.
7. Periodically inspect all fasteners and welds to make sure the mast is securely attached.
8. A bottom air inlet is available on all standard model masts. Swivel fittings (Will-Burt part numbers 900481 and 900483) for the bottom air inlet are available for rotatable masts.
9. Air to operate the mast may be provided by an air compressor or other source of clean dry air. The air system should be regulated to not exceed 20 psi. Refer to Section 2.4.4 for installation instructions of the pneumatic system.
10. For rotatable masts, locate the turning handles at a desired height (preferably above the weep hole if feasible). Tighten the turning handle bolts just enough to allow the turning handles to rotate the mast without slipping. Tightening the turning handles too much can deform the base tube and impede the movement of the next internal mast section. Lock the mast in place by tightening the locking screws located on the base plate. The locking screws should be tightened in against the mast at all times unless the mast is to be rotated. See Section 3 for instructions on rotating the mast.
11. The weep hole drain kit, intended to protect the interior of a vehicle from damage due to water drainage, is not required for externally mounted masts. However, the elbow from the kit may be used to shield the weep hole from blow sand, dust and other debris. Refer to point 2 in Section 2.4.3 for instructions on installing the elbow.

1. Mast
2. Support Bracket
3. Turning Handles (with manually rotatable mast)
4. External Shelf Bracket
5. Pneumatic System (several models available)
6. Air Control Valve
7. Air Hose (side air port)
8. Air Hose (bottom air port)
9. Warning Light

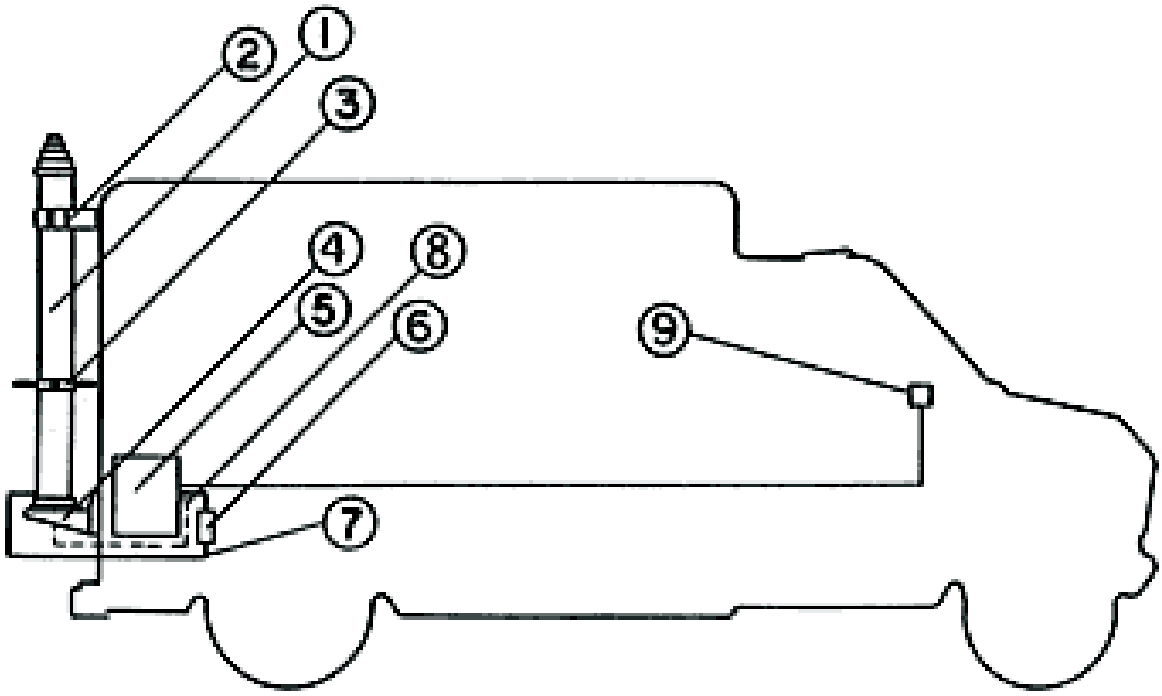


*Figure 2-2 Mast Installation – External Mounting*

## 2.4.3 Installation – Weep Hole Drain Kit

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

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

**⚠ CAUTION**

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

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

1. Be certain the locknut and washer are threaded over the end of ¼-inch hose adapter.
2. Fasten hose adapter to base mast section weep hole. Turn the hose adapter in ONLY 1 ½ to 2 turns after initial engagement of threads. Further turning will damage mast. Tighten the locknut to secure in place.
3. Drill hole in vehicle or enclosure to route water outside. Fasten bulkhead fitting to hole.
4. Attach drain tube to hose adapter and bulkhead fitting.

See Figure 2-3 below for illustrations of the weep hole drain kit.

