Product Data Sheet
March 2014
00813-0100-4160, Rev CD

Rosemount 2160 Wireless

Vibrating Fork Liquid Level Switch

- World's first wireless liquid level switch for reliable point level detection
- Wireless capabilities extend the full benefits of PlantWeb® to previously inaccessible locations
- Self-organizing network delivers information rich data with >99% data reliability
- Designed for operation in temperature extremes of –94 to 500 °F (–70 to 260 °C)
- Virtually unaffected by flow, bubbles, turbulence, foam, vibration, solids content, coating, properties of the liquid, and product variations
- "Fast Drip" fork design gives quicker response time, especially with viscous liquids
- Intrinsically Safe certification option
- TÜV tested and approved for overfill protection according to DiBt/ WHG regulations

ROSEMOUNT®

EMERSON™
Process Management

Overview of the Rosemount 2160

2160***S

2160***E

Measurement principle

The Rosemount 2160 is designed using the principle of a tuning fork. A piezo-electric crystal oscillates the forks at their natural frequency. Changes to this frequency are continuously monitored. The frequency of the vibrating fork sensor changes depending on the medium in which it is immersed. The denser the liquid, the lower the frequency.

When used as a **low level alarm**, the liquid in the tank or pipe drains down past the fork, causing a change of natural frequency that is detected by the electronics and switches the output state to DRY.

When the 2160 is used as a **high level alarm**, the liquid rises in the tank or pipe, making contact with the fork which then causes the output state to switch to WET.

Key features and benefits

- Virtually unaffected by turbulence, foam, vibration, solids content, coating, or liquid properties
- The *mid-range temperature* 2160 is designed for operation in temperatures from –40 to 302 °F (–40 to 150 °C)
- The *extreme temperature* 2160 is designed for operation in temperatures from –94 to 500 °F (–70 to 260 °C). It has a stainless steel thermal tube to move the electronics away from the process
- Electronic self-checking and condition monitoring, and alerts using a Field Communicator or AMS
- Software adjustable switching delay prevents false switching in turbulent or splashing applications
- Wireless and encrypted digital communication of the switch output state and other variables
- Optional integral LCD for indicating the switch output state and diagnostics
- 'Fast Drip' fork design gives quicker response time, especially with viscous liquids. Rapid wet-to-dry time for highly responsive switching
- Fork shape is optimized for hand polishing to meet hygienic requirements
- No moving parts or crevices for virtually no maintenance

'Fast Drip' Forks

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Superior diagnostics

- Built-in diagnostics continuously check electronic and mechanical health
- Fork conditions detected including internal and external damage, coated or blocked, and extreme corrosion
- Ideal for critical alarm duties

AMS Suite: Intelligent Device Manager

Fit and forget

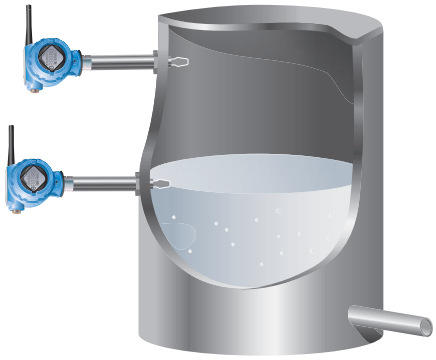
- Once installed, the 2160 is ready to go.
  It needs no calibration and requires minimum installation
- You can install, and forget it

Wireless power module

- The 2160 is powered by a replaceable wireless Power Module
- The fork sensor requires very little power, and the Power Module life remains long even with fast update rates

Extended high and low temperature performance

- The *extreme temperature* 2160 enables standardization of Rosemount vibrating fork switches across a wide range of process environments, and is ideally suited for harsh conditions where high reliability is essential



High and low level alarm

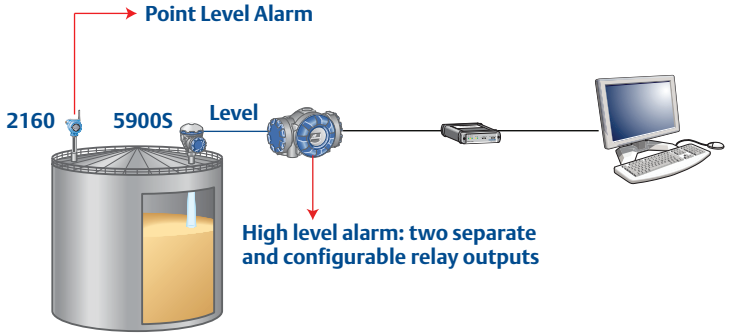
Wireless capability

- The 2160 is the world's first wireless liquid level switch
- Includes all the features of our wired level switches, but without the complications and cost of wiring
- Ideal for level detection in locations previously inaccessible, or too costly for wired devices

In tank gauging systems, a Rosemount 2160 high level alarm switch can be used as an alternative to a second radar level gauge (see the Rosemount Tank Gauging product data sheet 00813-0100-5100 for details)

Applications

- Overfill protection
- High and low level alarms
- Pump control or limit detection
- Run dry or pump protection
- Hygienic applications
- High temperature applications



For optimal performance, every wireless HART network should have a minimum of five devices and every device should have a minimum of three neighbours within effective range of the wireless gateway

Rosemount 2160 Level Switch Ordering

Table 1. Rosemount 2160 Ordering Information

★The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

Model	Product Description	
2160	Wireless Vibrating Fork Liquid Level Switch	
Output		
Standard		**Standard**
X	Wireless	★
Housing Material		
Standard		**Standard**
D	Dual Compartment Housing - Aluminum (Aluminium)	★
Conduit Entry / Cable Threads		
Standard		**Standard**
8	1/2-in. NPT thread	★
Operating Temperature		
Standard		**Standard**
S	Standard: –40 °F (–40 °C)...302 °F (150 °C)	★
E	Extreme: –94 °F (–70 °C)...500 °F (260 °C)	★
Material of Construction: Process Connection / Fork		
Standard		**Standard**
S(1)	316/316L Stainless Steel (1.4401/1.4404)	★
Expanded		
H(2)	Alloy C (UNS N10002), Alloy C-276 (UNS N10276), solid	
Process Connection Size		
Standard		**Standard**
9	3/4 in. / 19 mm	★
1	1 in. / 25 mm (DN25)	★
2	2 in. / 50 mm (DN50)	★
5	1 1/2 in. / 40 mm (DN40)	★
3	3 in. / 80 mm (DN80)	★
4	4 in. / 100 mm (DN100)	★
6	6 in. / 150 mm (DN150)	★
8	8 in. / 200 mm (DN200)	★
7	2 1/2-in. / 65 mm (DN65)	★
Expanded		
X(3)	Customer specific	
Process Connection Rating		
Standard		**Standard**
AA	ASME B16.5 Class 150 flange	★
AB	ASME B16.5 Class 300 flange	★
DB	EN1092-1 PN25/40 flange	★
NN	For use with non-flange process connection type	★
Expanded		
AC	ASME B16.5 Class 600 flange	
DA	EN1092-1 PN10/16 flange	
DC	EN1092-1 PN63 flange	
DD	EN1092-1 PN100 flange	
XX(3)	Customer specific	
Process Connection Type		
Standard		**Standard**
R	Raised Face (RF) flange	★
B	BSPT (R) thread	★
G	BSPP (G) thread	★
N	NPT thread	★

Table 1. Rosemount 2160 Ordering Information

★The Standard offering represents the most common options. The starred options (★) should be selected for best delivery.
The Expanded offering is subject to additional delivery lead time.

