

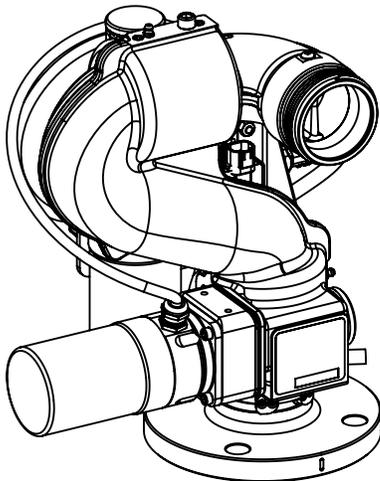
INSTRUCTION FOR INSTALLATION, OPERATION, AND MAINTENANCE

⚠ DANGER

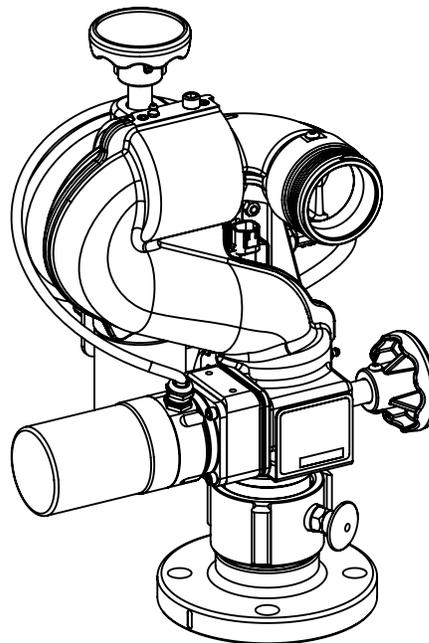
Understand manual before use. Operation of this device without understanding the manual and receiving proper training is a misuse of this equipment. Obtain safety information at tft.com/serial-number.

This equipment is intended for use by trained and qualified emergency services personnel for firefighting. All personnel using this equipment shall have completed a course of education approved by the Authority Having Jurisdiction (AHJ).

This instruction manual is intended to familiarize firefighters and maintenance personnel with the operation, servicing, and safety procedures associated with this product. This manual should be kept available to all operating and maintenance personnel.



RIGID BASE



QUICK CONNECT BASE

DANGER

PERSONAL RESPONSIBILITY CODE

The member companies of FEMSA that provide emergency response equipment and services want responders to know and understand the following:

1. **Firefighting and Emergency Response are inherently dangerous activities** requiring proper training in their hazards and the use of **extreme caution** at all times.
2. **IT IS YOUR RESPONSIBILITY** to read and understand any user's instructions, including purpose and limitations, provided with any piece of equipment you may be called on to use.
3. **IT IS YOUR RESPONSIBILITY** to know that you have been properly trained in Firefighting and/or Emergency Response and in the use, precautions, and care of any equipment you may be called upon to use.
4. **IT IS YOUR RESPONSIBILITY** to be in proper physical condition and to maintain the personal skill level required to operate any equipment you may be called upon to use.
5. **IT IS YOUR RESPONSIBILITY** to know that your equipment is in operable condition and has been maintained in accordance with the manufacturer's instructions.
6. Failure to follow these guidelines may result in death, burns or other severe injury.

Fire and Emergency Manufacturers and Service Association, Inc.
PO Box 147, Lynnfield, MA 01940 • www.FEMSA.org



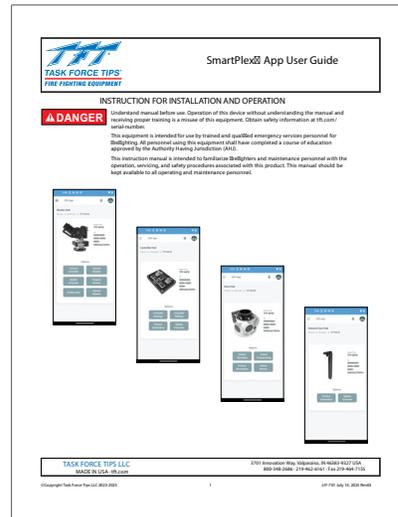
© 2020 FEMSA. All Rights Reserved.

SUPPORTING MATERIALS

The following document contains supporting safety and operating information pertaining to the equipment described in this manual.



LIY-550 - SmartPlex RC Monitor Controls



LIY-701 - SmartPlex App User Guide

TABLE OF CONTENTS

- 1.0 MEANING OF SAFETY SIGNAL WORDS
- 2.0 SAFETY
- 3.0 GENERAL INFORMATION
 - 3.1 MECHANICAL SPECIFICATIONS
 - 3.2 ELECTRICAL SPECIFICATIONS
 - 3.3 OPERATING ENVELOPE
 - 3.4 USE WITH SALT WATER
 - 3.5 VARIOUS MODELS AND TERMS
 - 3.6 INLETS AND OUTLETS
 - 3.7 OVERALL DIMENSIONS
- 4.0 INSTALLATION
 - 4.1 ELECTRICAL INSTALLATION
 - 4.2 STRUCTURAL REQUIREMENTS
 - 4.3 QUICK CONNECT INLET
 - 4.4 INLET ALIGNMENT
 - 4.5 HORIZONTAL TRAVEL RANGE AND STOPS
 - 4.5.1 RIGID BASE MODELS
 - 4.5.2 QUICK CONNECT INLET MODELS
 - 4.6 VERTICAL TRAVEL RANGE AND STOPS
 - 4.6.1 RIGID BASE MODELS
 - 4.6.2 QUICK CONNECT INLET MODELS
 - 4.7 NOZZLE INSTALLATION
 - 4.8 PRESSURE GAUGE PORT
 - 4.9 DRAINING RESIDUAL WATER
- 5.0 OPERATION
 - 5.1 RECOMMENDED STOW POSITION
 - 5.2 OVERRIDE KNOBS
 - 5.2.1 RIGID BASE MODELS
 - 5.2.2 QUICK CONNECT INLET MODELS
- 6.0 FLOW CHARACTERISTICS
 - 6.1 STACKED TIPS FLOW AND REACTION
 - 6.2 REACH AND TRAJECTORY
 - 6.3 TORNADO MAX MONITOR AND FRICTION LOSS
 - 6.4 STREAM STRAIGHTENERS
 - 6.4.1 STREAM STRAIGHTENERS WITH STACKED TIPS
 - 6.4.2 STREAM STRAIGHTENERS WITH FOG NOZZLES
- 7.0 WARRANTY
- 8.0 MAINTENANCE
 - 8.1 SERVICE TESTING
 - 8.2 LUBRICATION
 - 8.3 TROUBLESHOOTING
 - 8.4 REPAIR
- 9.0 EXPLODED VIEWS AND PARTS LISTS
- 10.0 OPERATION AND INSPECTION CHECKLIST

1.0 MEANING OF SAFETY SIGNAL WORDS

A safety related message is identified by a safety alert symbol and a signal word to indicate the level of risk involved with a particular hazard. Per ANSI Z535.6, the definitions of the four signal words are as follows:



DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.



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



CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.



NOTICE is used to address practices not related to physical injury.