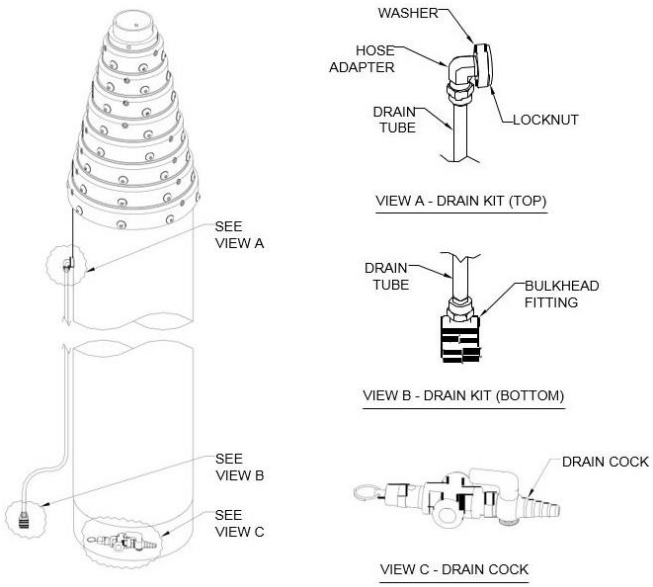


*Figure 2-3 Weep Hole Drain Kit*

## 2.4.4 Installation – Pneumatic System

**⚠ CAUTION**

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

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

**⚠ CAUTION**

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

1. **Mounting** – When mounting the pneumatic system, leave enough space around the unit for ventilation and for access to make initial installation, periodic adjustments, and future maintenance procedures as easy as possible. To reduce vibration in the system place rubber washers or grommets on the bolts between the mounting pads and the mounting surface. To reduce noise, separate the system from the inside workspace of the vehicle.
2. **Electrical** – In accordance with applicable electrical codes, select the proper wiring size, circuit breakers, or fuse size according to the maximum current draw of the pneumatic system being installed. Refer to rating information plate on the compressor motor. Be sure to properly ground the compressor motor and all other electrical components. Operation of the compressor may cause interference unless proper isolation or shielding is used. NOTE: A qualified electrician should perform installation and adjustments.
3. **Air Supply** – The compressor should have adequate ventilation to provide at least 10 SCFM of clean dry air at the air intake at all times. The recommended temperature range for inlet air is 32° F (0° C) to 95° F (35° C), so it works best when located in a heated compartment. The compressor should not be operated without the air filters in place.
4. **Control Valve** – A control valve should be installed to direct airflow in and out of the mast. The control valve should be positioned to avoid unintentional operation. Mast movement should stop when the controller is released (hold-to-run type). If the controller is not a hold-to-run type, an emergency stop must be provided. The control valve should be operable by a person wearing gloves and mounted so it can be used with the mast in full view. The control valve should be suitable for outdoor use and marked "Up", "Down" or similar. A check valve or similar device should be installed directly to the mast through rigid piping that would prevent an extended mast from exhausting uncontrollably if there is a pneumatic failure, such as a hose burst.

5. **Drain & Relief Fittings** – A drain cock and a safety valve should be installed at the air inlet at the base of the mast. The drain cock empties water that may have accumulated inside the mast. The drain cock should be opened periodically to drain the mast, particularly after the mast has been operated in the rain. The drain cock on any mast should be left open once the mast is fully retracted and once a locking mast is completely extended and locked into position. The safety valve prevents the mast from being over pressurized.

## 2.4.5 Installation – Mast Extension Magnetic Warning Kit

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

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

The system should be installed per the diagrams shown below. One flashing light should be mounted to the vehicle dash in full view of the driver. The mast extension magnetic warning kit will not operate unless it is installed properly.

Installation Instructions:

1. Assemble the magnetic switch assembly and the stainless-steel clamp as shown. Attach the switch assembly loosely around the mast base tube, approximately 6 to 20 inches (15 to 51 cm) above the base plate.
2. Use 16 AWG stranded wire (not included) to connect the flasher, lights and relay to the wires exiting the switch assembly. Connect the wires according to the diagram and schematic as shown. Be certain to observe any local codes or regulations.
3. With the ignition on, have the mast fully nested and the flasher/light installed and connected through the ignition to the battery. The lights should be flashing unless the switch is in proximity with the magnet assembly. Slide the magnetic switch assembly up and down along the lower two feet of the mast base tube to locate the magnet assembly inside the tube. When the magnet is located, the lights will stop flashing. The vertical sensing range should be about 1 to 3 inches (2.5 to 7.5 cm). Tighten the band to clamp the switch assembly in the sensing range, but not lower than 1 inch (2.5 cm) above the lower limit. The switch can be located anywhere around the perimeter of the base tube.
4. Pressurize the mast to extend it 1 to 2 ft. (31 to 61 cm) several times to test the mast extension magnetic warning kit.