P	BSPP (G) O-ring	★
C	Tri-Clover Clamp	★
Expanded		
X(3)	Customer specific	
Fork Length		
Standard		**Standard**
A	Standard length 1.7-in. (44 mm)	★
H(4)	Standard length flange 4.0-in. (102 mm)	★
E(5)	Extended, customer specified length in tenths of inches	★
M(5)	Extended, customer specified length in millimeters	★
Specific Extended Fork Length		
Standard		**Standard**
0000	Factory default length (only if fork length A or H is selected)	★
xxxx(5)	Specific customer specified length in tenths of inches, or millimeters (xxx.x inches or xxxx mm)	★
Surface Finish		
Standard		**Standard**
1	Standard surface finish	★
2	Hand polished (Ra < 0.4 µm)	★
Product Certifications		
Standard		**Standard**
NA	No Hazardous Locations Certifications	★
I1	ATEX Intrinsic Safety	★
I3	NEPSI Intrinsic Safety	★
I5	FM Intrinsic Safety	★
I6(6)	CSA Intrinsic Safety	★
I7	IECEx Intrinsic Safety	★
Wireless Update Rate, Operating Frequency and Protocol		
Standard		**Standard**
WA3	User configurable update rate, 2.4 GHz DSSS, IEC 62591 (WirelessHART™)	★
Omnidirectional Wireless Antenna and SmartPower		
Standard		**Standard**
WK1(7)	External antenna, adapter for black power module (I.S. power module sold separately)	★

OPTIONS		
Meter		
Standard		**Standard**
M5	LCD meter	★
Factory Configuration		
Standard		**Standard**
C1(8)	Factory configure Date, Descriptor, Message Fields and Wireless Parameters	★
Calibration Data Certification		
Standard		**Standard**
Q4	Certificate of functional test	★
Material Traceability Certification		
Standard		**Standard**
Q8	Material traceability certification per EN 10204 3.1	★
Special Procedures		
Standard		**Standard**
P1(9)	Hydrostatic testing with certificate	★
Typical Model Number: 2160 X D 8 S S 1 NN N A0000 1 I5 WA3 WK1 M5 Q8		

(1) Flanges are dual certified 316 and 316L Stainless Steel (1.4401 and 1.4404).

(2) Only available for BSPT and NPT threaded process connection types as standard, other upon request.

(3) Other process connections available upon request.

(4) Not available for hand polished wet side.

(5) Example: Code E1181 is 118.1 inches. Code M3000 is 3000 millimeters. See "Extended lengths" on page 7 for minimum and maximum extended lengths.

*(6) The requirements of CRN are met when a Rosemount 2160 CSA-approved vibrating fork level switch model 2160****S*********I6****** is configured with 316/316L stainless steel (1.4401/1.4404) wetted parts and either NPT threaded or 2-in. to 8-in. ASME B16.5 flanged process connections.*

(7) Black power module must be shipped separately, order Model 701PBKKF or part number 00753-9220-0001.

(8) A Configuration Data Sheet (CDS) can be downloaded from the "Documentation and Drawings" area or 2160 product page on www.rosemount.com. Submit a completed CDS with the order if the C1 option code is selected.

(9) Option limited to units with extended lengths up to 59.1-in. (1500 mm).

Overfill approval option

The Rosemount 2160 has been TÜV-tested and approved for overfill protection according to the German DIBt/WHG regulations. This option is not selectable in the ordering information table. If required, add "**R2259**" to the end of the model code. For example, 2160 X D 8 S S 1 NN N A0000 1 I5 WA3 WK1 M5 Q8 **R2259**.

Spare parts and accessories

Spares and Accessories		
Standard		**Standard**
02100-1000-0001	Seal for 1-in. BSPP (G1A). Material: Non-asbestos BS7531 grade X carbon fiber with rubber binder	★
02100-1040-0001	Seal for $^{3}/_{4}$-in. BSPP (G3/4A). Material: Non-asbestos BS7531 grade X carbon fiber with rubber binder	★
02100-1010-0001	Hygienic adaptor boss 1-in. BSPP. Material: 316 Stainless steel fitting. FPM/FKM o-ring	★
02100-1020-0001	2-in. (51 mm) Tri-clamp kit (vessel fitting, clamp ring and seal). Material: 316 Stainless steel, NBR Nitrile	★
02120-2000-0001(1)	$1^{1}/_{2}$-in. BSPP adjustable clamp gland for 1-in. extended lengths. Material: 316 Stainless steel, (Si) Silicone rubber seal	★
02120-2000-0002(1)	$1^{1}/_{2}$-in. NPT adjustable clamp gland for 1-in. extended lengths. Material: 316 Stainless steel, (Si) Silicone rubber seal	★

(1) The adjustable clamp gland is not explosion-proof.

Specification

Physical

Product

- The Rosemount 2160 Wireless Vibrating Fork Liquid Level Switch

Measuring principle

- Vibrating fork

Applications

- Most liquids including coating liquids, aerated liquids, and slurries

Mechanical

Enclosure

- Housing: Low-copper aluminum
- Paint: Polyurethane
- Cover O-ring: Nitrile butadiene

Terminal block and power module pack

- PBT

Antenna

- PBT/PC integrated omnidirectional antenna

Connections

- See "Rosemount 2160 Ordering Information" on page 14

Extended lengths

Process Connection	Minimum Extended Length
3/4–in. Threaded	3.8 in. (95 mm)
1–in. Threaded	3.7 in. (94 mm)
Flanged	3.5 in. (89 mm)
Tri-Clamp	4.1 in. (105 mm)

- The maximum extended length is 118.1 in. (3000 mm) for all except for hand-polished option where the maximum is 39.4 in. (1000 mm)

Process material

- 316/316L Stainless Steel (1.4401/1.4404) dual certified, or Alloy C (UNS N10002) and Alloy C-276 (UNS N10276)
- Hand-polished to better than 0.4 µm option available for hygienic connections
- Gasket material for 3/4-in. and 1-in. BSPP (G) is non-asbestos BS7531 Grade X carbon fiber with rubber binder

Dimensional drawings

- See "Dimensional Drawings" on page 11

Mounting

- Suitable for horizontal and vertical installations
- Rotatable housing allows correct alignment of both the forks and the omnidirectional antenna for optimal signal and best viewing position of the LCD integral display

Enclosure ratings

- Housing is NEMA 4X and IP66 compliant

Electrical

Wireless power module

- Replaceable, Intrinsically Safe Lithium-Thionyl Chloride power module with PBT enclosure
- Ten year life at one minute update rate (1)

(1) Reference conditions are 70 °F (21 °C), and routing data for three additional network devices.

NOTE: Continuous exposure to ambient temperature limits (-40 °F or 185 °F) (-40 °C or 85 °C) may reduce specified power module life by 20 percent.

