

IFD™ Sensor Installation Guide

How to successfully install the IFD sensor





Foreword

First of all, welcome to the IFD team! While this may sound a little on the fluffy side, we really do mean it. We're committed to reducing the risks line workers face and, with your decision to install IFD sensors it's clear you're committed to the same goal. That being said, here's what you can expect from your new support team.

We will listen

If you have any questions, ideas or concerns please let us know and someone will be happy to discuss them with you.

You will get answers

No matter what comes up over time you can rest assured our team won't stop until your curiosity is fully satisfied. Even if it has nothing to do with our products we will do our best to help out and if we can't find an answer, we can often connect you with someone who can.

We will make it right

We work hard to meet your requirements, but we also recognize that learning and continuous improvement are important parts of the customer support process. So, if we haven't fully met your expectations we welcome your feedback and the opportunity to learn and correct it for you.

We will strive to be your best supplier

We mean this, and we mean it regardless of your size or location. We will always remain committed to your success.

We will be there to support you every step of the way

Just call and we're on it, from the initial on-site training provided by our engineering team through to when the very oldest IFD sensor you've installed comes out of service.

You will have direct access to anyone on our team

No joke. Everyone on our team would be happy to take your call and take pride in the opportunity to work with you.

Finally, we'd just like to say thank you for your business, and thank you for taking action to help create a faster, safer and better utility industry.

How to contact us



1-604-734-0105



www.ifdcorporation.com



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About the IFD sensor

Since its introduction in 2001 line crews have come to trust the IFD sensor to tell them when a transformer has a dangerous internal fault. Today the IFD sensor is a benchmark in transformer safety that provides a simple, easy-to-use message:

“See the signal, replace the transformer!”

The IFD sensor detects and indicates low impedance internal arcing faults in pole mounted and pad mounted distribution transformers by releasing a highly visible orange indicator. When crews see this orange signal they know immediately the transformer is faulted and needs to be replaced.

In addition to improving worker safety, the maintenance free IFD mechanical sensor provides set-it-and-forget-it operation and a typical 12:1 return on investment over the life of the transformer.



Why the IFD sensor was invented

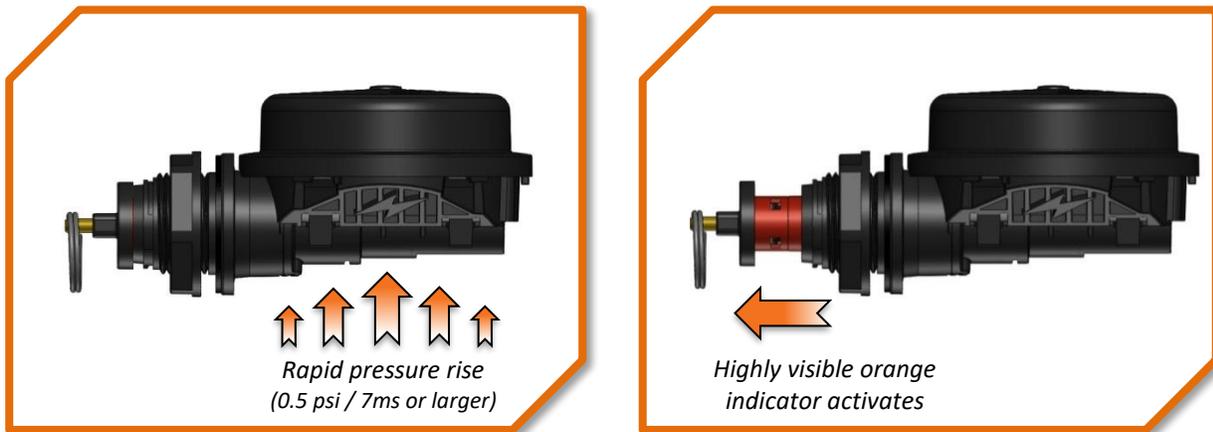
The IFD sensor evolved out of an industry objective to build a safer distribution transformer for line workers to interact with. This included many studies focused on learning how internal arcing faults developed and what the resulting internal pressures looked like inside the transformer. It was this research that uncovered the unique link between a low impedance internal arcing fault and a characteristic rapid pressure rise that followed in the airspace. It was observed that while this pressure rise had variable peak pressures it exhibited a consistent rate of rise in excess of 0.5 psi / 7 ms. This rapid rate of pressure rise is the fingerprint of a low impedance internal arcing fault that can cause tank rupture, and pose the highest risk to line workers.

The 2 functions of the IFD sensor

The IFD sensor is a two function device. Its primary function is to identify transformers with dangerous, low impedance internal faults. Its secondary function is to provide a means for standard pressure relief.

Primary function of the IFD sensor – Internal fault detection

The primary function of the IFD sensor is to detect and indicate rapid internal pressure rises associated with low impedance internal faults. These types of rapid pressure rises can develop 50 – 1500 times faster than the pressure build ups the pressure relief valve (PRV) is designed to vent. The potential for tank ruptures of these high energy internal faults is why the industry has developed manufacturing standards for tank strength, and continues to seek additional safety improvements to help protect line workers.



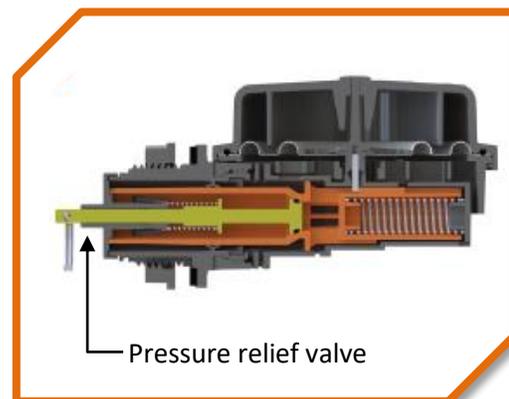
The IFD sensor is calibrated to activate when there is a pressure rise of 0.5 psi / 7 ms, or larger in the airspace of the transformer. This low activation threshold allows crews to avoid re-energizing transformers with potentially dangerous faults, even if the initial fault that caused power outage was well below the point of visible damage to the transformer. The transformer will remain sealed once the IFD sensor has activated.