5. Attach the "NOTICE" label in a visible area on the mast base tube.

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

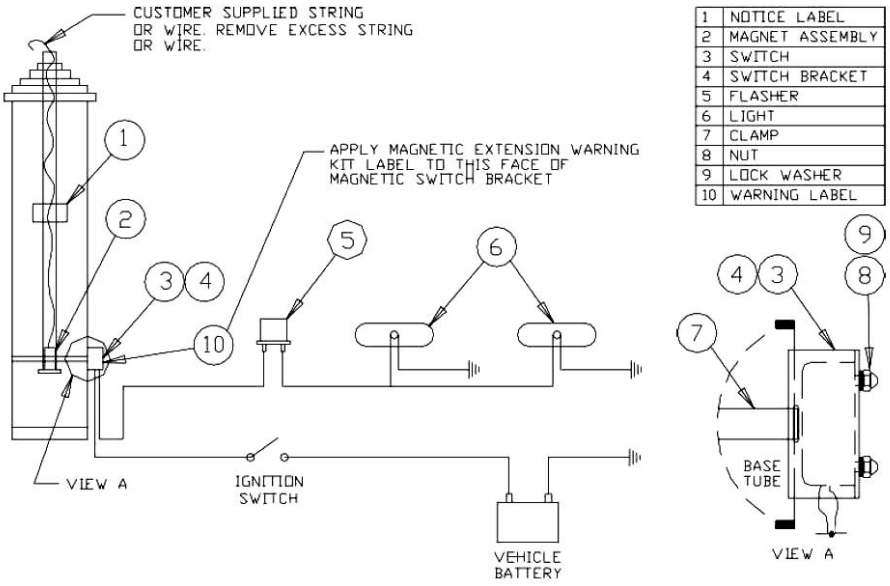


*Figure 2-4 Magnetic Warning Kit*

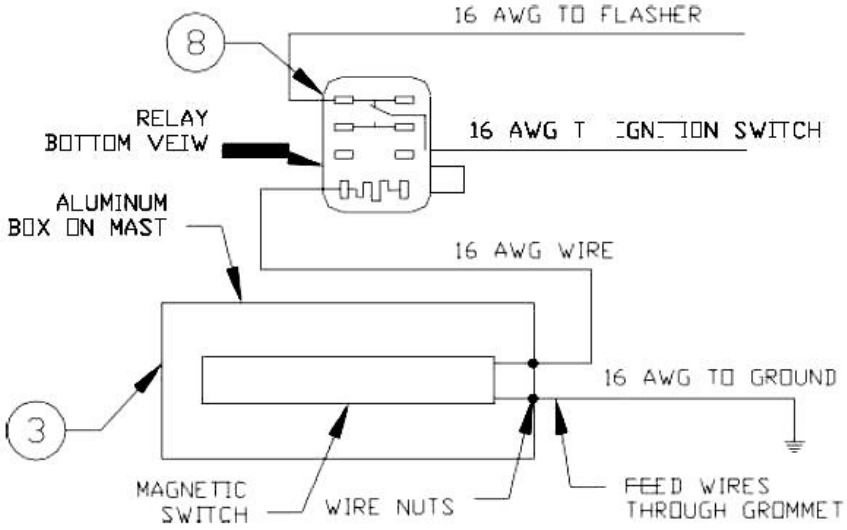


*Figure 2-5 Switch & Relay Assembly*

# Section 3 Operating Instructions

**⚠ WARNING**

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

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

**⚠ WARNING**

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

**⚠ WARNING**

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

**⚠ WARNING**

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

**⚠ WARNING**

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

**⚠ WARNING**

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

**⚠ WARNING**

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

**⚠ CAUTION**

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

## 3.1 Introduction

This section provides instructions for operating the IWM Pneumatic Mast.

## 3.2 Operation – Non-Locking Masts

### 3.2.1 Extending the Mast

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

### 3.2.2 Rotating the Mast

1. If the mast is a manually rotatable model, loosen the locking screws on the base plate approximately one turn. Using its turning handles, rotate the mast to the desired direction. Re-tighten the locking screws to hold the position.

### 3.2.3 Lowering the Mast

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

**⚠ WARNING**

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

3. Periodically open the drain cock when exhausting the mast to drain off any accumulated water.

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

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# Section 4 Maintenance and Service Instructions

**⚠ WARNING**

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

**⚠ CAUTION**

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

**⚠ CAUTION**

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

**⚠ CAUTION**

**Lifting Hazard!** Manually lifting over 55 lb. (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.

## 4.1 Introduction

This section provides instructions for maintaining and servicing an IWM Pneumatic Mast.

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

## 4.2 Tools and Materials Recommended/Required

*Table 4-1 Tools and Materials Recommended/Required*

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

## 4.3 Scheduled Maintenance

### 4.3.1 Mast Cleaning and Lubrication

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

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

Procedure:

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

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

3. One person operating the air control valve should slowly pressurize the mast just enough to extend the top mast section. Another person may need to hold down the larger mast section collars to assure the proper sequence of extension. Close the air control valve as soon as the mast section is up.
4. Dampen a rag with a non-abrasive cleanser or solvent such as lacquer thinner to wipe down the extended mast section. Do not allow the cleaning fluid or solvent to run down inside the collar.
5. Repeat steps 3 and 4 for the next larger mast section.
6. Inject approximately ½ oz. of Mast Lubricant* or a lightweight machine oil into the weep hole (drain) of the exposed mast section. The weep holes are located between one and three feet below the collar on each tube except the top one.
7. Repeat steps 3, 4 and 6 for each of the remaining mast sections. The larger diameter sections should be injected with approximately 1 oz. of lubricant.
8. Lower the mast completely. Allow several minutes for the lubricant to settle and spread around the wear ring and seal at the bottom of each mast section.