Field communicator connections

- Clips are permanently fixed to the terminal block

Performance

Electromagnetic Compatibility (EMC)

- All models meet all relevant requirements of EN 61326

Hysteresis (water)

- ±0.039 in. (±1 mm) nominal

Switching point (water)

- 0.5 in. (13 mm) from fork tip if mounted vertically
- 0.5 in. (13 mm) from the fork edge if mounted horizontally
- The switch point varies with different liquid densities

Functional

Output

- IEC 62591 (WirelessHART) 2.4 GHz DSSS

Radio frequency power output from antenna

- Maximum of 10 mW (10 dBm) EIRP

Local display

- A 'locate device' function allows easy identification of instrument during commissioning inspection
- The optional five-digit integral LCD can indicate a sequence of up to four process variables (dry/wet, electronics temperature, frequency, and supply voltage) and diagnostic information

Humidity limits

- 0 to 100% relative humidity

Wireless update rate

- User-selectable: from one second up to sixty minutes
- The optional integral LCD display updates at each wireless update

Maximum operating pressure

- Threaded connection: See Figure 1
- Hygienic connection: 435 psig (30 bar g)
- Flanged connection:
  The maximum operating pressure is the lower of the process pressure (Figure 1) and flange pressure rating (Table 2)

Note
The final maximum operating pressure rating depends on the process (tank) connection. Clamp glands (order #02120-2000-0001 or 02120-2000-0002) limit the maximum operating pressure to 18.85 psig (1.3 bar g).

Figure 1. Process pressure

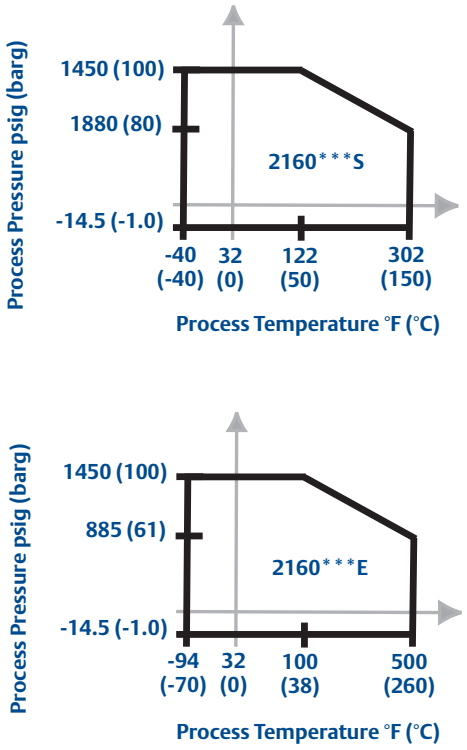


Table 2. Maximum flange pressure rating

Flange Standard	SST Flanges (1)
ASME B16.5 Class 150	275 psig (2)
ASME B16.5 Class 300	720 psig (2)
ASME B16.5 Class 600	1440 psig (2)
EN1092-1 PN 10/16	16 bar g (3)
EN1092-1 PN 25/40	40 bar g (3)
EN1092-1 PN 63	63 bar g (3)
EN1092-1 PN 100	100 bar g (3)

(1) ASTM stainless steel.

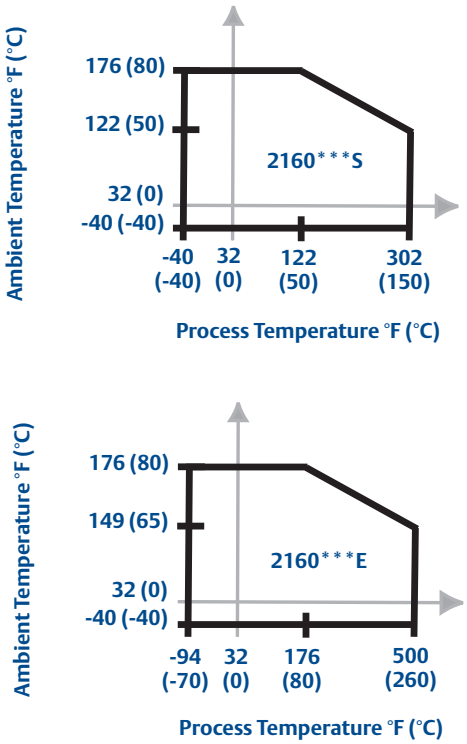
(2) At 100 °F (38 °C), the pressure rating decreases with an increasing process temperature.

(3) At 122 °F (50 °C), the pressure rating decreases with an increasing process temperature.

Temperature

- See Figure 2 for the maximum and minimum operating temperatures

Figure 2. Temperature



Liquid density range

- Minimum liquid density is 31.2 lb/ft^3 (500 kg/m^3)

Liquid viscosity range

- 0.2 to 10000 cP (centiPoise)

Solids content and coating

- The maximum recommended diameter of solid particles in the liquid is 0.2 in. (5 mm)
- For coating products, avoid bridging of forks (fork-to-fork)

CIP (Clean In Place) cleaning

- The 2160 withstands steam cleaning

Product Certifications

European directive information

The EC declaration of conformity for all applicable European directives for this product can be found on the Rosemount website at www.rosemount.com.

ATEX Directive (94/9/EC)

- Emerson Process Management complies with the ATEX Directive

European Pressure Equipment Directive (PED) (97/23/EC)

- The 2160 is outside the scope of PED Directive

Low Voltage Directive

- EN61010-1 Pollution degree 2, Category II (264 V max), Pollution degree 2, Category III (150 V max)

Electro Magnetic Compatibility (EMC) (2004/108/EC)

- EN61326 Emissions to Class B
- Immunity to industrial location requirements
- NAMUR NE21

Radio and Telecommunications Terminal Equipment Directive (R&TTE) (1999/5/EC)

- Emerson Process Management complies with the R&TTE Directive

Telecommunication compliance

- All wireless devices require certification to ensure that they adhere to regulations regarding the use of the RF spectrum. Nearly every country requires this type of product certification. Emerson is working with governmental agencies around the world to supply fully compliant products and remove the risk of violating country directives or laws governing wireless device usage. To see which countries our devices have received certification for use in, see www.rosemount.com/smartwireless

FCC and IC

- This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation
- This device must be installed to ensure a minimum antenna separation distance of 8 in. (20 cm) from all persons

FCC ID: LW2RM2510

IC ID: 2731A-RM2510

Overfill approval

- Certificate number: Z-65.11-518
  TÜV-tested and approved for overfill protection according to the German DIBt/WHG regulations. Certified under safety devices for tanks and piping related to water pollution control.

  This option is not selectable in the ordering information table.
  If required, add "**R2259**" to the end of the model code.
  For example, 2130 L A 2 E S 9 NN B A 0000 1 NA Q8 **R2259**

Drinking water approval

- Mobrey Ltd. (Slough, United Kingdom) confirms that the wetted parts of the Rosemount 2160 wireless vibrating fork level switch are suitable and approved for drinking water usage. The wetted parts of the vibrating fork level switches executed in stainless steel (option code S) and Alloy C/Alloy C-276 (option code H)
- These materials are toxicological and microbiological classified as safe and in accordance with DIN 50930-6

NAMUR approval

- NAMUR NE95 type test report available upon request.
  Complies with NAMUR NE21

Canadian Registration Number

- **CRN** 0F04227.2C

NOTE
The requirements of CRN are met when a Rosemount 2160 CSA-approved vibrating fork level switch model 2160****S**********I6****** is configured with 316/316L stainless steel (1.4401/1.4404) wetted parts and either NPT threaded or 2-in. to 8-in. ASME B16.5 flanged process connections.