2.0 SAFETY



An inadequate supply of pressure and/or flow will cause an ineffective stream and can result in injury or death. Choose operating conditions to deliver adequate fire suppression. See flow graphs.



This equipment is intended for use by trained personnel for firefighting. Use of this equipment for other purposes may involve hazards not addressed by this manual. Seek appropriate guidance and training to reduce risk of injury.



Injury or damage can occur from an inadequately supported monitor. The mounting must be capable of supporting the nozzle reaction force which can be as high as 1500 lbs.



The stream exiting a nozzle is very powerful and capable of causing injury and property damage. Make sure the nozzle is securely attached and pointing in a safe direction before water is turned on. Do not direct water stream to cause injury or damage to persons or property.



Equipment may be damaged if frozen while containing significant amounts of water. Such damage may be difficult to detect visually. Subsequent pressurization can lead to injury or death. Any time the equipment is subject to possible damage due to freezing, it must be tested and approved for use by qualified personnel before being considered safe for use.



On many vehicle installations, the monitor is the highest point on the apparatus. Damage or injury could occur if there is not sufficient clearance to safely pass under doors or overhead obstructions. Always check stowed position of the monitor before moving.



The electric drives are current limited but may still produce enough force to cause injury. To avoid injury from moving equipment:

- Be aware that equipment may be remotely operated
- Keep hands and fingers away from pinch points
- Never operate the manual override while electric controls are in operation

3.0 GENERAL INFORMATION

The TORNADO MAX is a 2 ¼ inch waterway monitor. It is available in electric remote or joystick controlled versions.

3.1 MECHANICAL SPECIFICATIONS

	RIGID		QUICK CONNECT	
	US	METRIC	US	METRIC
Weight	28.5 lbs	11.3 kg	32.1 lbs	14.6 kg
Minimum Flow Area	2.5 in ²	16.1 cm ²	2.5 in ²	16.1 cm ²
Maximum Flow	Refer to the Safe Operating Envelope Graph in 3.3			
Maximum Operating Pressure				
Operating Temperature Range of Fluid	33°F to 120°F / 1°C to 50°C			
Storage Temperature Range	-40 to 150°F / -40 to 65°C			
Materials	ANSI A356.0-T6 Aluminum, Stainless, Nylon			

Figure 3.1

3.2 ELECTRICAL SPECIFICATIONS

Nominal Operating Voltage	12 or 24 VDC	
Maximum Voltage	32 VDC	
Maximum Torque (Elevation)	35 ft·lbs	50 N·m
Maximum Torque (Horizontal)	35 ft·lbs	50 N·m
Speed (Elevation)	25 deg/sec	
Speed (Horizontal)	25 deg/sec	

Figure 3.2

Further specifications for TORNADO MAX models are shown in the SmartPlex RC Controls instruction (LIY-550) and SmartPlex App User Guide (LIY-701).

3.3 OPERATING ENVELOPE



Damage or injury could result from operating the monitor beyond the safe operating envelope. Do not operate the monitor outside the envelope in the following graph(s).

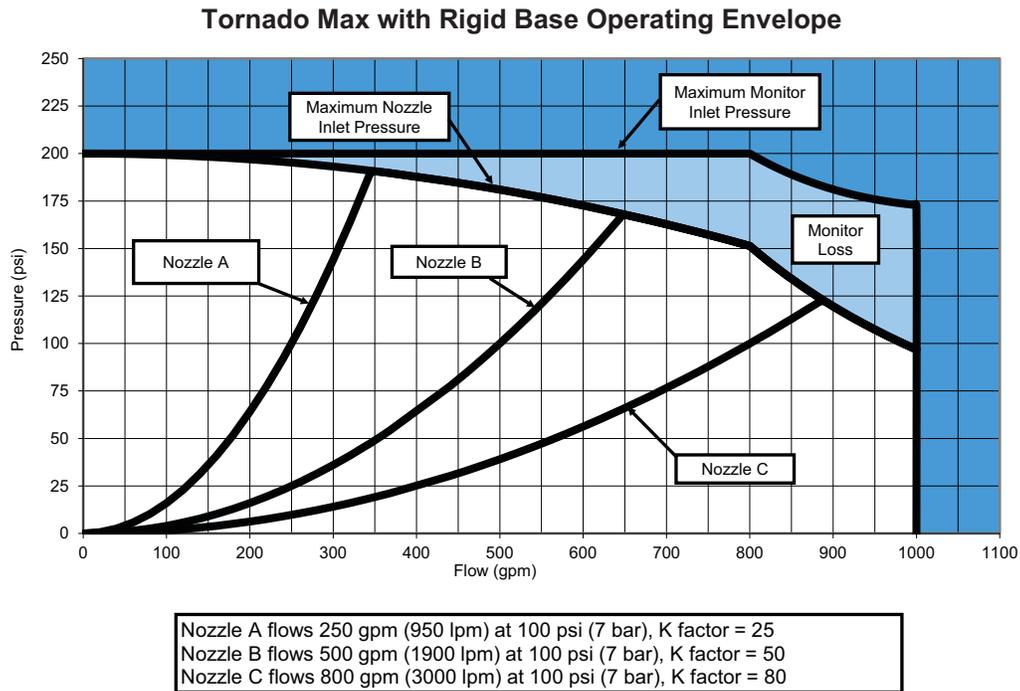


Figure 3.3A

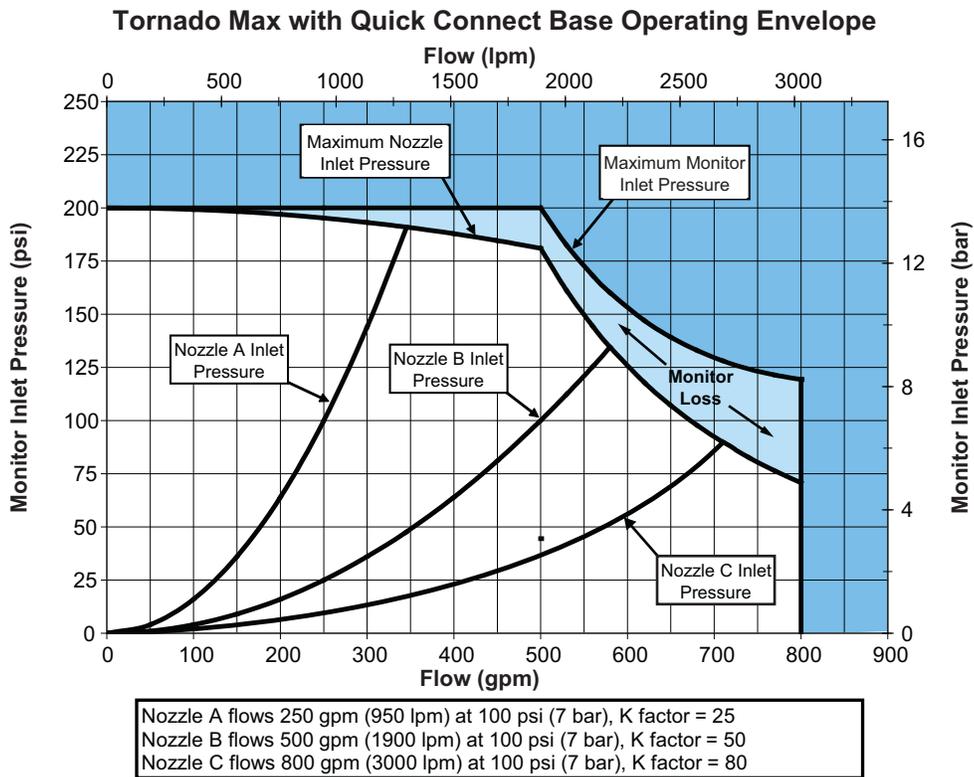


Figure 3.3B

3.4 USE WITH SALT WATER

Use with salt water is permissible provided the equipment is thoroughly cleaned with fresh water after each use. The service life of the equipment may be shortened due to the effects of corrosion, and is not covered under warranty.