Secondary function of the IFD sensor – Pressure relief

The IFD sensor also incorporates a standard PRV in order to provide both functions through the same hole in the transformer tank wall.

The PRV allows for automatic or manual venting when internal pressures rise slowly. These slow pressure build ups have various causes including high ambient temperatures, overloading and low energy internal faults. In these cases, the PRV protects the transformer by venting gases before they pose a risk to the transformer. The PRV will continue to function if the IFD sensor has activated.

The PRV specifications can be selected to meet either the IEEE or CSA standards requirements.



Transformer design requirements

The following section reviews the installation requirements for the IFD sensor along with some tips and tricks to help position the IFD sensor inside your transformer design.



Detailed dimensions of the IFD sensor are provided in Appendix A and 3D models are available on request.

Minimum oil clearance

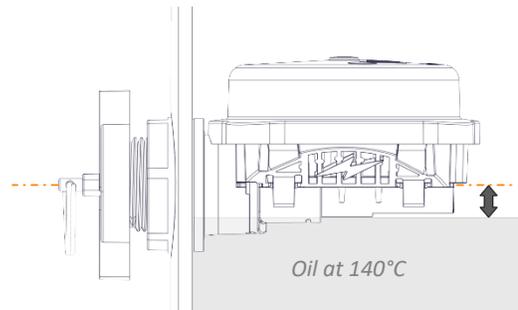


Clearance from the center of the mounting hole to the oil level must be a **minimum** of:

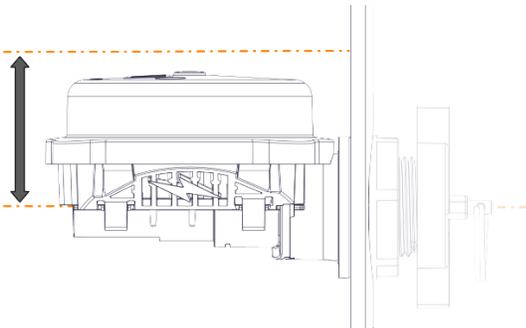
- **0.25 in [6 mm] at 140°C**



For best results, mount the IFD sensor as high above the oil level as possible.



Lid clearance



Clearance from the center of the mounting hole to the lid must be:

- **2.0 in [51 mm] minimum**



Take care to leave clearance for lid bracings, hinges, suspended components, etc.

In 3-ph pads, consider clearances from lid bracings during lid installation.

Component clearance

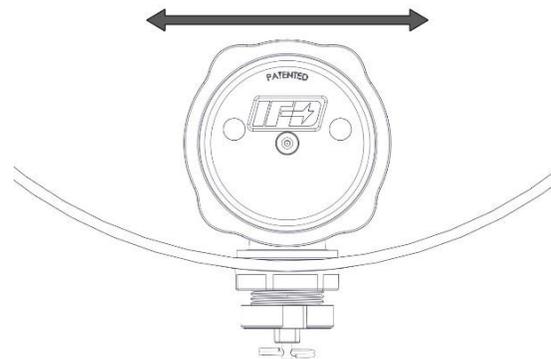


The IFD sensor requires a **clearance** from all other transformer components of:

- **0.25 in [6 mm] minimum**



IFD sensor dimensions are included in Appendix A.



Shipping Lock clearance

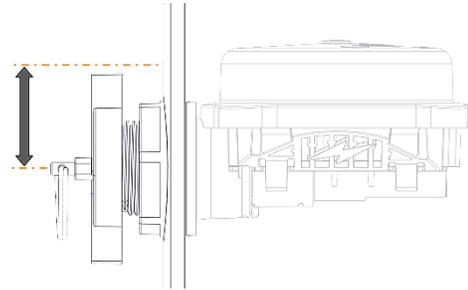


To allow for the Shipping Lock to be installed the center of the IFD sensor requires an external clearance of:

- **1.5 in [38 mm] minimum**



Make sure to also meet the **lid and component clearance** specifications listed above.



Wall thickness



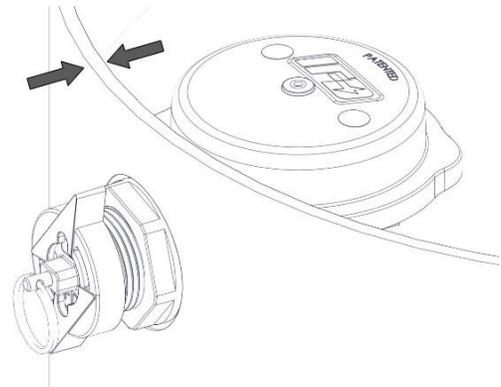
The IFD sensor is designed to be installed on tanks with a wall thickness between:

- **0.07 in [2 mm] → 0.32 in [8 mm]**



For a wall thickness greater than 0.17 in [4 mm] modified tooling may be required for pressure testing. Contact us for guidance.

See “Tooling Selection Guide” on page 9.



Tips and tricks



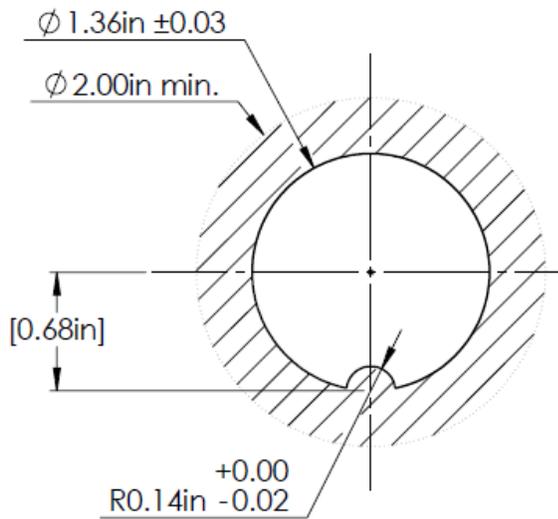
At this point you may still have a few options in where to locate the IFD sensor. If this is the case, it is helpful to consider the following:

For line crews installing and troubleshooting the transformer out in the field...