Hazardous locations certificates

American and Canadian approvals

Factory Mutual (FM) approvals

I5 Project ID: 3036541

FM Intrinsic Safety, Non-incendive, and Dust Ignition-proof Intrinsically Safe for Class I/II/III, Division 1, Groups A, B, C, D, E, F, and G

Zone Marking: Class I, Zone 0, AEx ia IIC

Temperature Codes T4 (T_{amb} = –50 to 70 °C)

Non-incendive for Class I, Division 2, Groups A, B, C, and D

Dust Ignition-proof for Class II/III, Division I, Groups E, F, G

Ambient temperature limits: –50 to 70 °C

For use with Rosemount SmartPower® options P/N 753-9220-0001 only.

Enclosure Type 4X / IP66

Special condition for safe use:

1. Warning – Potential Electrostatic Charging Hazard – The enclosure is partially constructed from plastic. To prevent the risk of electrostatic sparking, use only a damp cloth to clean the plastic surfaces.

Canadian Standards Association (CSA) approval

I6 Certificate Number: 06 CSA 1786345

CSA Intrinsically Safe

Intrinsically Safe for Class I, Division 1, Groups A, B, C, and D

Temperature Code T3C

Enclosure Type 4X / IP66

Intrinsically Safe when installed in accordance with Rosemount drawing 71097/1271.

For use with Rosemount SmartPower options P/N 753-9220-0001 only.

Single Seal

European approvals

ATEX approval

I1 ATEX Intrinsic Safety

Certificate Number: Baseefa 09ATEX0253X

II 1 G, Ex ia IIC T5-T2 (T_a = –40 to 70 °C)

IP66

For use with Rosemount SmartPower options P/N 753-9220-0001 only

Special conditions for safe use:

1. The surface resistivity of the antenna is greater than one gigaohm. To avoid electrostatic charge build-up, it must not be rubbed or cleaned with solvents or a dry cloth.
2. Warning – Potential Electrostatic Charging Hazard – The enclosure is partially constructed from plastic. To prevent the risk of electrostatic sparking, use only a damp cloth to clean the plastic surfaces.

Rest of the world approvals

IECEx approval

I7 IECEx Intrinsic Safety

Certificate Number: IECEx BAS 09.0123X

Ex ia IIC T5-T2 (T_a = –40 to 70 °C)

IP66

For use with Rosemount SmartPower options P/N 753-9220-0001 only.

Special conditions for safe use:

1. The surface resistivity of the antenna is greater than one gigaohm. To avoid electrostatic charge build-up, it must not be rubbed or cleaned with solvents or a dry cloth.
2. Warning – Potential Electrostatic Charging Hazard – The enclosure is partially constructed from plastic. To prevent the risk of electrostatic sparking, use only a damp cloth to clean the plastic surfaces.

National Supervision and Inspection Centre (NEPSI) approvals

I3 NEPSI Intrinsic Safety

Certificate: GYJ101138X

Ex ia IIC T5-T2

Special conditions for safe use:

1. Symbol “X” is used to denote specific conditions of use:
   a. Model 648 WTT or Model 3051S WPT type battery pack provided by the manufacturer should be used
   b. The surface resistivity of the antenna is greater than one gigaohm. To avoid electrostatic charge build-up, it must not be rubbed or cleaned with solvents or a dry cloth
   c. The Rosemount 2160 enclosure is made of aluminum alloy and given a protective epoxy coating. However, care should be taken to protect it from impact or abrasion if located in a Zone 0

Dimensional Drawings

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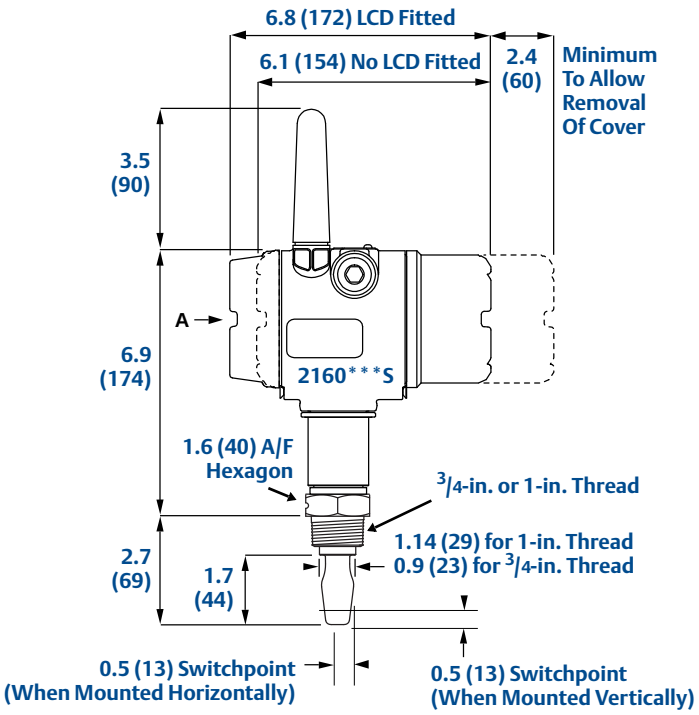
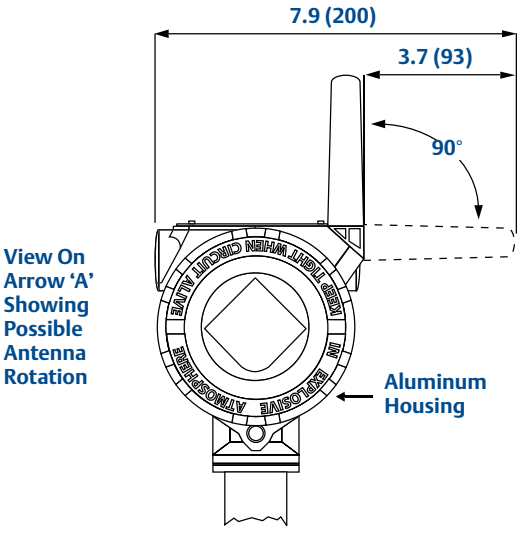
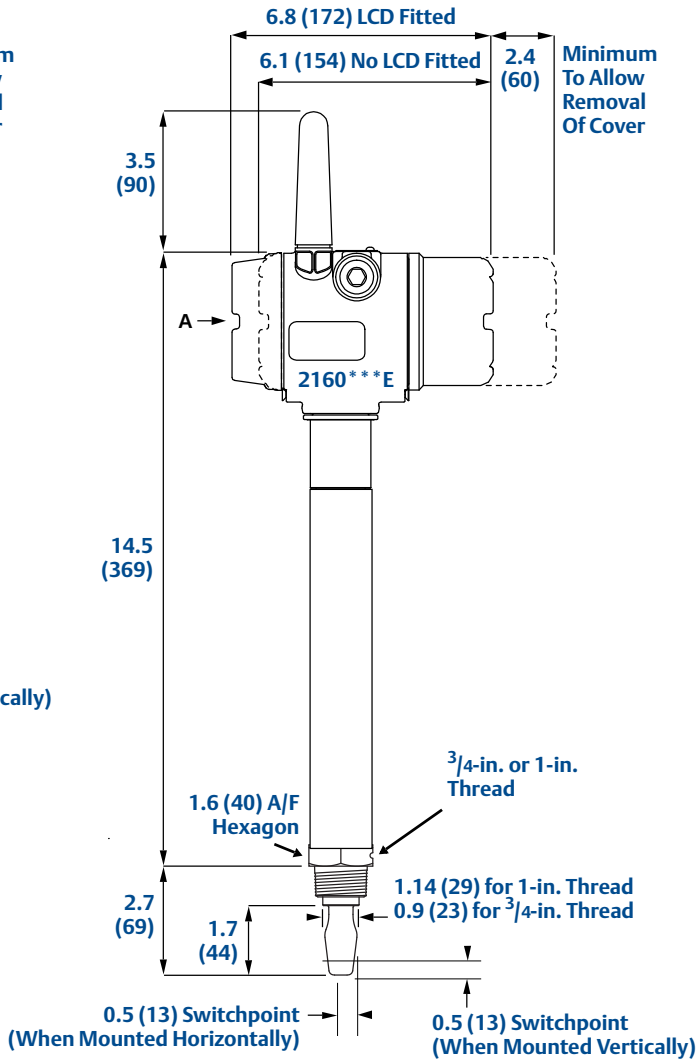
2160 thread mounting (standard length)