3.5 VARIOUS MODELS AND TERMS

The TORNADO MAX monitor is available in several different models and inlet connections. Basic body styles are shown below, along with various parts and controls.

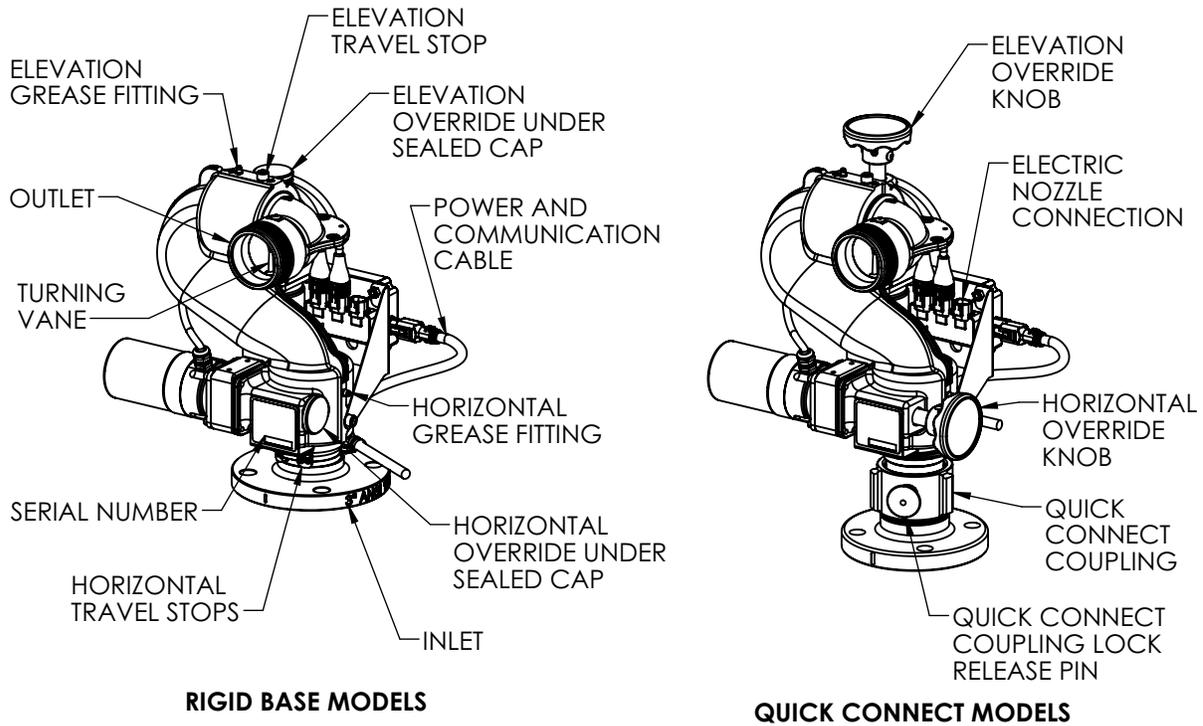


Figure 3.5

3.6 INLETS AND OUTLETS

There is a wide variety of inlet and outlet options for the TORNADO MAX monitor. The overall weight of the monitor may differ slightly based on the inlet and outlet configuration. See the finished good drawing on the website listing for specific model dimensions.

3.7 OVERALL DIMENSIONS

Dimensions shown are for nominal monitor height. See tables for additional height as a result of the chosen inlet.