- ...is the IFD sensor clearly visible?** It is best to position the IFD sensor away from pole side of the transformer for higher visibility.
- ...is the Shipping Lock easy to remove?** Positioning the IFD sensor on the same side as the low voltage bushing provides the line crews with easy access to the Shipping Lock in the field.
- ...will the IFD sensor get damaged during handling?** The IFD sensor should be mounted far enough away from mounting brackets to prevent damage to the sensor during lifting.

Mounting hole specifications

The specifications below outline the required dimensions and features of the mounting hole for the IFD sensor.



Cut-out



The IFD sensor requires a hole cut-out with a diameter of:

- **$\phi 1.36\text{ in} \pm 0.03$** [$\phi 34.5\text{ mm} \pm 0.8$]

Key



A key must be located at the 6 o'clock position with a radius of:

- **$R0.14\text{ in} \pm \frac{0.00}{0.02}$** [$3.6\text{ mm} \pm \frac{0.0}{0.5}$]

Flat boss



To provide adequate sealing, the hole cut-out must be positioned within a flat boss that has a diameter of:

- **$\phi 2.0\text{ in}$** [$\phi 50\text{ mm}$] **minimum**



Our objective is to allow you to use tools you already have (such as the hole punch you would use for the tap changer or a low voltage bushing).

So if you have a tool that is close, but doesn't meet these specifications, contact us for guidance.

Installation specifications

This section outlines the required specifications that must be met when installing the IFD sensor.

Torque specification

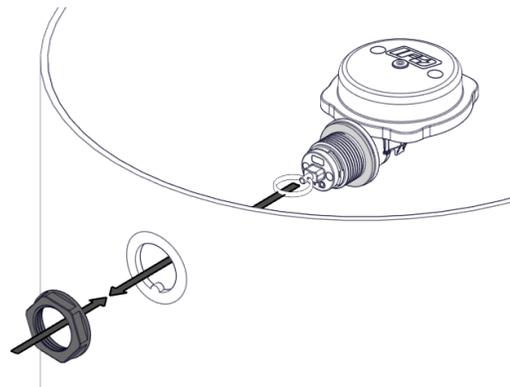


Torque the nut to:

- **$100 \pm 20\text{ in-lb}$** [$11 \pm 2\text{ N}\cdot\text{m}$]



Do not hold the IFD sensor when applying torque to the nut. Damage may occur.



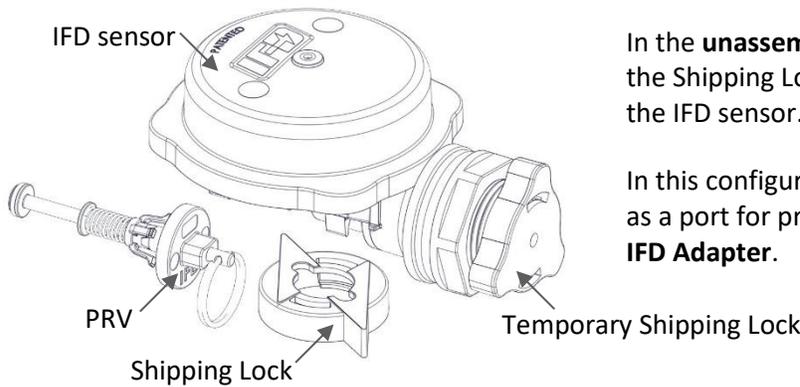
Purchasing configurations and tooling options

To optimize installation for various production methods, the IFD sensor is available in two different purchasing configurations along with several different tooling options.



For a complete list of parts and pricing, please contact us.

Unassembled configuration



In the **unassembled configuration** the PRV and the Shipping Lock are packaged separately from the IFD sensor.

In this configuration the IFD sensor may be used as a port for pressure testing with the use of the **IFD Adapter**.

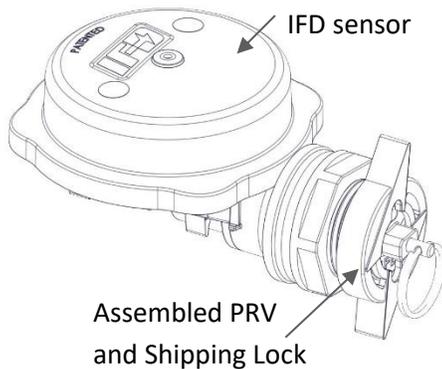


IFD Socket
A 42 mm, 3/8" drive socket used to torque the IFD nut.



IFD Adapter
Converts the IFD sensor into 1/4" NPT port for pressure testing.

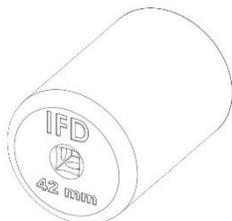
Assembled configuration



In the **assembled configuration** the IFD sensor, PRV and Shipping Lock are shipped fully assembled as one unit.

This configuration is ideal for manufacturing lines where pressure testing is:

- **not** required, or
- performed through a **different port**



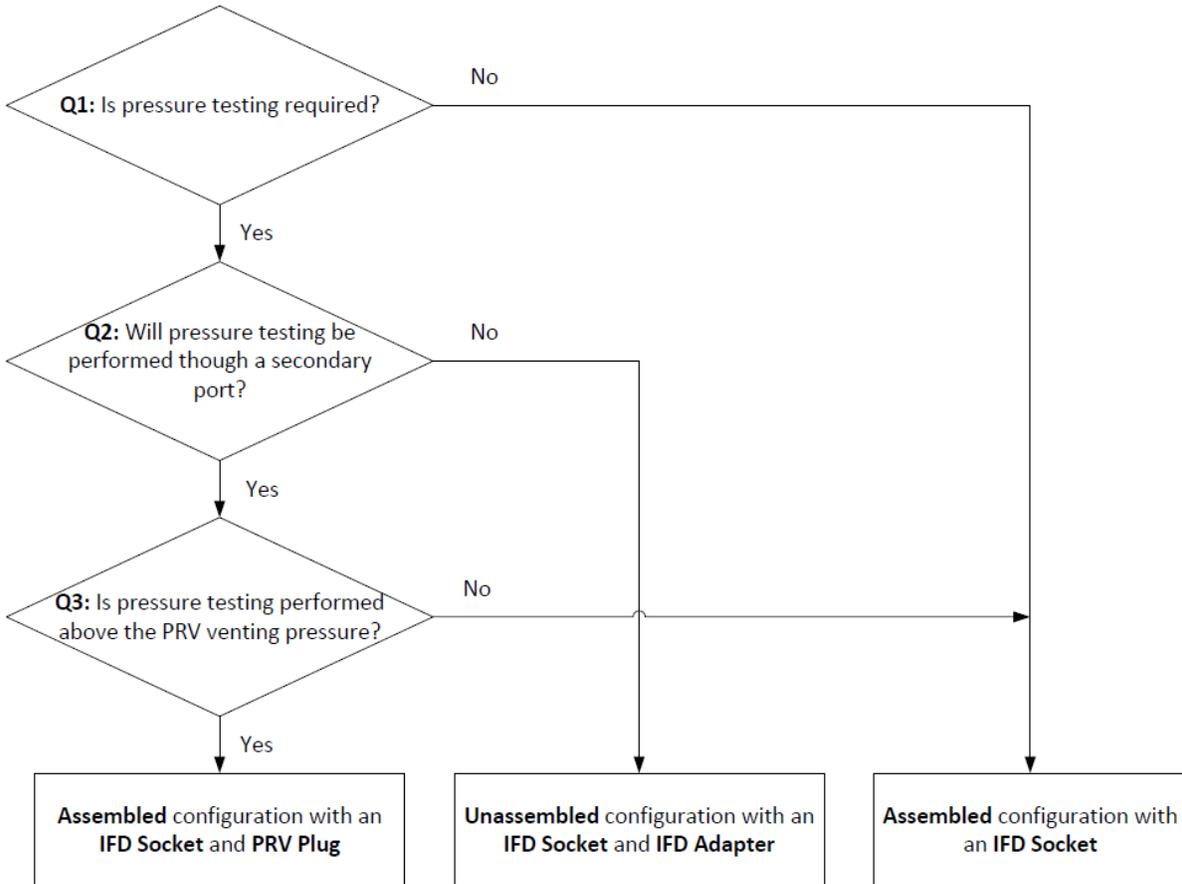
IFD Socket
A 42 mm, 3/8" drive socket used to torque the IFD nut.



PRV Plug (optional)
Prevents the PRV from venting during pressure testing.

Tooling selection guide

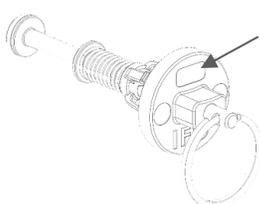
Take a look through the flow chart below to identify the best configuration and tooling options for your process. If you have any questions give us a call and we will be happy to assist you.



If you require the PRV Plug or IFD Adapter for pressure testing the maximum wall thickness the IFD sensor can be installed on is reduced to 0.17 in [4 mm]. If the wall thickness of your transformer is outside this specification you may require modified tooling. Contact us for guidance.

PRV options

In order to comply with IEEE or CSA standards, the IFD sensor can be purchased with either a 10 psi or 45 kPa PRV. The specification of the PRV is stamped on the front surface of the dust cover.



PRV Stamp Location

	<i>Specification</i>	<i>Venting Pressure</i>
IEEE		10 ± 2 psi [69 ± 14 kPa]
CSA		45 ± 5 kPa [6.5 ± 0.7 psi]



Ensure the PRV is selected in accordance to the customer's specifications.

Installing the IFD sensor

Complete step by step guides to installing the various configurations along with tooling options are included in Appendix B.



The IFD sensor is a device designed for line worker safety. If a unit is damaged during installation or if damage is suspected, please contact us immediately. We will ask you to return the sensor to us for inspection and issue you a credit for replacement.

Best practices for installation

We've learned a lot from our customers over the years! The intent of this section is to pass along the learning from our combined experience and to highlight some of the best practices used to ensure seamless integration of the IFD sensor into your production line.

Have IFD staff run a training session

We offer onsite training to all our customers. From experience, face-to-face training will create value in a number of ways:

- Get real-time feedback on how to effectively integrate the IFD sensor into your production line
- Take advantage of our experience to ensure quality is high from the get-go
- Put a face behind the product, so when a question arises you know who to call



Our goal behind these training sessions is for you to be as prepared as possible to install the IFD sensor successfully. So don't hesitate to contact us -- arrange a training session today!

Use visual work instructions

We have learned visual work instructions are powerful tools for production environments. We encourage you to print out the instruction set that applies to your process and display it for easy reference on the production line.



Shop floor instructions for each of the different configurations and tooling options are included in Appendix B.

Use appropriate sized torque wrench

The IFD nut requires a torque value of **100 ± 20 in-lb** [11 ± 2 Nm] for proper gasket sealing. Using a torque wrench where the target value is near the mid-range of the wrench capacity will allow operators to consistently meet the IFD nut torque requirement.

Ensure the IFD sensor is always locked out

To prevent premature activations that may occur while handling the transformer the IFD sensor must always be locked out with one of the following:

- Shipping Lock
- PRV Plug
- IFD Adapter

Install the IFD decal

The IFD decal is a training document that reminds line crews how to work with an IFD equipped transformer. The IFD decal should be installed on the outside of the transformer as close to the IFD sensor as possible.



The IFD Decal can be placed below, or on either side of the IFD sensor.



Perform end of line inspections

We recommend a simple, three-step, end of line quality check for the IFD sensor. The visual work instructions for these checks are outlined in Appendix B and consist of the following:



Three-step, end of line quality check

- 1. Verify IFD sensor installation**
Remove Shipping Lock to check that the indicator does not activate
- 2. Verify PRV installation**
*Tug Pull Ring to check Spring Retainer installation or
Push and rotate PRV Dust Cover until Spring Retainer clicks into place*
- 3. Verify Shipping Lock and Decal installation**
Ensure the Shipping Lock is fully engaged with tabs in the vertical position and Check that the IFD Decal is positioned near the IFD sensor

Maintain IFD sensor training

While initial training is very important, that training won't last forever as there are always new people coming onto the line. Running periodic training sessions ensures any new operators are fully up to speed and serves as a great refresher for your experienced people.