**⚠ WARNING**

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

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

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

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

## 4.4 Corrective Maintenance

### 4.4.1 Replacing Seals – Standard Duty

1. Place the mast horizontally on a pair of sawhorses or similar supports. Secure the mast base tube to the supports so that the mast does not roll off. To disassemble the mast, start with the top section and work toward the base section. Remove any plugs from air inlet ports.
2. To remove the top mast section pull it out several inches away from the collar and remove the top tube stop. On locking collar models, it is necessary to retract the latch pins to allow the mast section to be pulled out. Remove the collar bolts on the top collar and slide the collar over the end of the mast section. On locking collar models, retract the latch pins fully to allow the collar to slide off the end of the mast section. Slide the top section out. Do not drop the mast section as it comes out.

3. Remove the wear ring from the butt plate and wipe it clean. Remove the old seal and clean the seal groove. The mast section should be cleaned inside and outside with a solvent such as lacquer thinner. Do not use anything that might scratch the inside surface of the mast section. Repeat this procedure for each subsequent mast section.
4. Refer to Section 4.4.2 for replacement of collar bearing strips; Section 4.4.3 for replacement of wear rings; Section 4.4.4 for replacement of internal bumpers; and Section 4.4.5 for replacement of external bumpers.
5. Apply a coat of Mast Lubricant or lightweight machine oil such as SAE 10 to the inside surface of all mast sections except the top section. Oil the new seal. With the lip edge of the seal toward the bottom end of the mast section, slide it on the butt plate and into the seal groove. Replace the wear ring on the butt plate. Repeat this procedure for each mast section.
6. When reassembling the mast, start with the base section and work toward the top section.
7. Secure the base mast section of the mast horizontally on saw horses or similar supports. Using a second person or using some other brace to support the top end, hold the next mast section so that the top end of the section is at a lower elevation than the seal end. Next, rest the lip of the seal on the inside of the receiving section. Refer to Figure 4-1. Slowly raise the lower end of the mast section to horizontal while carefully pressing the lip of the seal into the receiving section. Use your thumbs and forefingers on both sides of the seal to simultaneously press both sides of the seal in an upward motion. Work this way until your fingers meet at the top. Make sure that the seal is in correctly. If not, the mast will eventually leak air. If the seal has not been inserted into the receiving tube correctly, remove the mast section and try again. Once the seal is inserted, guide the wear ring into position within its groove, and slide in the mast section. Be careful not to damage the seal as it slides past the collar bolt holes that are located near the insertion end of the receiving section.
8. Slide the section in leaving several inches protruding. Rotate the section so that the match mark "0" stamped on one of the keys at the end of the section is in line with the "0" stamped on the end of the base section.
9. Replace the collar on the mast section. Line up the match mark "0" on the collar with the "0" on the mast section. On locking collar masts, retract the latch pins to allow the collar to slide onto the end of the mast section. Make certain that all the bolt holes in the collar align exactly with the holes in the mast section. Install and hand tighten the collar bolts and lock washers. Torque the collar bolts to 80 lb.-in. maximum.
10. Repeat steps 6 through 9 for each subsequent mast section.