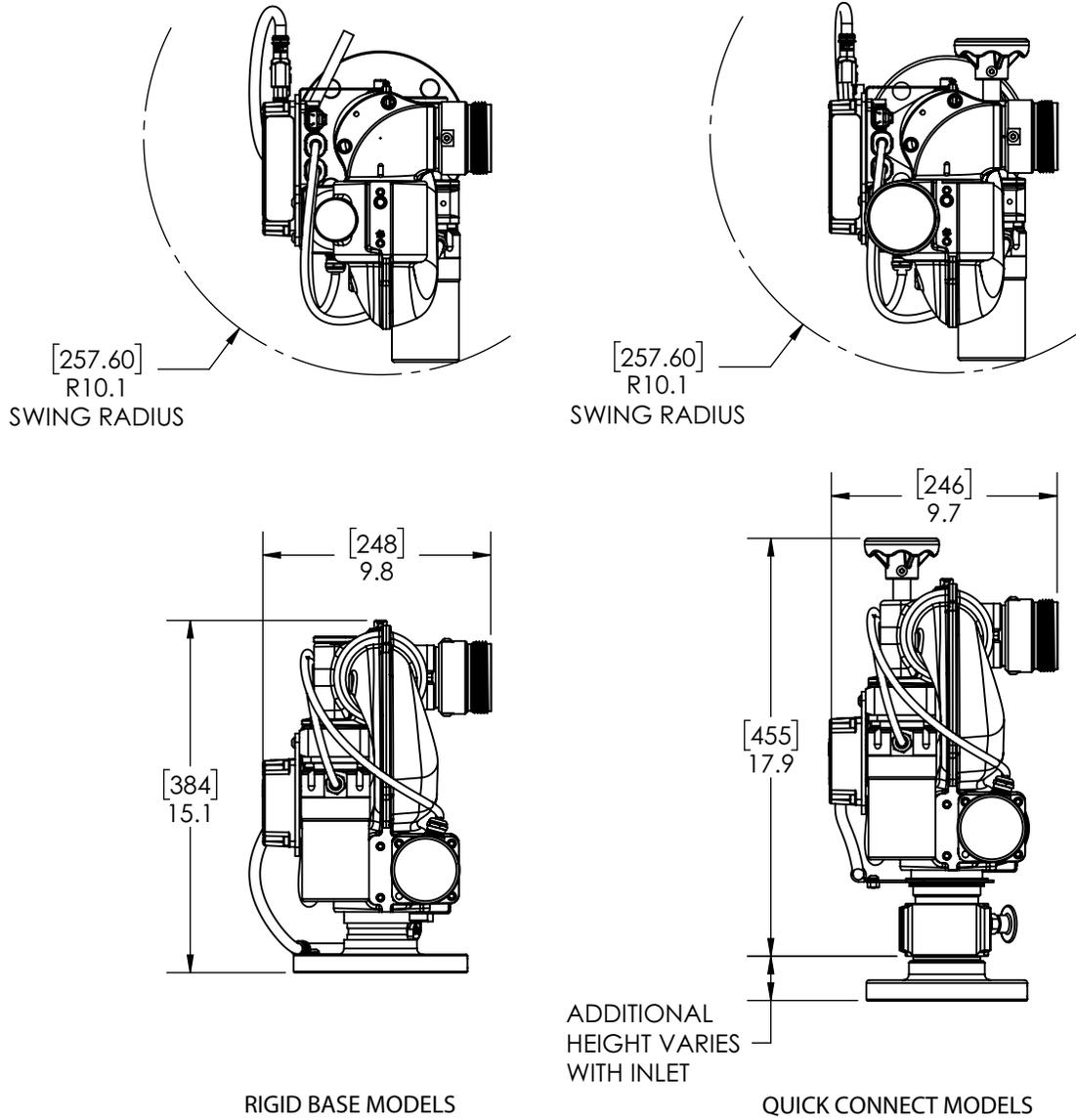


Figure 3.7

4.0 INSTALLATION

4.1 ELECTRICAL INSTALLATION

See SmartPlex (RC) Monitor Electrical Controls Instructions LIY-550 and LIY-701.

4.2 STRUCTURAL REQUIREMENTS

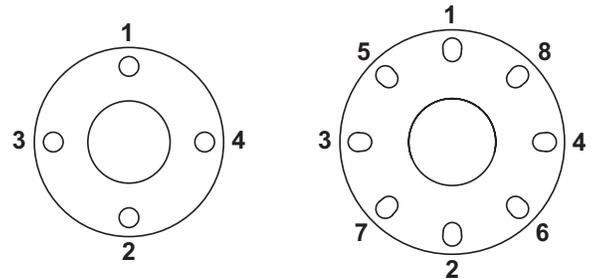


Reaction forces generated by master stream flows are capable of causing injury and property damage if not properly supported. Monitors should be securely installed by qualified individuals.

- Mounting objects must be capable of withstanding maximum nozzle reaction force.
- The monitor must be securely mounted to rigid support members.
- Do not use flanges or pipe made from plastic for monitor mounting.
- Torque all fasteners to specified values.

The structure that the monitor is mounted to must withstand the internal pressure of the monitor as well as shear and bending forces due to nozzle reaction.

For flanged connections, the use of flat flanges without raised faces is recommended. Use a ring gasket as defined in ASME 16.21 or ISO 7483. Tighten flange bolts in an alternating sequence as shown below. Tighten sequentially each bolt or stud three times to 30%, then 60%, and finally 100% of the specified torque. Tighten to a total of 76-80 ft-lb (100-110 N·m).



Tighten Sequentially Each Bolt Three Times to a Total of 76-80 ft-lb (100-110 N·m)

Figure 4.2

FLANGE TYPE	OUTSIDE DIAMETER		THICKNESS		BOLT HOLE CIRCLE		# OF BOLTS	SIZE OF BOLTS	
	in	mm	in	mm	in	mm		in	mm
2.5" ANSI 150	6.9	175	0.98	25	5.5	140	4	5/8	16
3" ANSI 125/150-DN80 PN20	7.5	190	0.75	20	6.0	152.5	4	5/8	16
DN80, PN16 Flange	7.9	200	0.87	22	6.3	160	8	5/8	16

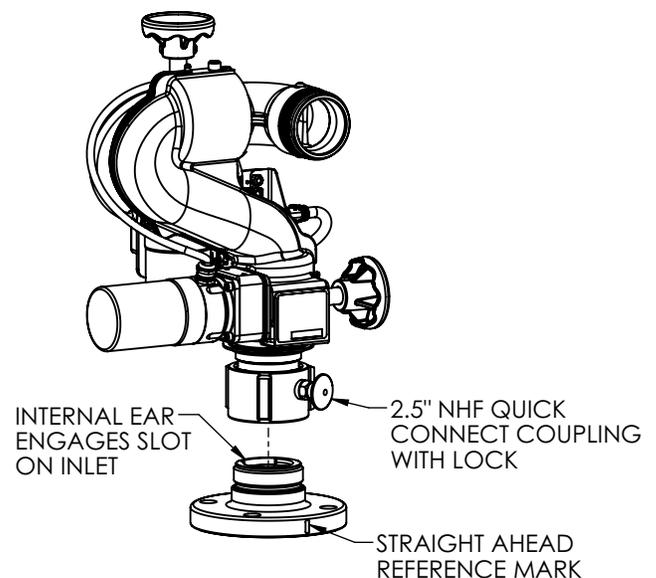
Table 4.2

4.3 QUICK CONNECT INLET

A rotational lock is included on quick connect couplings. The locking pin also holds the coupling up and out of the way while orienting the monitor to engage the internal ear into the slot on the adapter. Hold the pin out, push the coupling up and release the pin before installing monitor on the adapter. Once the monitor is properly aligned on the adapter, hold the pin out while sliding the coupling down to the adapter. Rotate the coupling until it is tight. The coupling may become sufficiently tight before reaching the next detent position. It is not necessary to over-tighten the coupling if the pull pin is between detent positions. Do not use the pull pin as a lever to tighten or loosen the coupling.

4.4 INLET ALIGNMENT

The Inlet must be oriented upon installation so the TORNADO MAX will point in the desired direction. Inlets are marked with a slot to indicate the Straight-Ahead Reference Mark. This mark establishes the center of horizontal travel range. Maximum travel ranges relative to the Straight-Ahead Reference Mark are shown below.



4.5 HORIZONTAL TRAVEL RANGE AND STOPS

4.5.1 RIGID BASE MODELS

The Maximum horizontal monitor travel range is shown below and can be limited by adjusting the Horizontal Travel Stops.

To install and adjust the Horizontal Travel Stops:

1. Align the monitor with the Straight-Ahead Reference Mark.
2. When facing the front of the monitor, the travel stop marked "L" must be installed on the left-hand side, and the travel stop marked "R" must be installed on the right-hand side.
3. Hold the travel stop with the letter (L or R) facing up, rotate the travel stop 90° and insert into the coupling track.
4. Rotate back to the original position with the letter facing up.
5. Move the monitor to the desired end of travel and slide the travel stop against the stop ear on the monitor.
6. Apply Loctite 242 (blue) to the screw threads and tighten set screws to lock the travel stop position.
7. Repeat for the other side.