All our training material can be found online at www.ifdcorporation.com or, contact us and we can send our training material directly to you.

Common questions

This section answers some questions you may have during installation of the IFD sensor. If you have a question that is not covered here give us a call and we will be happy to help you out.

Can I put the IFD sensor through a paint curing oven?

It is common for the IFD sensor to be processed through a paint curing oven after it is installed in a transformer. As every process is a little different please contact our engineering team for further details.

What if the IFD sensor activates during production?

Without locking out the IFD sensor it is possible for premature activation to occur during handling. If this happens, the IFD Reset Tool will allow you to reset the sensor without opening the transformer. Before resetting the IFD sensor it is important double check that no damage is suspected to either the transformer or IFD sensor.



It is only acceptable to reset the IFD sensor if...

- 1. You are confident that the transformer has never been energized / does not contain an internal arcing fault*
- 2. No damage to the IFD sensor is suspected (ie. hitting it or dropping it)*

NEVER TRY TO RESET THE IFD SENSOR BY PUSHING ON THE ORANGE INDICATOR. Doing so may result in permanent damage to the sensor.



Further information about the IFD Reset Tool including a user manual and video is available on our website at www.ifdcorporation.com.

I am unable to reset the IFD sensor, what is next?

This likely indicates the IFD sensor is damaged and needs to be replaced. Please contact us and we will issue a credit for a replacement upon return of the damaged unit.

What should I do if an IFD equipped transformer needs investigation?

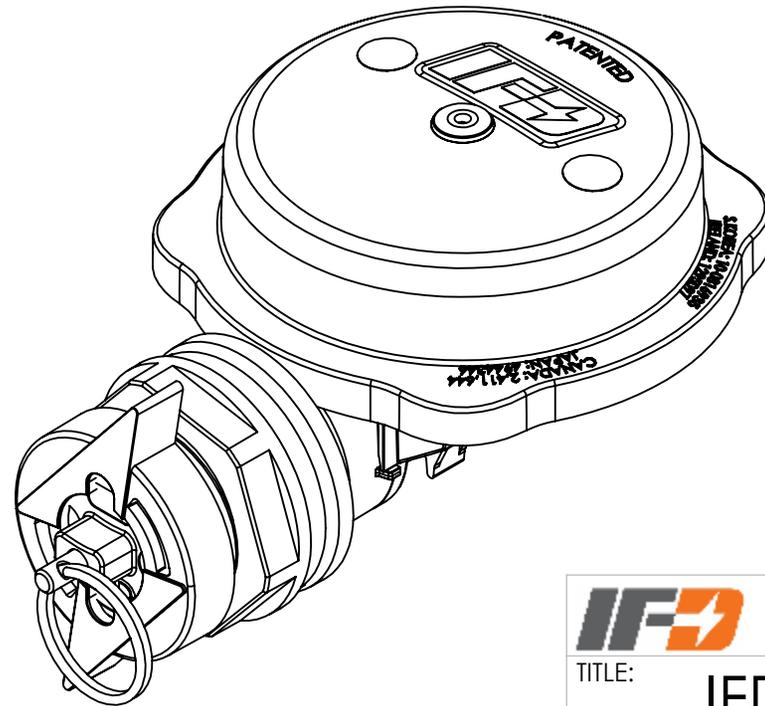
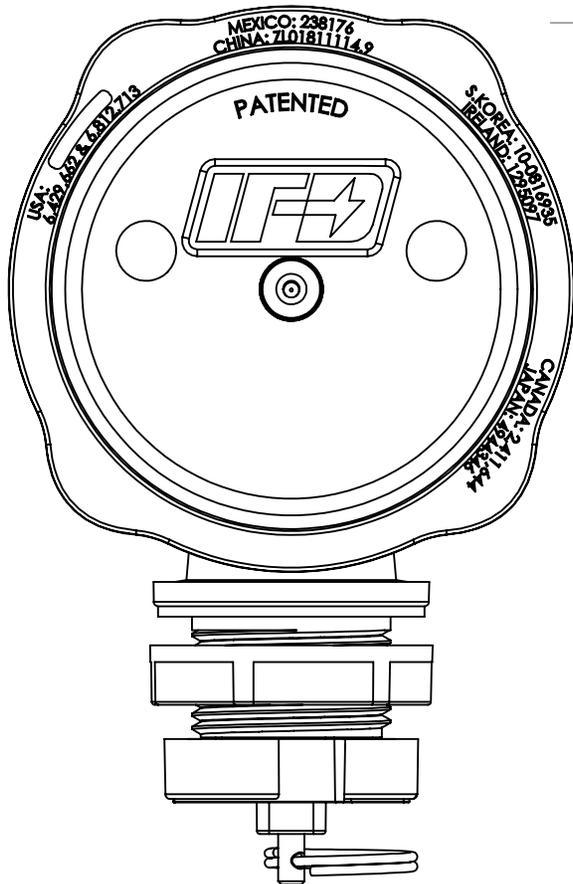
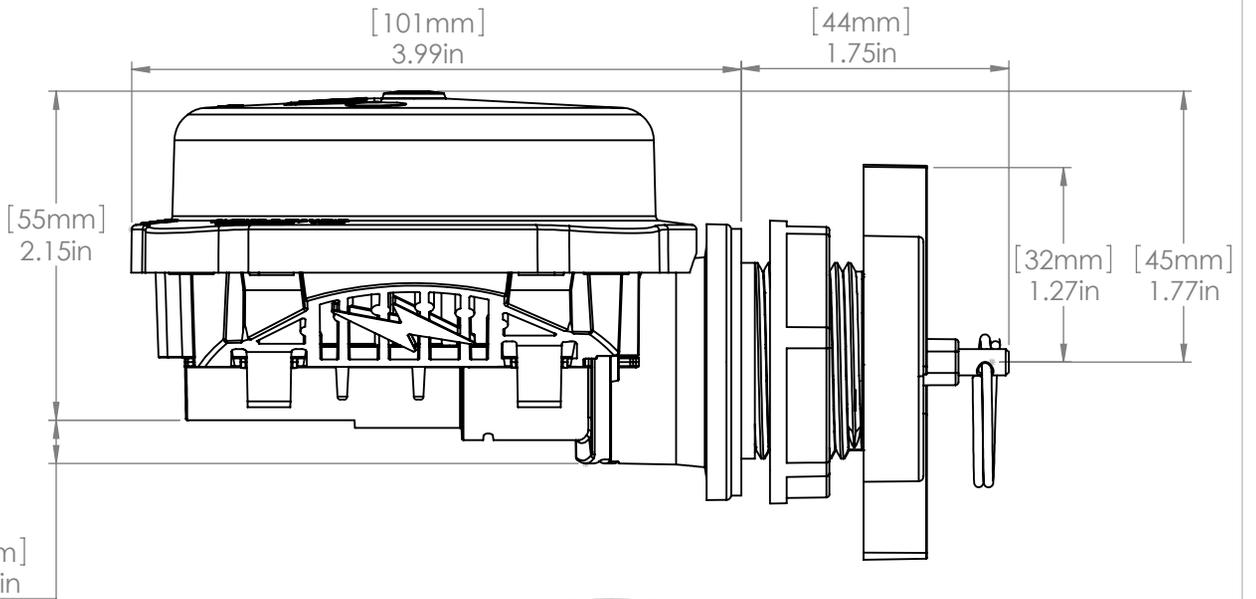
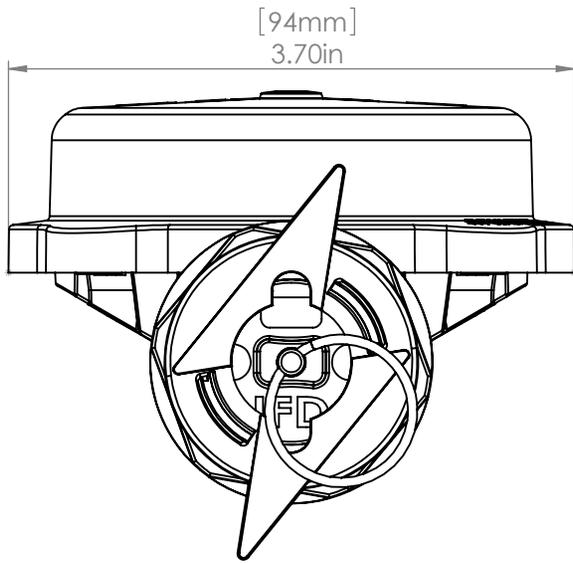
Please contact us and one of our engineers will guide you through our investigation process. Some of the information we will need to get started is:

- Description of what happened / the situation
- Current location / status of the IFD sensor
- Transformer information: type, size, serial number, manufacturing date
- We would also appreciate any available pictures

Please ensure you retain the IFD sensor as we will need it returned for further analysis.



Appendix A: IFD sensor drawing



IFD IFD Corporation

TITLE: IFD Orca

PROPRIETARY AND CONFIDENTIAL
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF IFD CORP. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF IFD CORP. IS PROHIBITED.

SIZE	PART NO.	REV
A	See IFD price list	0
IFD-DWG-2016-00		Page 1 of 1

Appendix B: Visual work instructions

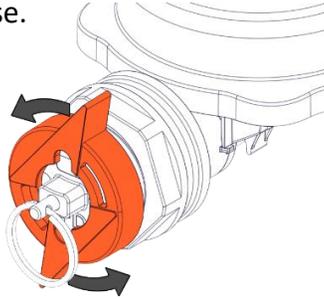
<i>Installing the IFD sensor.....</i>	<i>16</i>
<i>Installing the IFD sensor with PRV Plug</i>	<i>17</i>
<i>Installing the IFD sensor with IFD Adapter.....</i>	<i>18</i>
<i>End of line quality checks.....</i>	<i>19</i>

Installing the IFD sensor

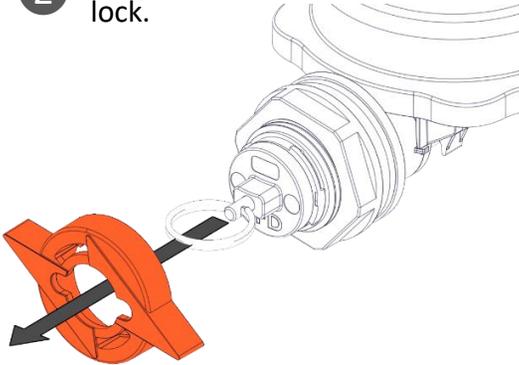


PREPARE SENSOR

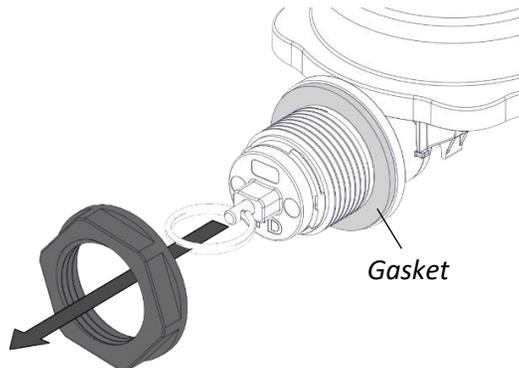
- 1 Turn shipping lock 90° counter-clockwise.



- 2 Remove and retain shipping lock.



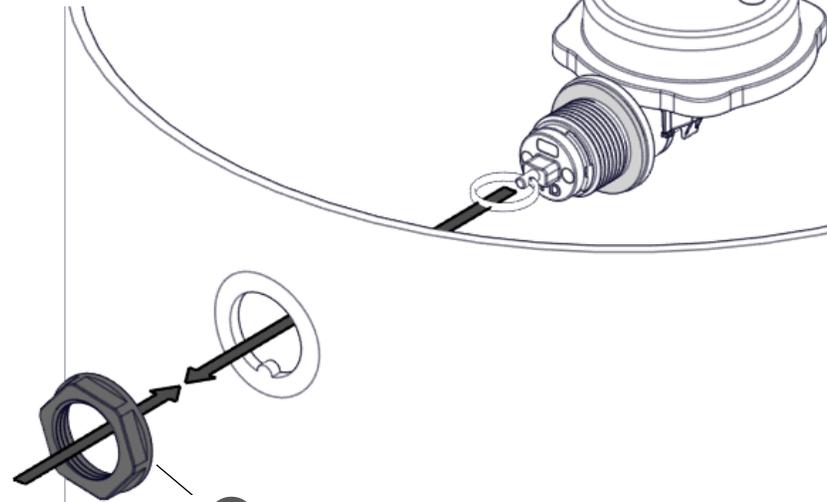
- 3 Remove nut. Make sure gasket remains on IFD body.