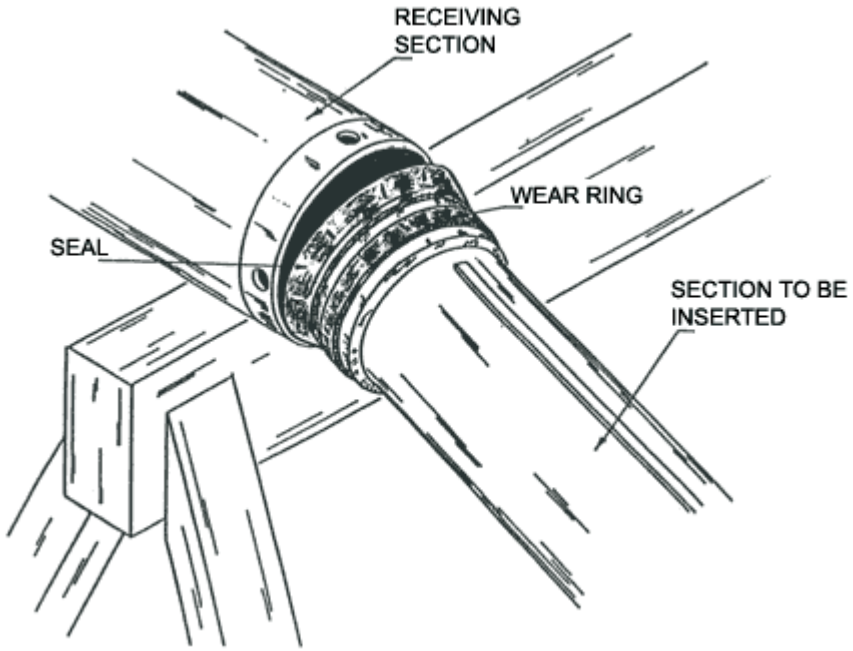


*Figure 4-1 Seal Replacement -- Standard Duty*

## 4.4.2 Replacing Collar Bearing Strips

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

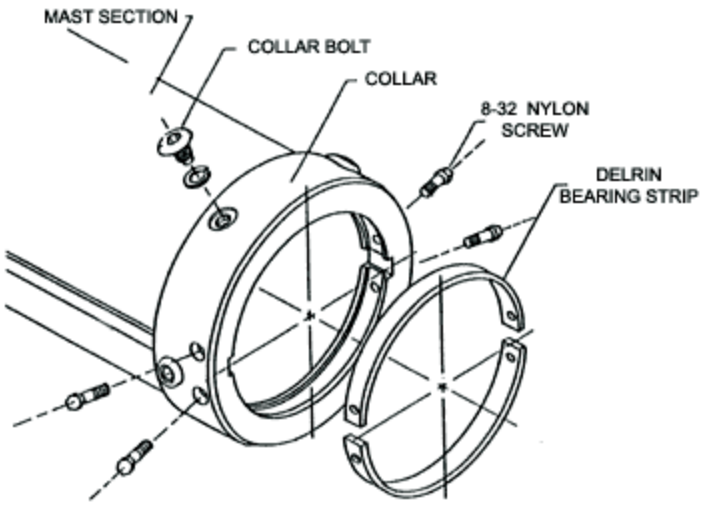


*Figure 4-2 Replacing Collar Bearing Strips*

## 4.4.3 Replacing Wear Rings

1. Wear rings are preformed split synthetic bearings that fit around the butt plate above the seal on each interior mast section. Wear rings can be replaced when the mast is disassembled for seal replacement. Check the wear rings for wear. If the wear ring is worn down to the butt plate surface, it must be replaced.
2. Clean the butt plate and wear ring groove. Slide the wear ring over the mast and into the groove. Press the wear ring into the groove to make sure there is at least ⅛-inch clearance between the two ends. If necessary, cut enough off one end to get the required gap.
3. The wear ring must be held in place until this mast section is inserted into the receiving mast section. It may help to put a drop of glue on the two ends to hold the wear ring in place. If the Wear Ring prevents the Mast Section from sliding inside the next section, grind the Wear Ring OD as necessary. Before reassembling the mast section, slide each mast section inside its mating mast section. If the smaller mast section does not slide freely inside the next largest mast section, it will be necessary to sand high spots on the wear ring to fit. The high spots will appear as shiny or discolored marks on the outside diameter of the wear ring.