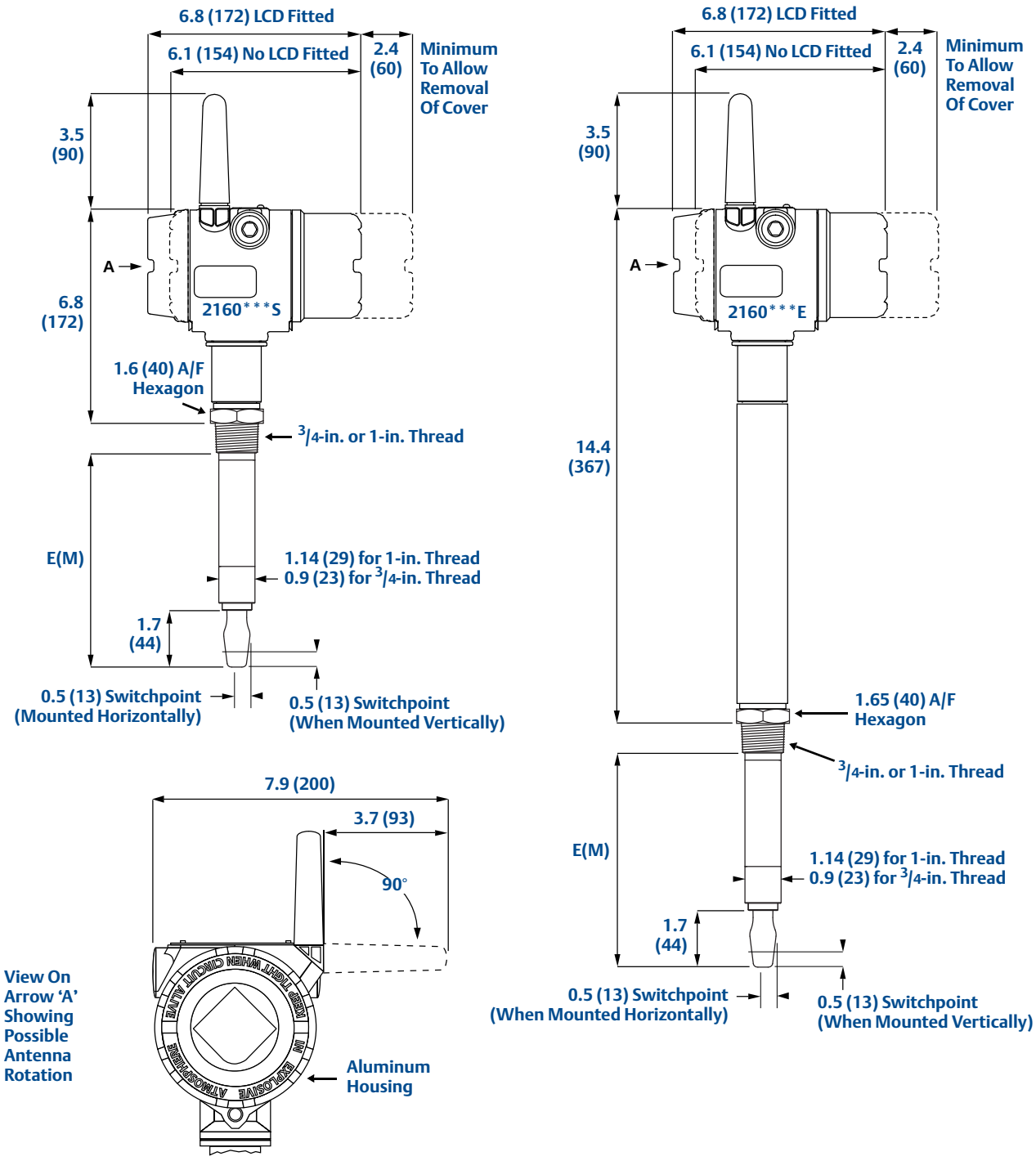






Note: Dimensions are in inches (millimeters)

2160 thread mounting (extended length)