INSTALL SENSOR

- 4 Align keyway and insert the IFD sensor into the mounting hole.

- 5 Install nut. Tighten by hand until snug.



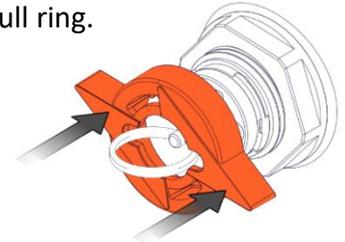
- 6 Torque the nut to:
 - 100 ± 20 in-lb
 - [11 ± 2 Nm]



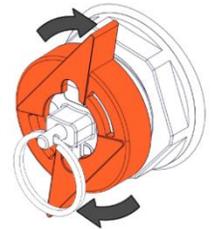
Important: Do not hold the IFD sensor when applying torque to the nut. Damage may occur.

INSTALL SHIPPING LOCK

- 7 Slide shipping lock over PRV pull ring.



- 8 Push and rotate shipping lock 90° clockwise.



INSTALL DECAL

- 9 Install the IFD decal.

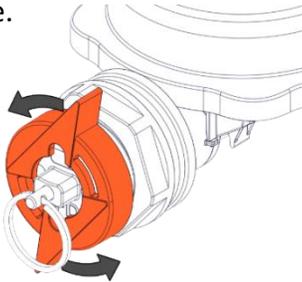


Installing the IFD sensor with PRV Plug

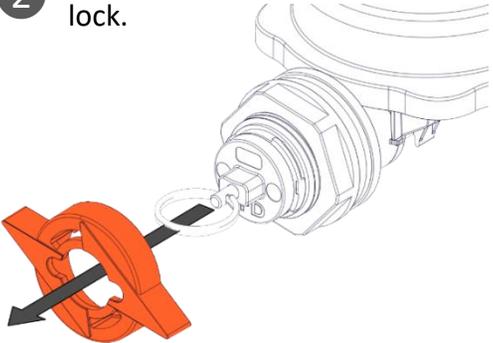


PREPARE SENSOR

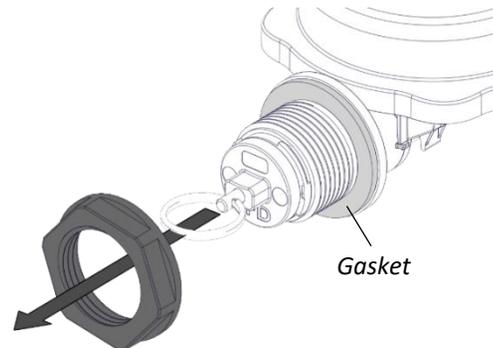
- 1 Turn shipping lock 90° counter-clockwise.



- 2 Remove and retain shipping lock.



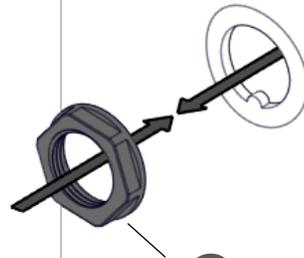
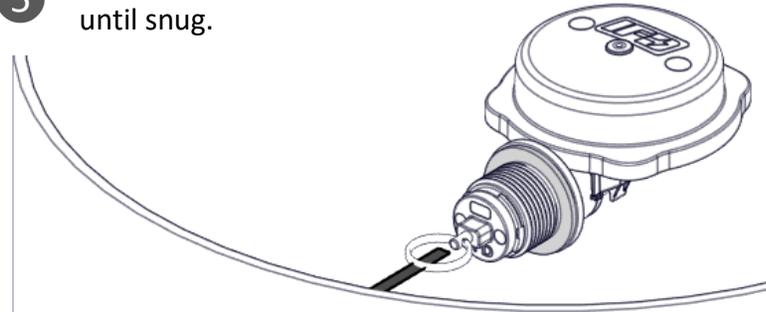
- 3 Remove nut. Make sure gasket remains on IFD body.



INSTALL SENSOR

- 4 Align keyway and insert the IFD sensor into the mounting hole.

- 5 Install nut. Tighten by hand until snug.



- 6 Torque the nut to:
 - 100 ± 20 in-lb
 - [11 ± 2 Nm]

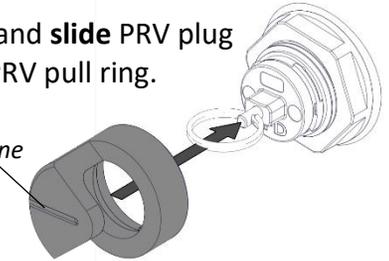


Important: Do not hold the IFD sensor when applying torque to the nut. Damage may occur.

INSTALL PRV PLUG

- 7 Align and slide PRV plug over PRV pull ring.

Indicator line



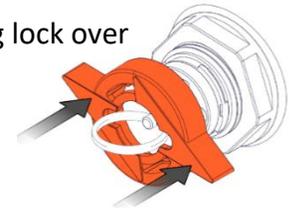
- 8 Push and rotate PRV Plug 90° clockwise.



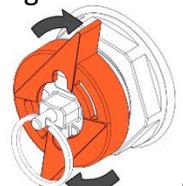
PREPARE FOR SHIPPING

- 9 Remove PRV plug.

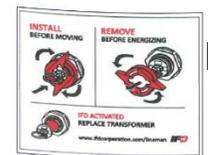
- 10 Slide shipping lock over PRV pull ring.



- 11 Push and rotate shipping lock 90° clockwise.



- 12 Install IFD decal.