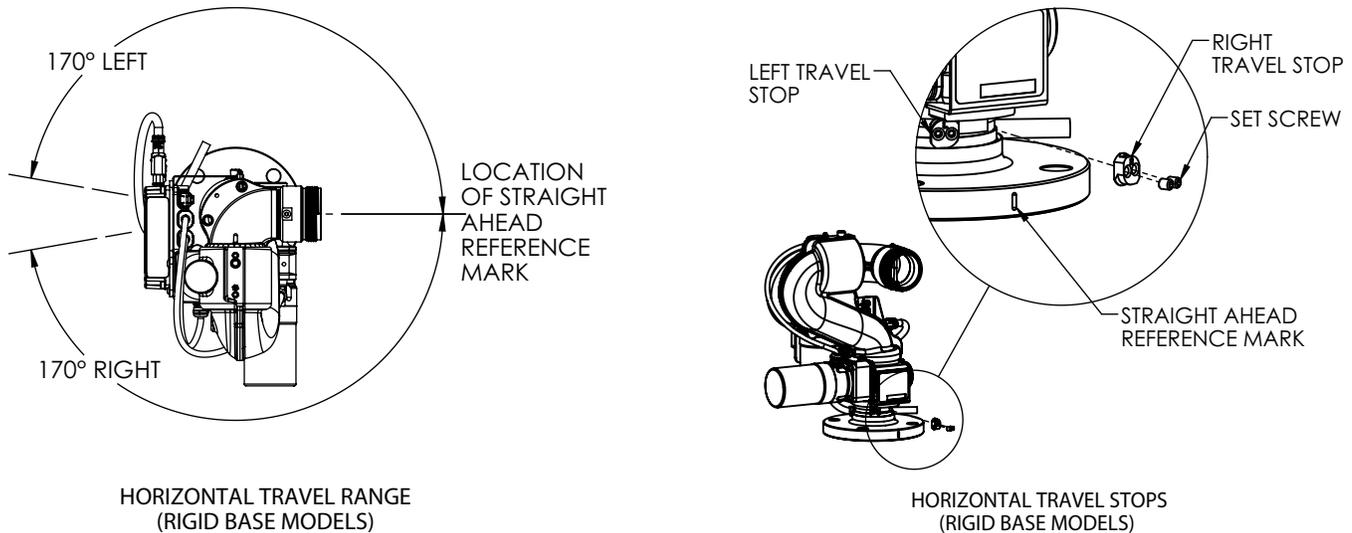


Figure 4.5.1

4.5.2 QUICK CONNECT INLET MODELS

The Maximum horizontal monitor travel range is shown below and can be limited by installing the #Y4145 Stop Bolt and optional #Y3146 Travel Stop Discs.

1. Remove #VT37-24SH500 Socket Head Cap Screw.
2. Optional: For ranges less than 90 degrees per side, install #Y3146 Travel Stop Discs to limit travel by approximately 13 degrees per disc.
3. Install #Y4145 Stop bolt.

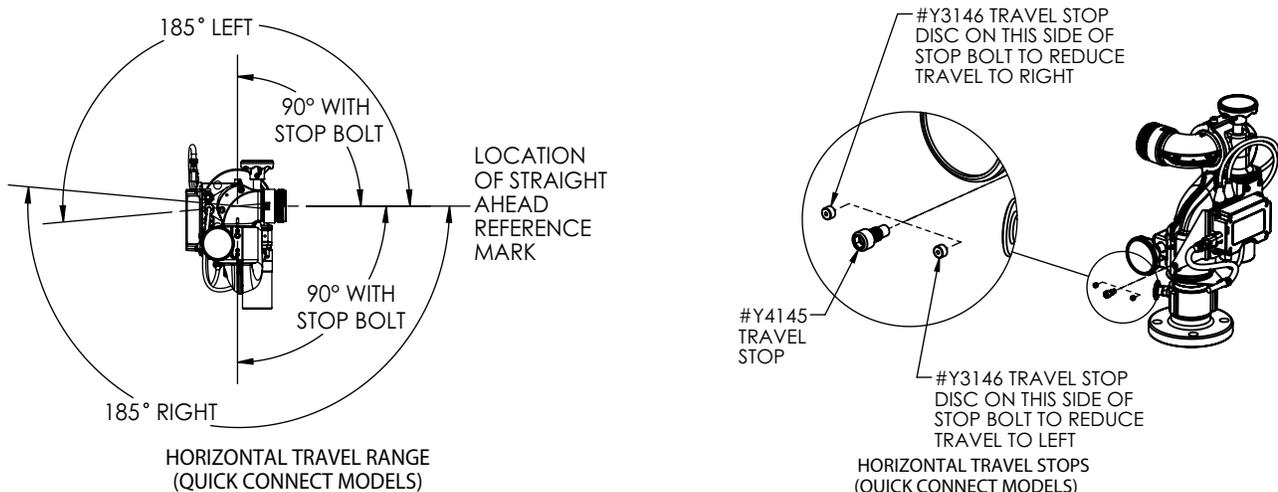


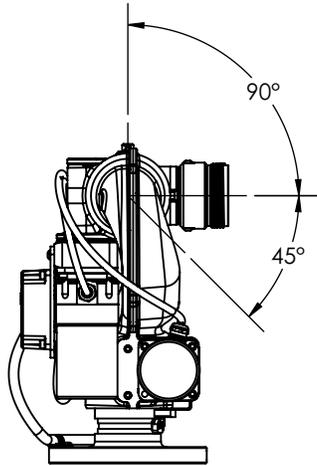
Figure 4.5.2

4.6 VERTICAL TRAVEL RANGE AND STOPS

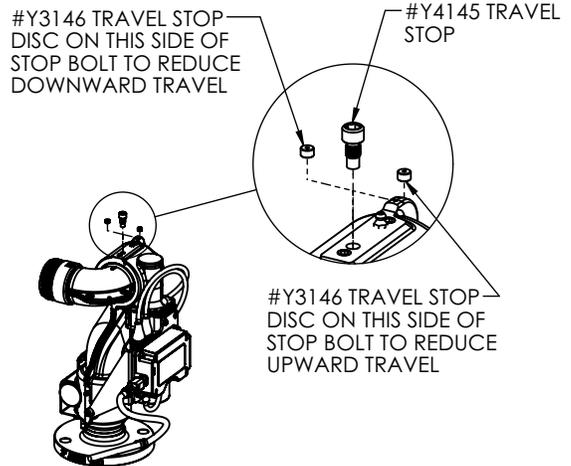
4.6.1 RIGID BASE MODELS

The Maximum vertical monitor travel range is shown below and can be limited by installing #Y3146 Travel Stop Discs.

1. Remove #Y4145 Stop bolt.
2. Install #Y3146 Travel Stop Discs to limit travel by approximately 13 degrees per disc.
3. Reinstall #Y4145 Stop bolt.



VERTICAL TRAVEL RANGE
(RIGID BASE MODELS)



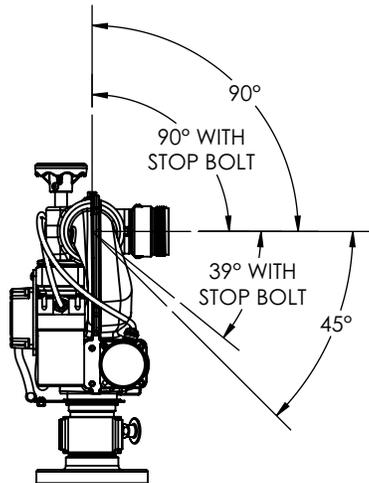
VERTICAL TRAVEL STOPS
(RIGID BASE MODELS)

Figure 4.6.1

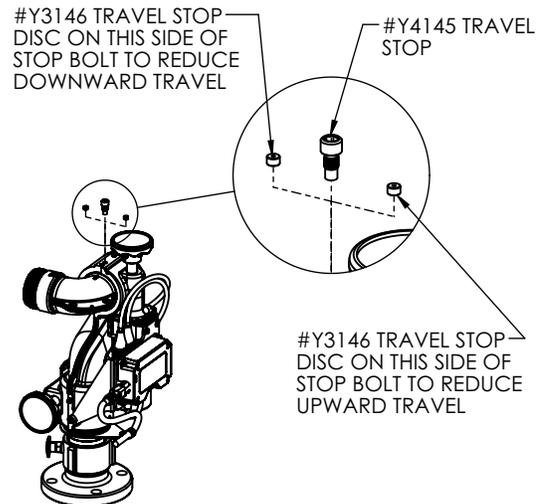
4.6.2 QUICK CONNECT INLET MODELS

The Maximum vertical monitor travel is shown below and can be limited by installing the #Y4145 Stop Bolt and optional #Y3146 Travel Stop Discs.