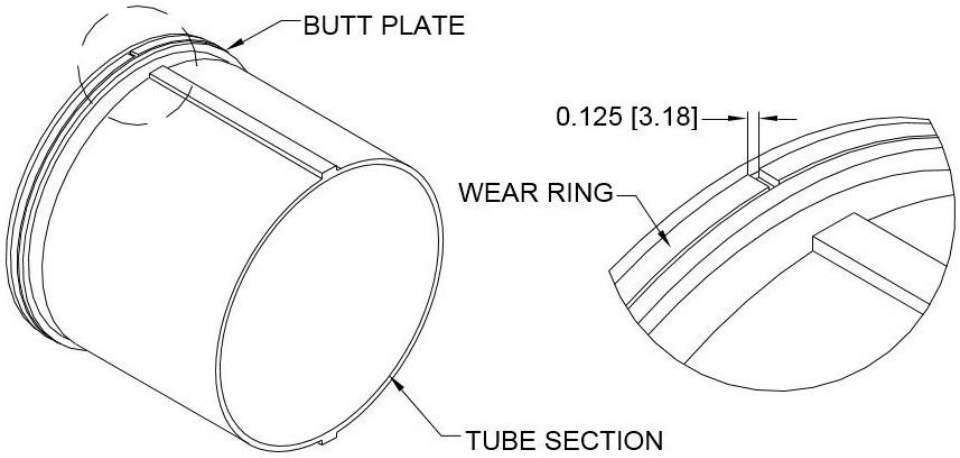


*Figure 4-3 Replacing Wear Rings*

## 4.4.4 Replacing Internal Bumpers

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

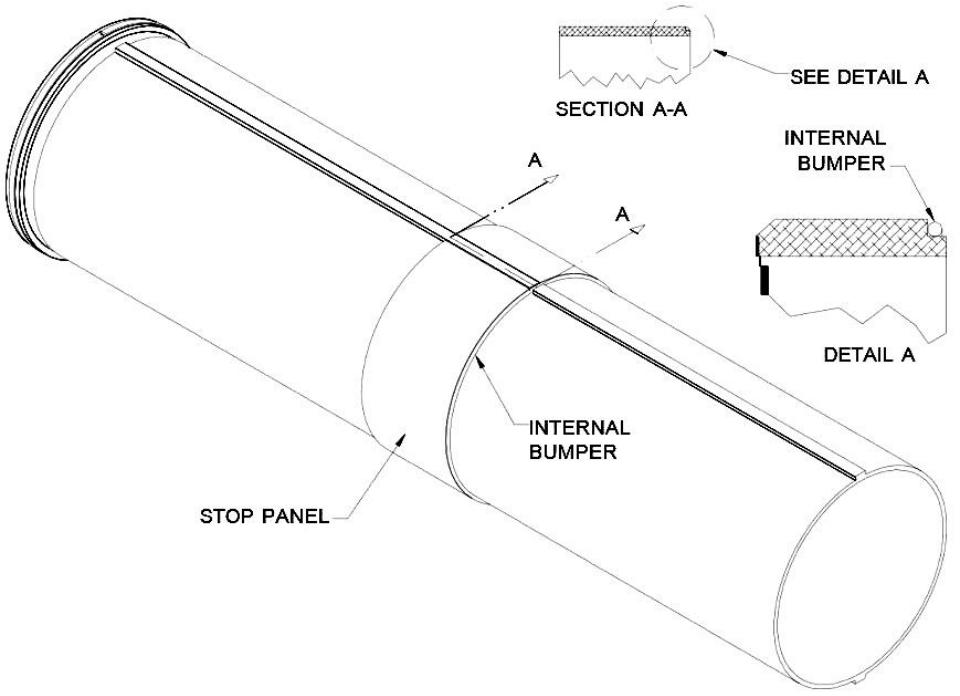


*Figure 4-4 Replacing Internal Bumpers*

## 4.4.5 Replacing External Bumpers

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

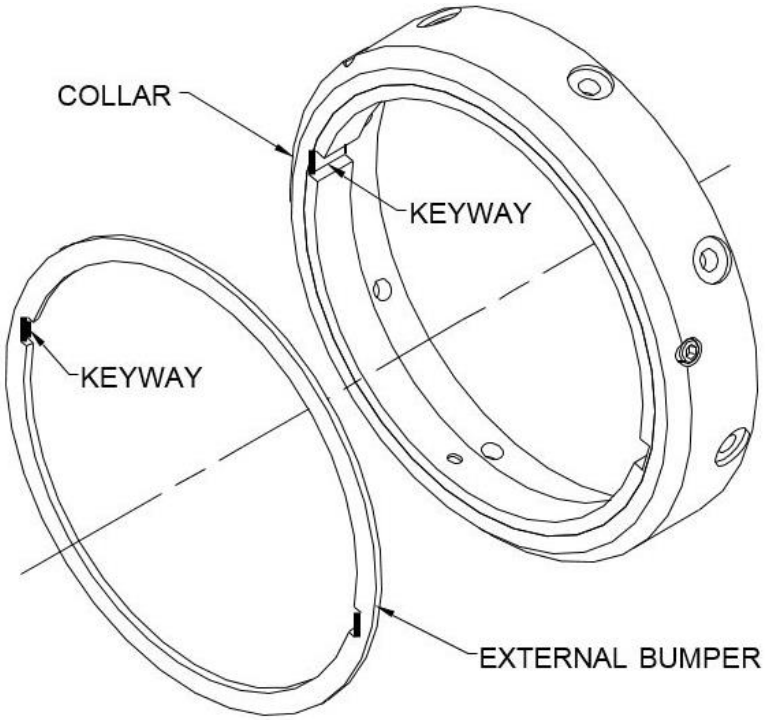


*Figure 4-5 Replacing External Bumpers*

## 4.5 Troubleshooting

| Problem | Possible Cause(s) | Possible Solutions |
|---|---|---|
| Mast frozen in extended position. | 1. Mast Base Section not drained routinely. Typically freezes around collar area. | 1. Wrap warming blankets around collar until ice melts. Use heat gun or 500W quartz light.<br>2. Depressurize Mast. Inject 1 oz. Antifreeze, suited for aluminum engines, where top of collar and Intermediate tube meet. |
| Mast frozen in nested position. | 1. Mast Base Section not drained routinely. Typically damages Tubes. | 1. Send to manufacturer for repair or replacement. |
| Mast will not lower without rocking. | 1. Mast not oiled in extreme conditions.<br>2. Not enough weight.<br>3. Bent Tube.<br>4. Broken internal bumper.<br>5. Inserts tight. | 1. See Section 4.3.1 Mast Cleaning & Lubrication.<br>2. Add weight to platform or stub adapter.<br>3. Check tube trueness. Order replacement if bent.<br>4. Depressurize. Remove collar & lift tube to check Internal bumper. Order replacement. See Section 4.4.4.<br>5. Depressurize. Disassemble. File & grind to prefit collar inserts as necessary. |
| Largest Intermediate Tube Section stuck | 1. Turning Handles tight.<br>2. Support bracket tight. | 1. Remove Turning Handles and cycle.<br>*Cycles properly:* Reinstall Handles<br>*Does not cycle:* Tubes damaged; Order replacement.<br>2. Loosen bolts. Shim as necessary between clamp halves. |
| Rotational movement in Mast Sections | 1. Bearing Strips or Inserts worn. | 1. Non-locking Insert Collar: Order Insert.*<br>*Customer must prefit. |
| Cannot slide Weather Bonnet over Base Section. | 1. Bonnets are designed tight. | 1. Use soapy water per point 6 in Section 2.4.1 Internal Mounting.<br>2. Oil O-ring and use mallet to tap evenly around diameter of Bonnet. |
| For additional information, please contract Customer Service at 330-684-5298. | | |