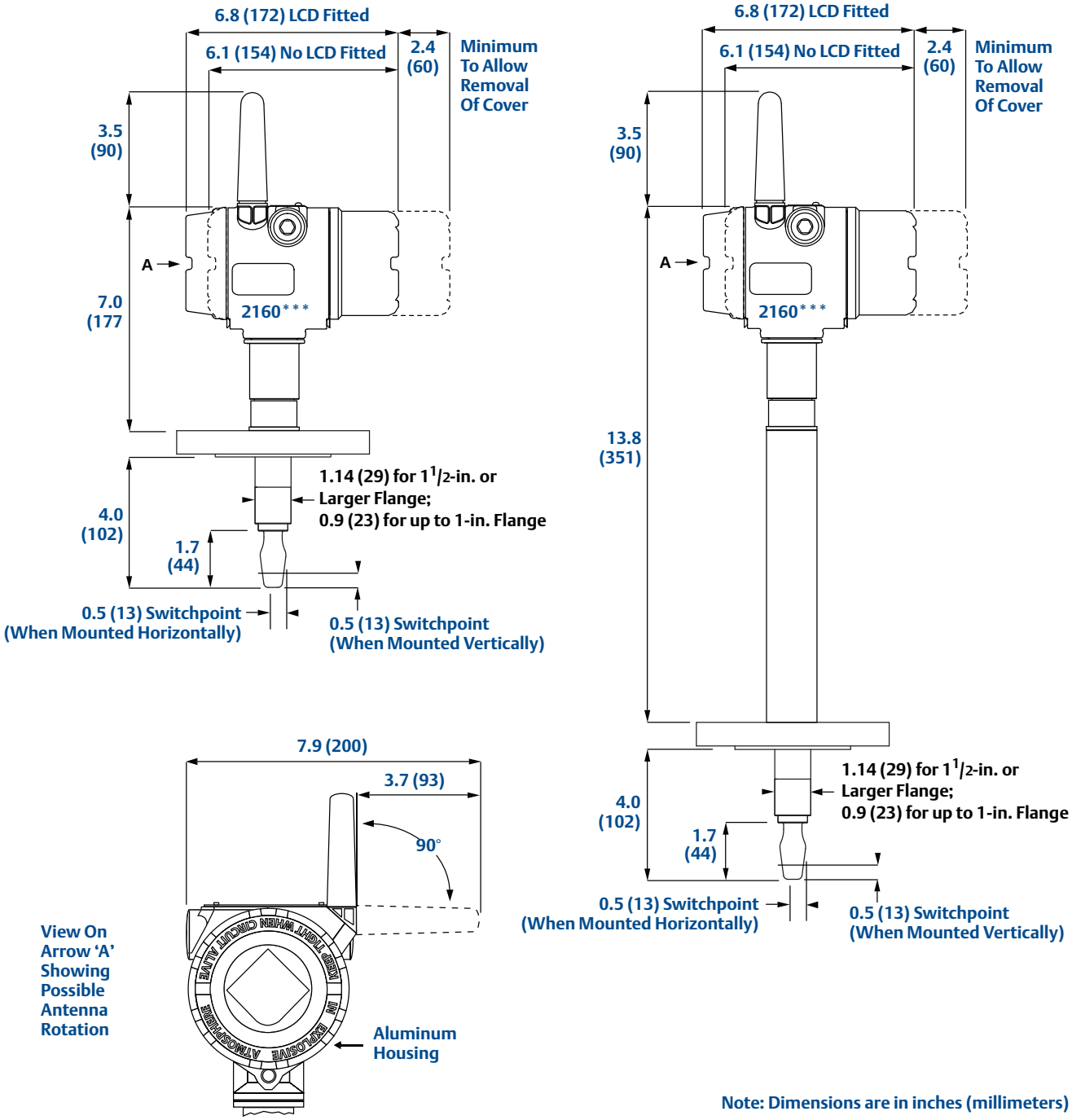
Note: Dimensions are in inches (millimeters)

Table 3. Thread mounting fork length

Process Connection	Standard Length Model Code A	Minimum Length Model Code E (M)	Maximum Length Model Code E (M)(1)
3/4-in. Thread	1.73 in. (44 mm)	3.75 in. (95 mm)	118.1 in. (3000 mm)
1-in. Thread	1.73 in. (44 mm)	3.74 in. (94 mm)	118.1 in. (3000 mm)

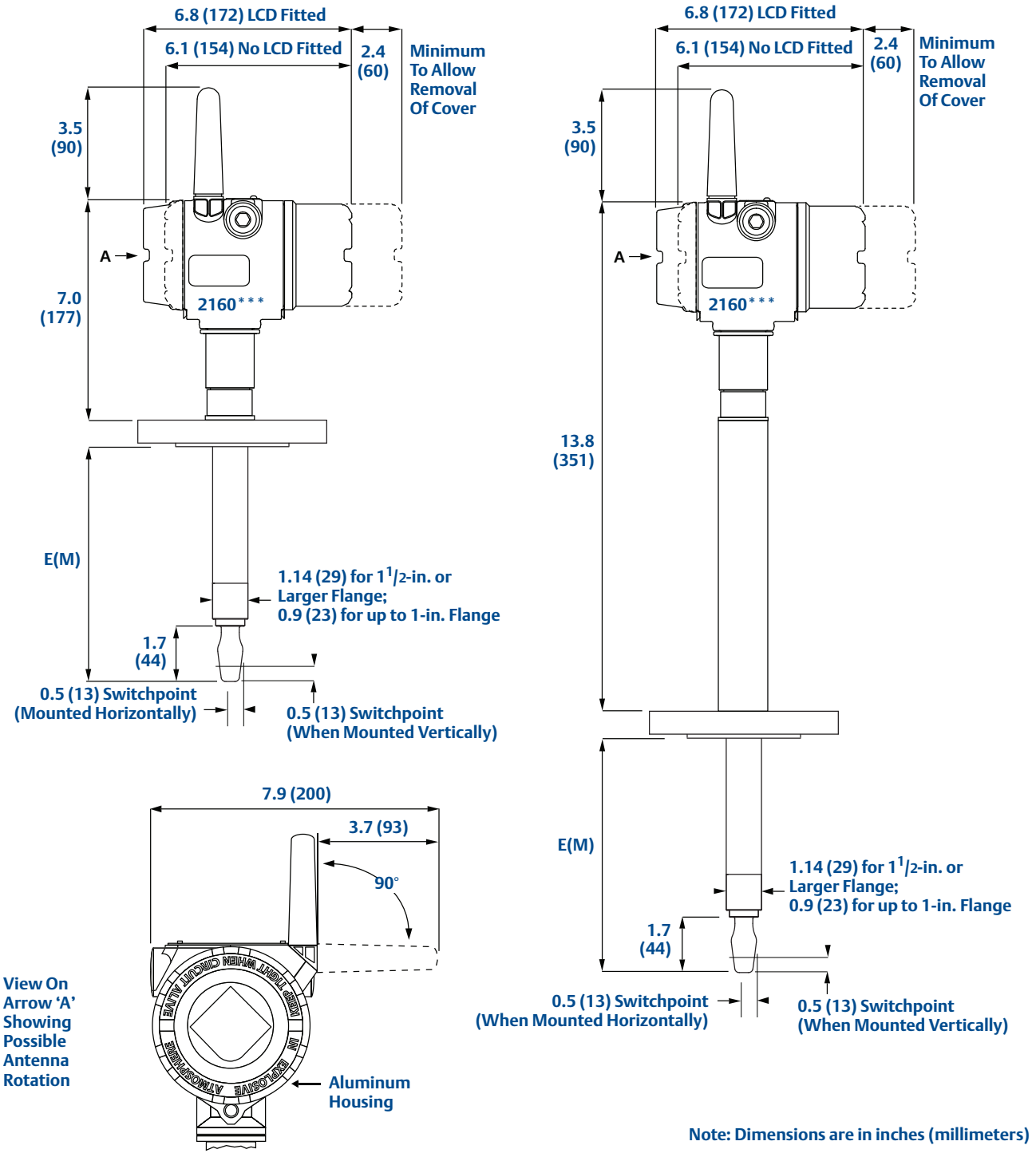
(1) Maximum extended length of fork with hand-polished option is 39.4 in. (1000 mm).