1. Remove #VT37-24SS375 socket head cap screw.
2. Optional: For ranges less than 90 degrees up and 39 degrees down, install #Y3146 Travel Stop Discs to limit travel by approximately 13 degrees per disc.
3. Install #Y4145 Stop bolt.



VERTICAL TRAVEL RANGE
(QUICK CONNECT MODELS)

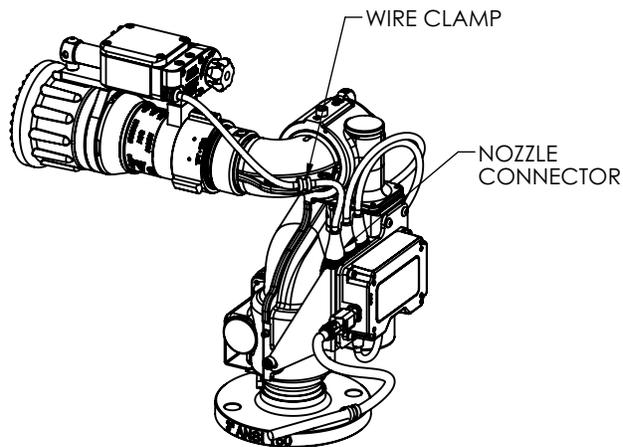


VERTICAL TRAVEL STOPS
(QUICK CONNECT MODELS)

Figure 4.6.2

4.7 NOZZLE INSTALLATION

Thread the compatible nozzle onto the monitor's outlet threads. Ensure that no part of the nozzle, including the RC Actuator, contacts the horizontal drive motor housing when the nozzle is in the lowest elevation position. Connect nozzle wire to junction box. Use enclosed wire clamp to ensure nozzle wire is free throughout monitor's vertical range of travel.



NOZZLE CONNECTION

⚠ CAUTION

Mismatched or damaged waterway connections may cause equipment to leak or uncouple under pressure. Failure could result in injury. Equipment must be mated to matched connections.

⚠ CAUTION

Dissimilar metals coupled together can cause galvanic corrosion that can result in the inability to uncouple the connection, or complete loss of engagement over time. Failure could cause injury. Per NFPA 1930, if dissimilar metals are left coupled together, an anti-corrosive lubricant should be applied to the connection and the coupling should be disconnected and inspected at least quarterly.

4.8 PRESSURE GAUGE PORT

There is a ¼" NPT female threaded hole on the back of the monitor and the exit elbow. The holes are plugged from the factory. If a pressure gauge is desired, unscrew the plug and install the gage using pipe sealant. Make sure the gauge does not interfere with operation.

4.9 DRAINING RESIDUAL WATER

There is no drain on the TORNADO monitor itself. A drain valve should be installed on the piping to which the monitor is attached.

⚠ WARNING

Monitors, valves, and piping may be damaged if frozen while containing sufficient amounts of water. Such damage may be difficult to detect visually and can lead to possible damage, injury, or death. Equipment that may be exposed to freezing conditions must be drained immediately following use to prevent damage.

⚠ CAUTION

Structural damage from corrosion can result from failure to drain appliance between uses. Damage from corrosion can cause injury due to equipment failure. Always drain appliance between uses.

5.0 OPERATION

See SmartPlex RC Monitor Controls Instructions LIY-550 and LIY-701 for operation of the TORNADO MAX Monitors.

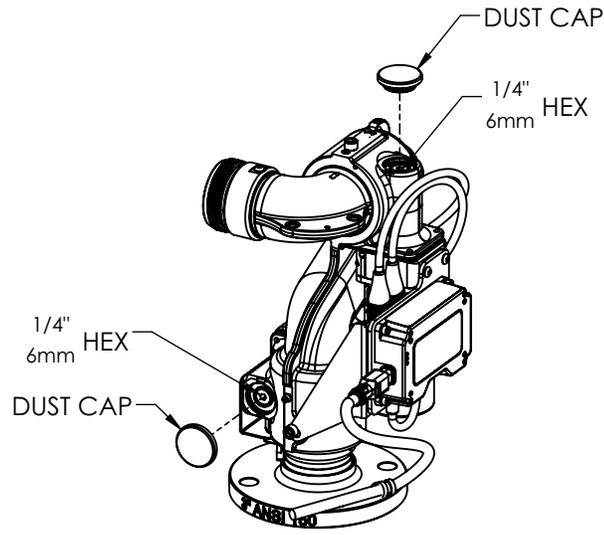
5.1 RECOMMENDED STOW POSITION

For truck mounted applications, it is recommended that the monitor be stowed in a position such that the monitor's nozzle rests against a bracket or support surface. If a support surface is not available, run the elevation against one of the travel stops to take some of the backlash out of the gear drive. This will minimize bouncing of the nozzle when the apparatus is traveling. Always be sure the monitor is properly stowed before moving the truck and know the overall height to avoid damage from overhead obstructions such as doors or bridges. See LIY-550 and LIY-701 for information on programming STOW position.

5.2 OVERRIDE KNOBS

5.2.1 RIGID BASE MODELS

In the event of electrical system failure on the monitor or fire truck, the TORNADO MAX monitor may be manually operated. Removing the Dust Caps exposes a hex drive so a 1/4" hex key may be used for manual override.

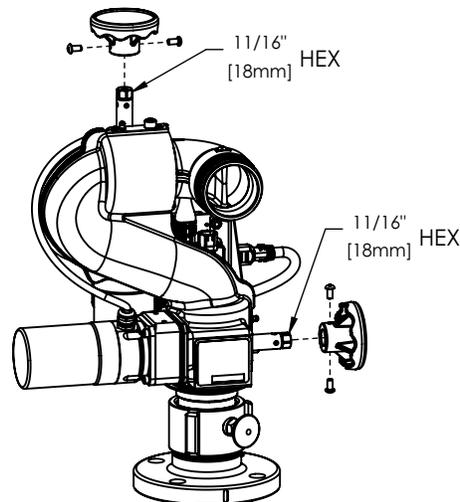


MANUAL OVERRIDE FEATURE
(RIGID BASE MODELS)

Figure 5.2.1

5.2.2 QUICK CONNECT INLET MODELS

In the event of electrical system failure on the monitor or fire truck, the TORNADO MAX monitor may be manually operated with factory supplied override knobs. To make the TORNADO MAX more compact, the manual override knobs may be removed. Removing the override knobs exposes a hex so an 11/16" wrench or socket may be used for manual override.