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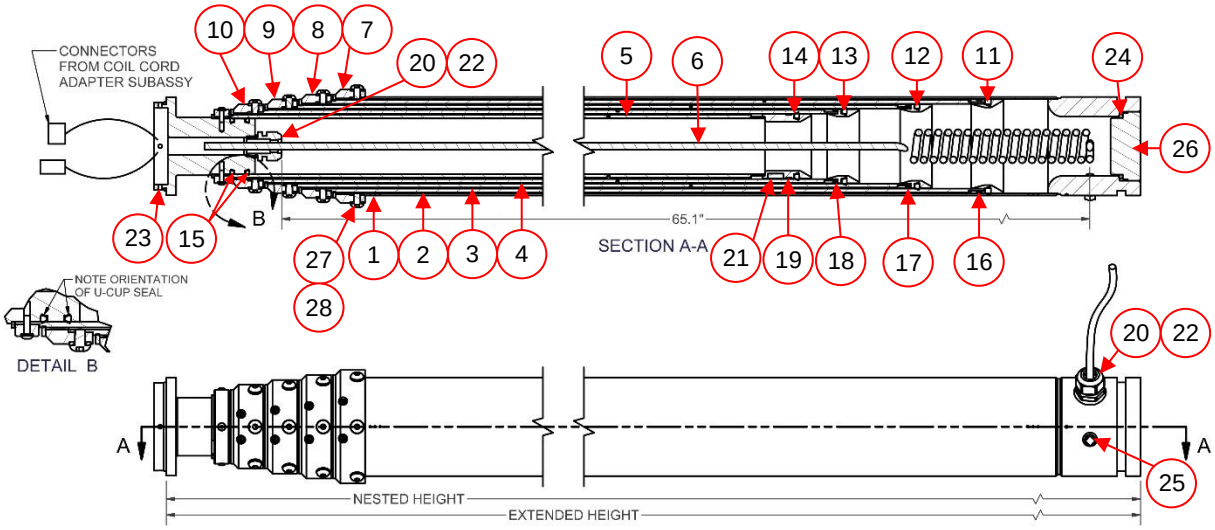
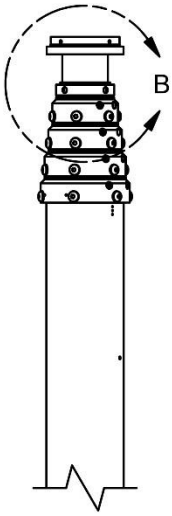
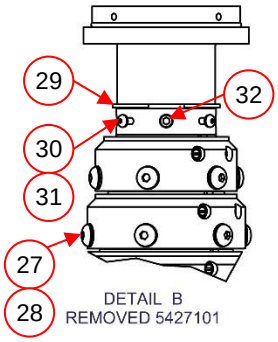
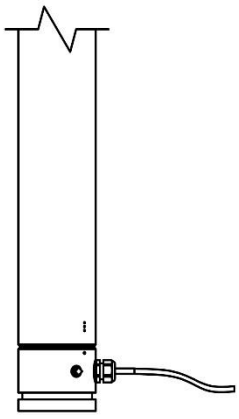
# Section 5 Mast Parts