2160 Flange Mounting (Standard Length)



Note: Dimensions are in inches (millimeters)

2160 flange mounting (extended length)

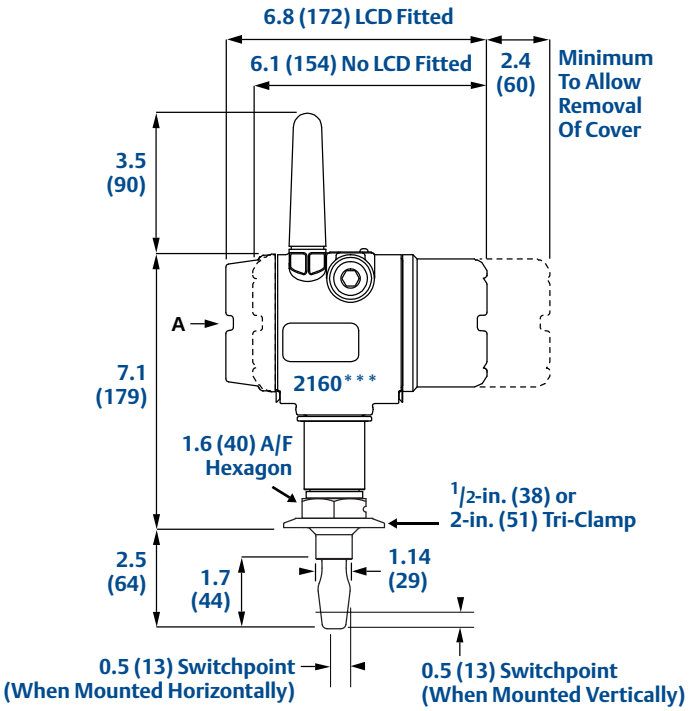


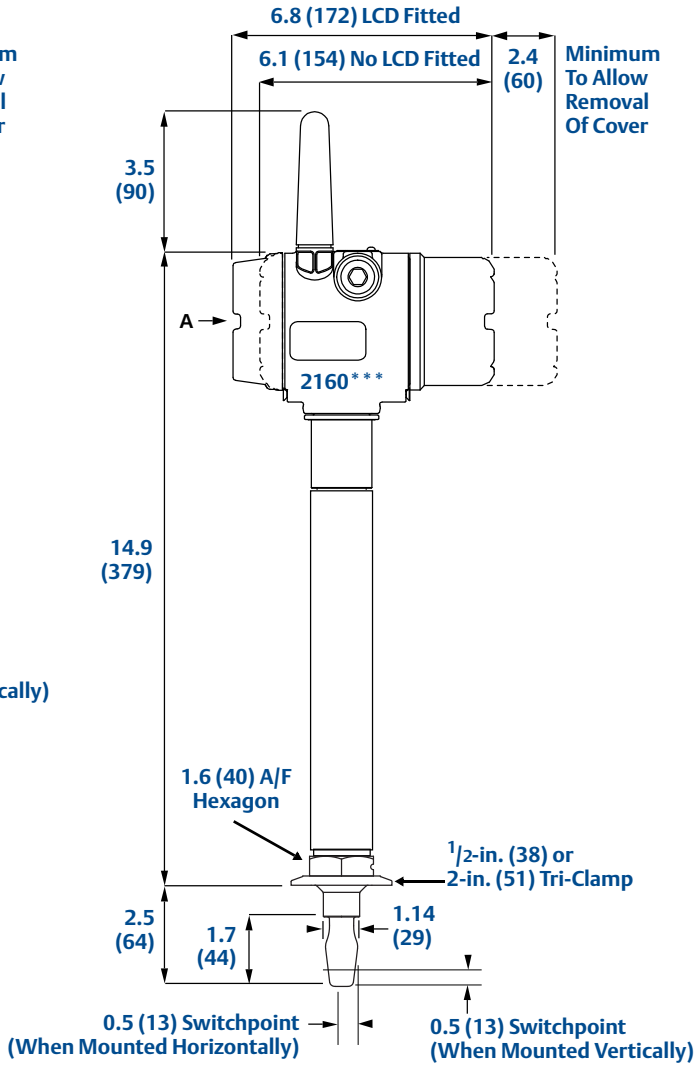
Note: Dimensions are in inches (millimeters)

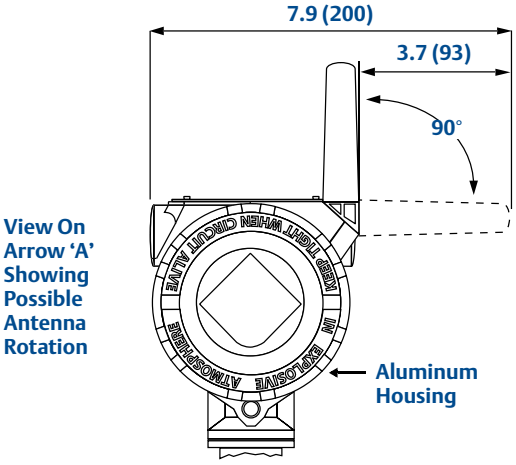
Table 4. Flange mounting fork length

Process Connection	Standard Length Fork Length Code H	Minimum Length Fork Length Code E(M)	Maximum Length Fork Length Code E(M)
3/4-in., 1-in. or larger flange	4.0 in. (102 mm)	3.7 in. (94 mm)	118.1 in. (3000 mm)

2160 hygienic fitting (standard length)