MANUAL OVERRIDE FEATURE
(QUICK CONNECT MODELS)

Figure 5.2.2

6.0 FLOW CHARACTERISTICS

6.1 STACKED TIPS FLOW AND REACTION

NOZZLE DIAMETER	NOZZLE INLET PRESSURE									
	50 PSI		80 PSI		100 PSI		150 PSI		175 PSI	
	FLOW (GPM)	REACTION (LBS)	FLOW (GPM)	REACTION (LBS)	FLOW (GPM)	REACTION (LBS)	FLOW (GPM)	REACTION (LBS)	FLOW (GPM)	REACTION (LBS)
1.00"	210	80	270	120	300	150	360	230	390	260
1.25"	330	120	410	190	460	230	569	368	614	429
1.50"	470	170	598	283	668	353	--	--	--	--

FLOW EXCEEDS RATING OF THE TORNADO MAX MONITOR

NOZZLE DIAMETER	NOZZLE INLET PRESSURE									
	4 BAR		6 BAR		8 BAR		10 BAR		12 BAR	
	FLOW (L/min)	REACTION (KG)	FLOW (L/min)	REACTION (KG)	FLOW (L/min)	REACTION (KG)	FLOW (L/min)	REACTION (KG)	FLOW (L/min)	REACTION (KG)
25 mm	830	40	1000	60	1200	80	1300	100	1400	120
32 mm	1300	70	1700	100	1900	130	2154	167	2324	195
38 mm	1900	90	2264	128	2528	160	--	--	--	--