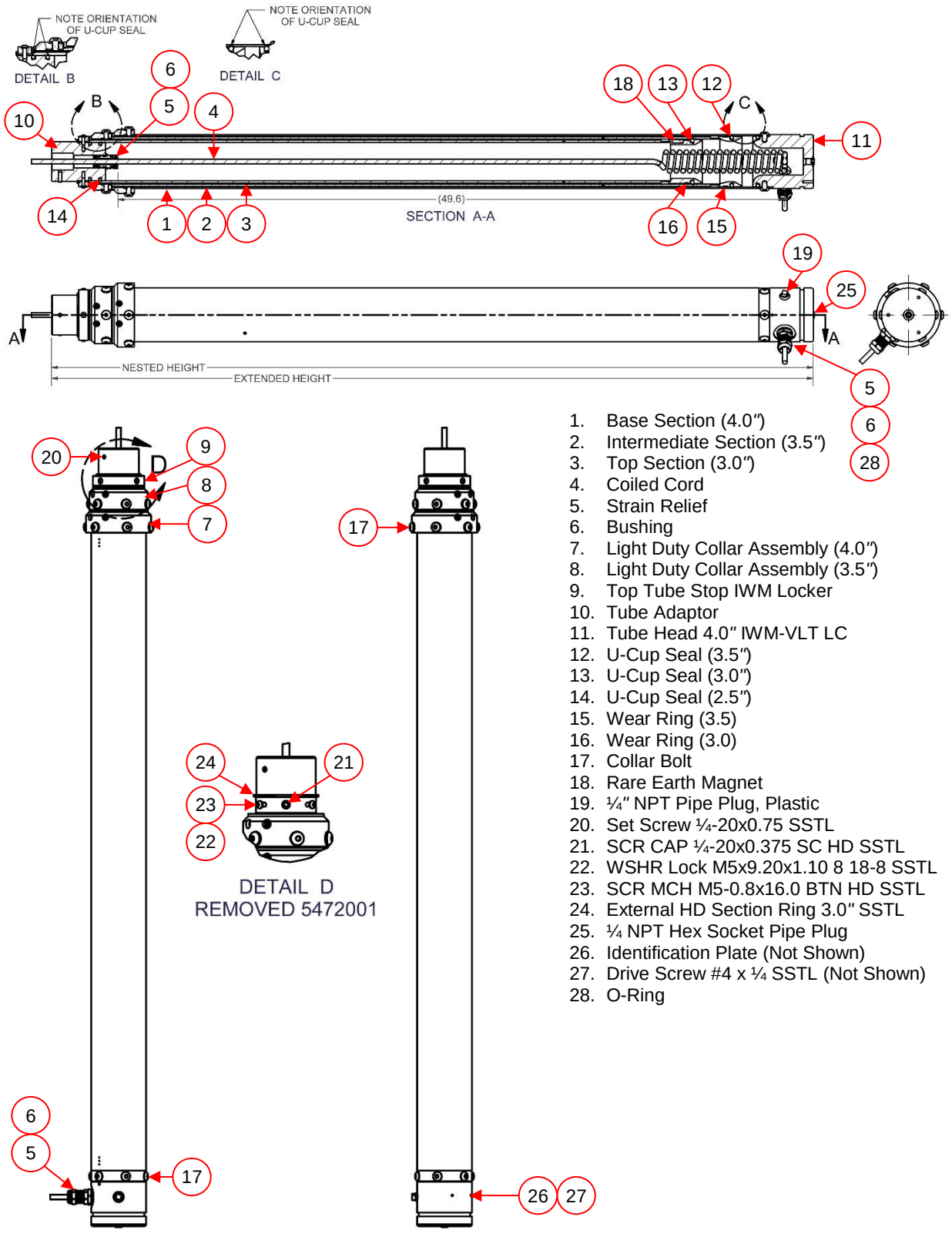



1. Base Section (5.0″)
2. Intermediate Section (4.5″)
3. Intermediate Section (4.0″)
4. Intermediate Section (3.5″)
5. Top Section (3.0″)
6. Coil Cord
7. Light Duty Collar Assembly (5.0″)
8. Light Duty Collar Assembly (4.5″)
9. Light Duty Collar Assembly (4.0″)
10. Light Duty Collar Assembly (3.5″)
11. U-Cup Seal (4.5″)
12. U-Cup Seal (4.0″)
13. U-Cup Seal (3.5″)
14. U-Cup Seal (3.0″)
15. U-Cup Seal (2.5″)
16. Wear Ring (4.5)
17. Wear Ring (4.0)
18. Wear Ring (3.5)
19. Wear Ring (3.0)
20. Strain Relief
21. Rare Earth Magnet
22. O-Ring
23. O-Ring
24. O-Ring
25. ⅜ NPT Pipe Plug Plastic
26. Tube Head Plug
27. Collar Bolt
28. Collar Bolt Washer
29. External HD Section Ring
30. SCR MCH M5-0.8x16.0 BTN HD SSTL
31. WSHR LOCK M5x9.20x1.10 8 18-8 SSTL
32. SCR CAP ¼-20x0.375 SC HD SSTL

*Figure 5-1 Standard IWM (Images Not to Scale)*




1. Base Section (4.0″)
2. Intermediate Section (3.5″)
3. Top Section (3.0″)
4. Coiled Cord
5. Strain Relief
6. Bushing
7. Light Duty Collar Assembly (4.0″)
8. Light Duty Collar Assembly (3.5″)
9. Top Tube Stop IWM Locker
10. Tube Adaptor
11. Tube Head 4.0″ IWM-VLT LC
12. U-Cup Seal (3.5″)
13. U-Cup Seal (3.0″)
14. U-Cup Seal (2.5″)
15. Wear Ring (3.5)
16. Wear Ring (3.0)
17. Collar Bolt
18. Rare Earth Magnet
19. ¼″ NPT Pipe Plug, Plastic
20. Set Screw ¼-20x0.75 SSTL
21. SCR CAP ¼-20x0.375 SC HD SSTL
22. WSHR Lock M5x9.20x1.10 8 18-8 SSTL
23. SCR MCH M5-0.8x16.0 BTN HD SSTL
24. External HD Section Ring 3.0″ SSTL
25. ¼ NPT Hex Socket Pipe Plug
26. Identification Plate (Not Shown)
27. Drive Screw #4 x ¼ SSTL (Not Shown)
28. O-Ring

*Figure 5-2 Entry Level IWM (Images Not to Scale)*