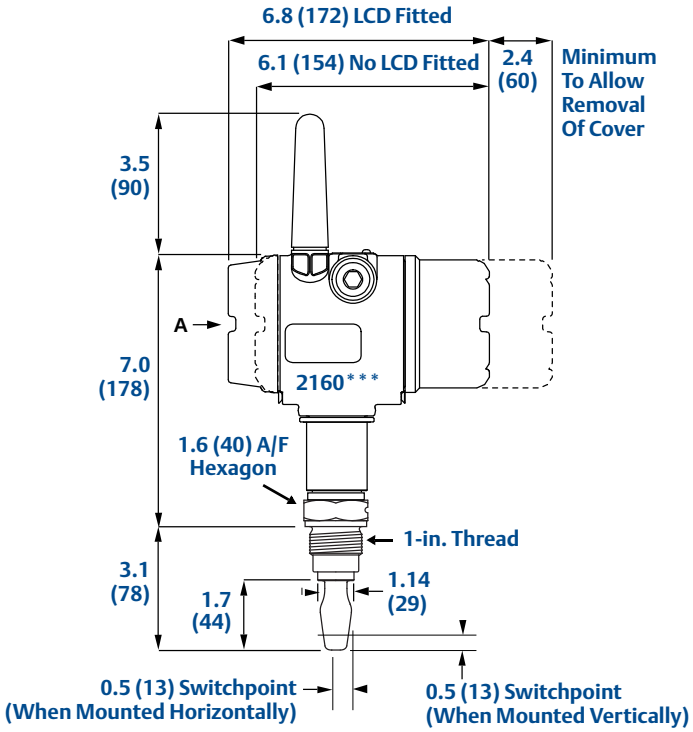


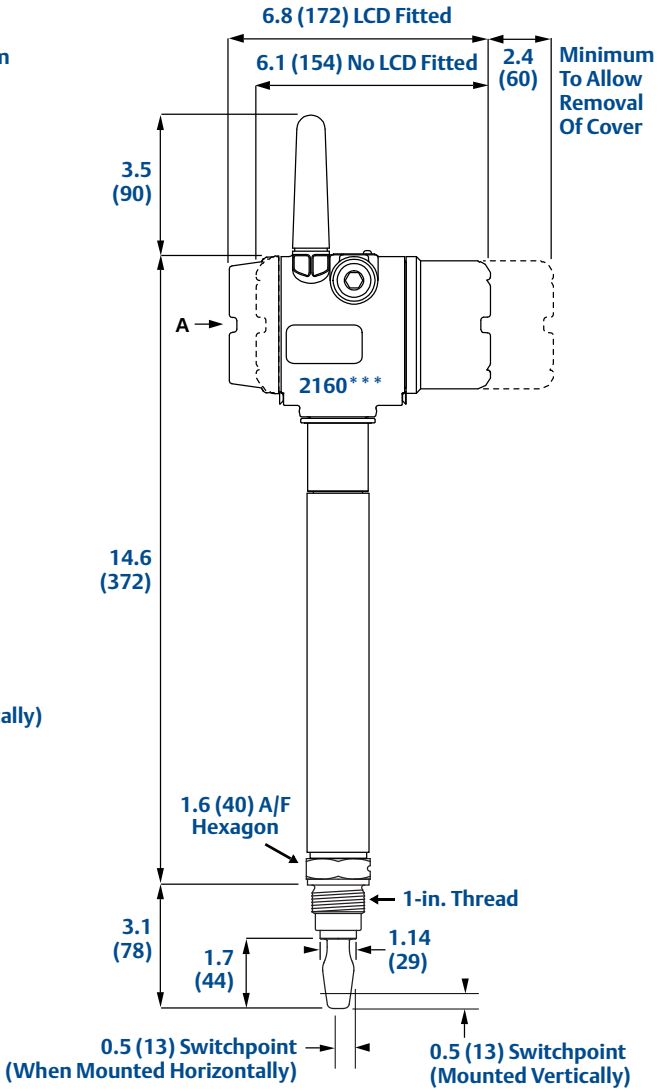


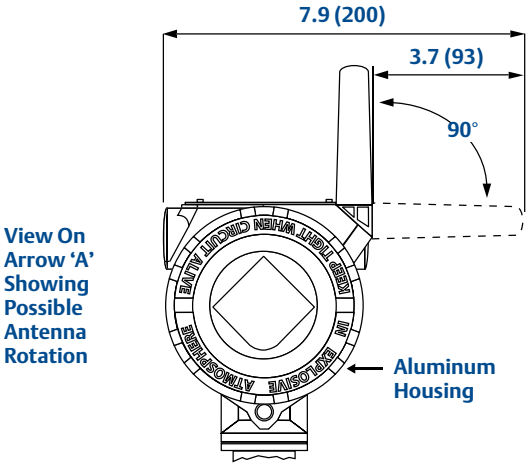


Note: Dimensions are in inches (millimeters)

2160 hygienic fitting (standard length) continued

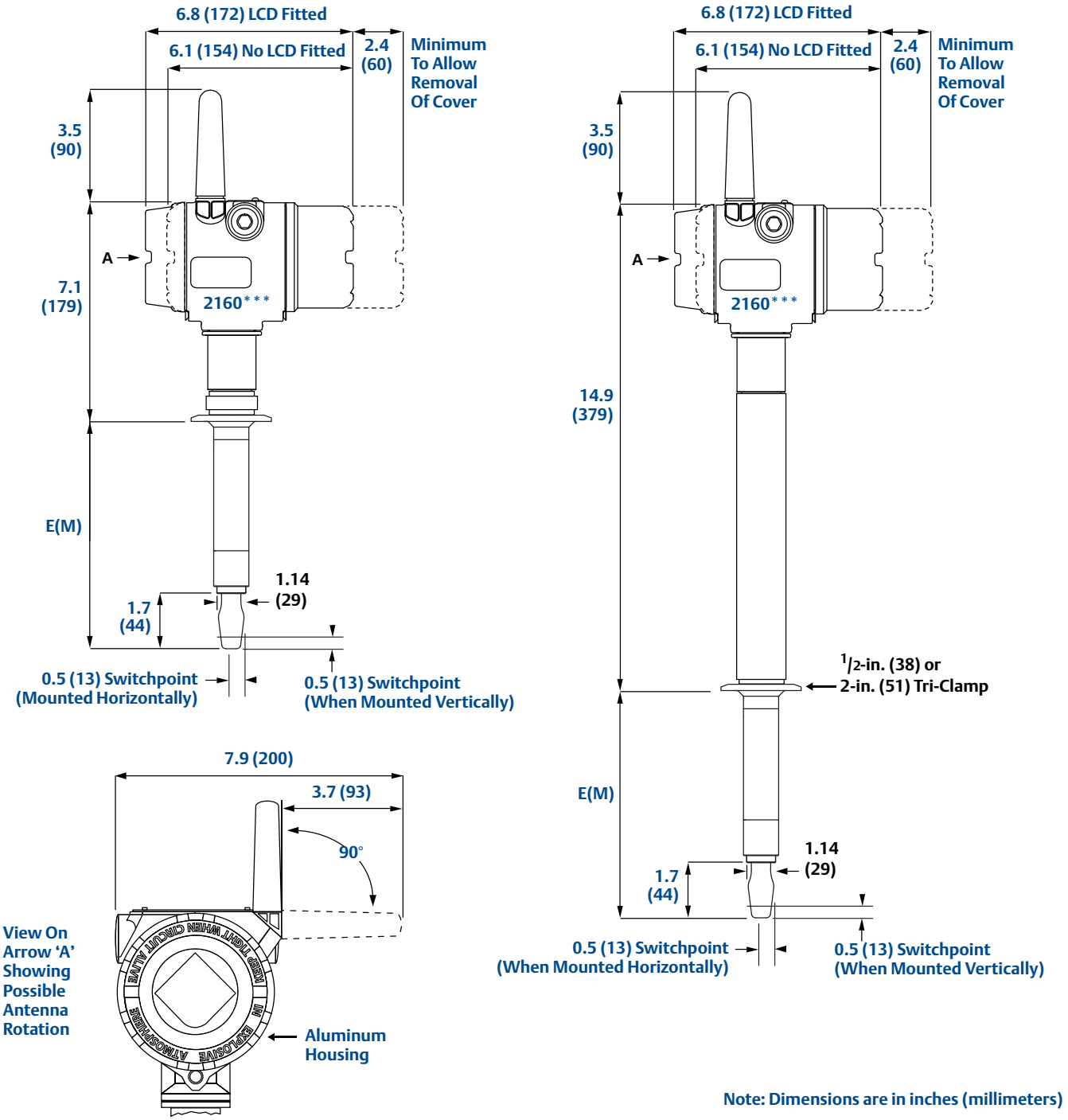






Note: Dimensions are in inches (millimeters)

2160 hygienic fitting (extended length)



Note: Dimensions are in inches (millimeters)

Table 5. Hygienic fitting fork length

Process Connection	Standard Length Fork Length Code H	Minimum Length Fork Length Code E(M)	Maximum Length Fork Length Code E(M)(1)
Tri-Clamp	1.73 in. (44 mm)	4.13 in. (105 mm)	118.1 in. (3000 mm)
1-in. Threaded	1.73 in. (44 mm)	3.74 in. (94 mm)	118.1 in. (3000 mm)

(1) Maximum extended length of fork with hand-polished option is 39.4 in. (1000 mm).

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