FLOW EXCEEDS RATING OF THE TORNADO MAX MONITOR

Table 6.1

6.2 REACH AND TRAJECTORY

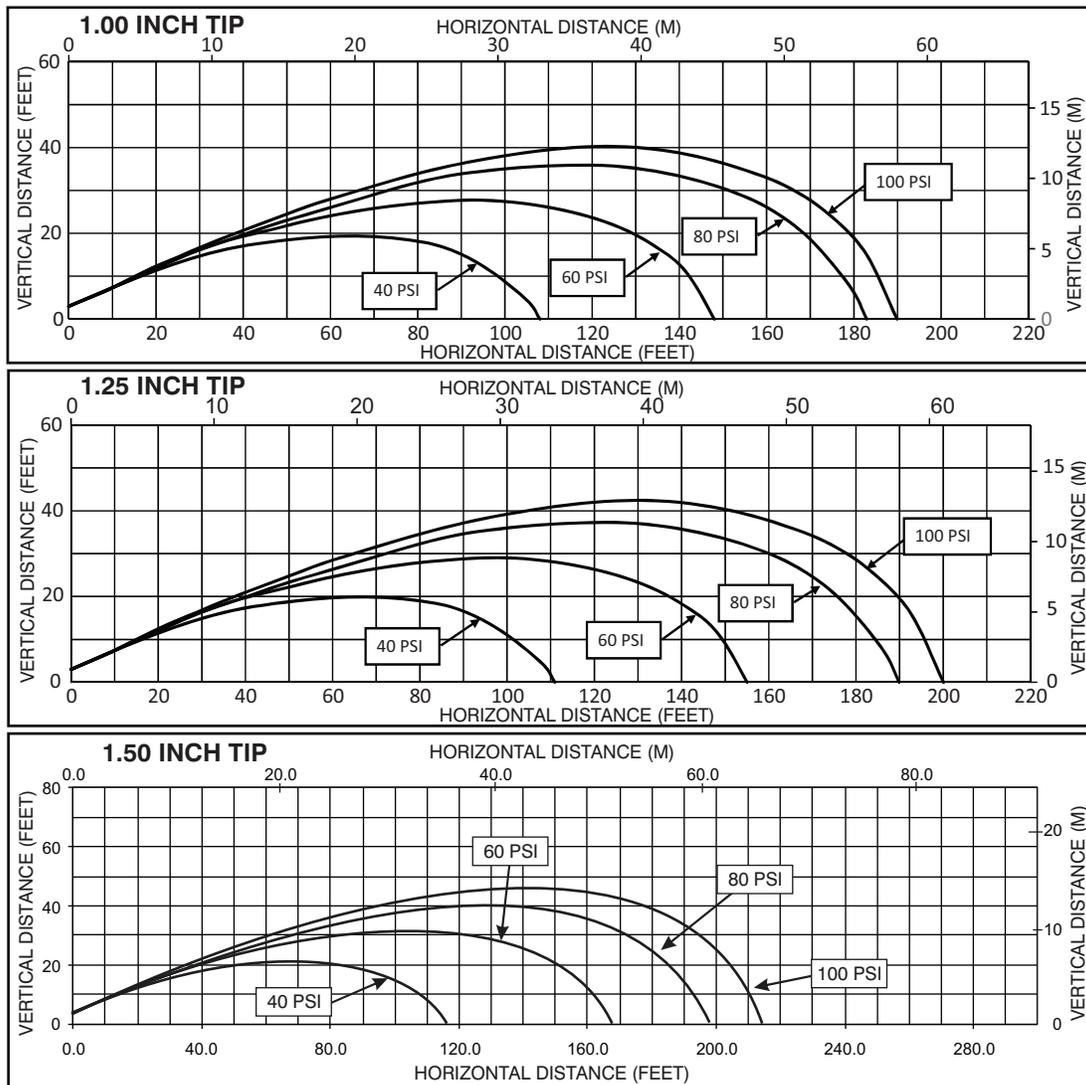


Figure 6.2

6.3 TORNADO MAX MONITOR AND FRICTION LOSS

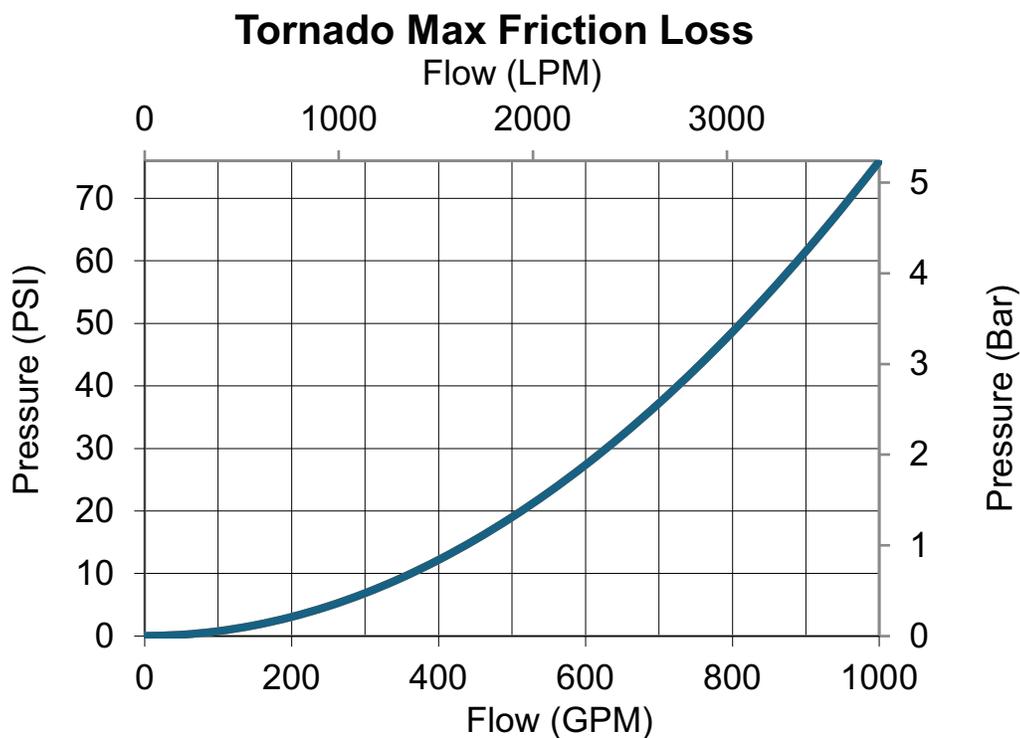


Figure 6.3

6.4 STREAM STRAIGHTENERS

6.4.1 STREAM STRAIGHTENERS WITH STACKED TIPS

Turbulence through the TORNADO MAX monitor is very low, but stream quality and reach can be improved with the use of the integral stream straightener on the TFT stacked tip nozzle. Stream straighteners will add some friction loss.

6.4.2 STREAM STRAIGHTENERS WITH FOG NOZZLES

When using a fog nozzle for flows below 300 gpm (1,100 L/min), it is recommended that no stream straightener be used since the fog nozzle's flow path serves as a stream straightener. Above 300 gpm (1,100 L/min), TFT's 5 inch Stream Straightener will generally improve a fog nozzle's stream.

7.0 WARRANTY

Go to tft.com for all warranty information.

8.0 MAINTENANCE

TFT products are designed and manufactured to be damage resistant and require minimal maintenance. However, as the primary firefighting tool upon which your life depends, it should be treated accordingly. The unit should be kept clean and free of dirt by rinsing with water after each use. Any inoperable or damaged parts should be repaired or replaced before placing the unit in service. To help prevent mechanical damage, do not drop or throw equipment.

In applications where appliances are left continuously connected to the apparatus or other devices or are used where water is trapped inside the appliance, the appliance must be flushed with fresh water following each use and inspected for damage.

This appliance should be disconnected, cleaned and visually inspected inside and out at least quarterly, or as water quality and use may require. Moving parts such as handles, valve ball and couplings should be checked for smooth and free operation. Seals shall be greased as needed with Silicone based grease such as Molykote 112. Any scrapes that expose bare aluminum should be cleaned and touched up with enamel paint such as Rust-Oleum. Replace any missing or damaged parts before returning to service.

Any equipment taken out of service due to failure should be returned to the factory for repair or replacement. If you have any questions regarding the testing or maintenance of your valve, please call Task Force Tips at 800-348-2686.

8.1 SERVICE TESTING

In accordance with NFPA 1930, equipment must be tested a minimum of annually. Units failing any part of this test must be removed from service, repaired and retested upon completion of the repair.

8.2 LUBRICATION

The TORNADO MAX monitor generally should not require greasing. In the event that the operation becomes stiff, grease may be applied to the horizontal rotation and elevation worm gears. See section 3.5 for grease fitting locations. Use medium viscosity automotive chassis grease. Apply only enough grease to restore normal operation. If normal operation is not restored by greasing, inspect for other causes of stiff operation.

NOTICE

Do not over pump grease. The monitor's greased areas lead to large chambers that could trap several pounds of grease before becoming visible.

8.3 TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	REMEDY
Leaks	Debris or damage in the seal area	Clean out debris or replace damaged parts
Elevation Binding	Debris or damage to the elevation drive parts	Clean out debris or replace damaged parts
	Lack of lubricant	Grease, (see section 8.2)
Horizontal Rotation Binding	Debris or damage to the horizontal drive parts	Clean out debris or replace damaged parts
	Lack of lubricant	Grease, (see section 8.2)

8.4 REPAIR

Factory service is available. Factory serviced equipment is repaired by experienced technicians, wet tested to original specifications, and promptly returned. Call TFT service department at 1-800-348-2686 to troubleshoot and, if needed, directions for return. A return for service form can also be obtained at tft.com/Support/Returning-an-Item-for-Service.

Repair parts and service procedures are available for those wishing to perform their own repairs. Task Force Tips assumes no liability for damage to equipment or injury to personnel that is a result of user service. Contact the factory or visit the web site at tft.com for parts lists, exploded views, test procedures and troubleshooting guides.

Performance tests shall be conducted on the equipment after a repair, or anytime a problem is reported to verify operation in accordance with TFT test procedures. Consult factory for the procedure that corresponds to the model and serial number of the equipment. Any equipment which fails the related test criteria should be removed from service immediately. Troubleshooting guides are available with each test procedure or equipment can be returned to the factory for service and testing.

WARNING

It is the responsibility of service technicians to ensure the use of appropriate protective clothing and equipment. The chosen protective clothing and equipment must provide protection from potential hazards users may encounter while servicing equipment. Requirements for protective clothing and equipment are determined by the Authority Having Jurisdiction (AHJ).

CAUTION

Any alterations to the product or its markings could diminish safety and constitutes a misuse of this product.

NOTICE

All replacement parts must be obtained from the manufacturer to assure proper performance and operation of the device.

9.0 EXPLODED VIEWS AND PARTS LISTS

Exploded views and parts lists are available at tft.com/serial-number.

10.0 OPERATION AND INSPECTION CHECKLIST

BEFORE EACH USE, appliances must be inspected to this checklist:

1. All valves (if so equipped) open and close fully and smoothly
2. Waterway is clear of obstructions
3. There is no damage to any thread or other connection
4. All locks and hold-down devices work properly
5. The pressure setting on the relief valve (if so equipped) is set correctly
6. Gaskets are in good repair
7. There is no obvious damage such as missing, broken or loose parts
8. There is no damage to the appliance that could impair safe operation (e.g. dents, cracks, corrosion, or other defects)
9. All swiveling elements rotate freely
10. Nozzle is securely attached

BEFORE BEING PLACED BACK IN SERVICE, appliances must be inspected to this checklist:

1. All valves (if so equipped) open and close smoothly and fully
2. The waterway is clear of obstructions
3. There is no damage to any thread or other type connection
4. The pressure setting of the relief valve, if any, is set correctly
5. All locks and hold-down devices work properly
6. Internal gaskets are in accordance with NFPA 1962
7. There is no damage to the appliance that could impair safe operation (e.g. dents, cracks, corrosion, or other defects)
8. All swiveling connections rotate freely
9. There are no missing parts or components
10. The marking for maximum operating pressure is visible
11. There are no missing, broken, or worn lugs on couplings



Equipment failing any part of the checklist is unsafe for use and must have the problem corrected before use or being placed back into service. Operating equipment that has failed the checklist is a misuse of this equipment.