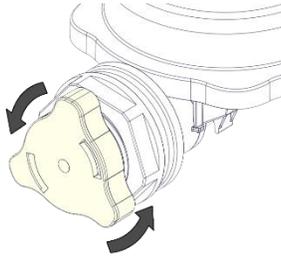


Installing the IFD sensor with IFD Adapter

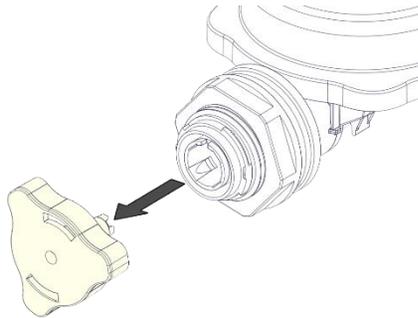


PREPARE SENSOR

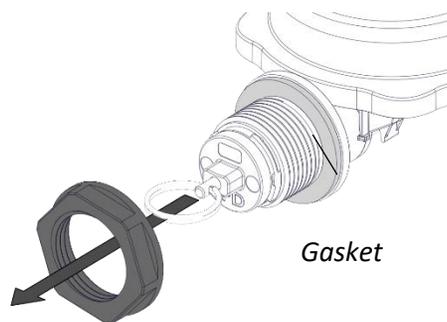
- 1 Twist temporary lock 90° counter-clockwise.



- 2 Remove and recycle (discard) temporary lock.

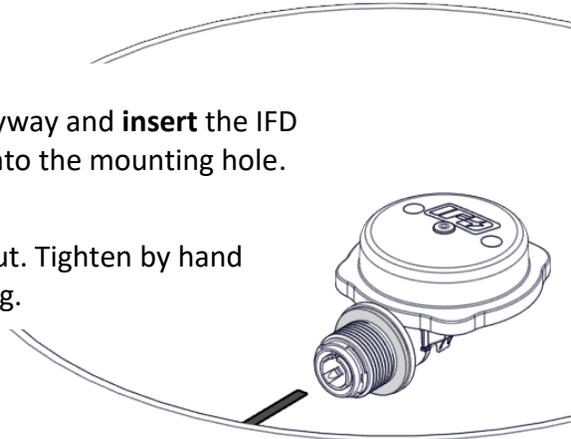


- 3 Remove nut. Make sure gasket remains on IFD body.

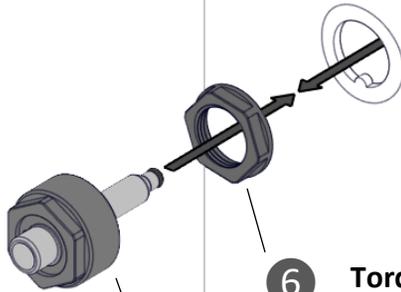


INSTALL SENSOR

- 4 Align keyway and insert the IFD sensor into the mounting hole.



- 5 Install nut. Tighten by hand until snug.



- 6 Torque the nut to:
 - 100 ± 20 in-lb
[11 ± 2 Nm]



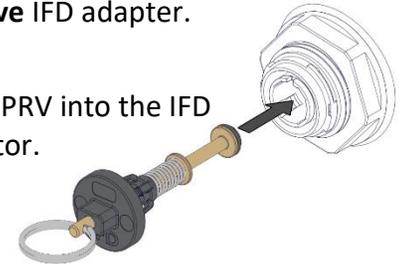
Important: Do not hold the IFD sensor when applying torque to the nut. Damage may occur.

- 7 Insert IFD adapter and torque to:
 - 80 ± 10 in-lb
[9 ± 1 Nm]

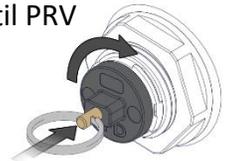
INSTALL PRV

- 8 Remove IFD adapter.

- 9 Insert PRV into the IFD indicator.

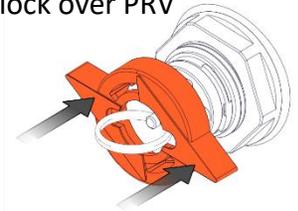


- 10 Push and rotate until PRV snaps into place.

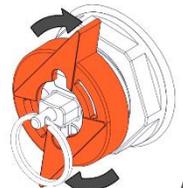


PREPARE FOR SHIPPING

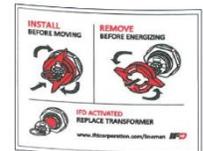
- 11 Slide shipping lock over PRV pull ring.



- 12 Push and rotate shipping lock 90° clockwise.



- 13 Install IFD decal.

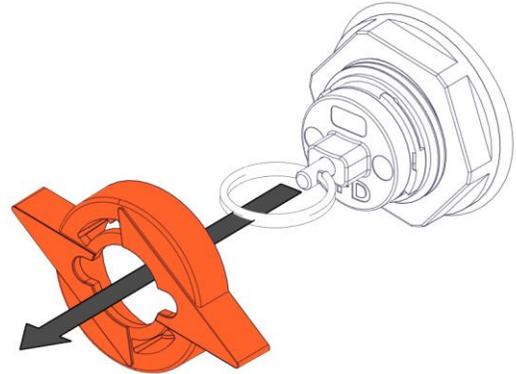


End of line quality checks



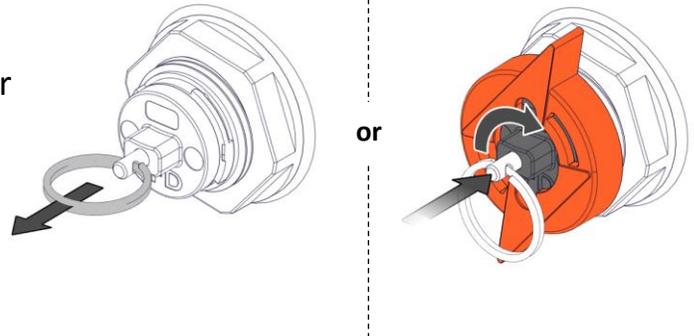
VERIFY IFD SENSOR INSTALLATION

- **Remove** shipping lock to check that the indicator does not activate



VERIFY PRV INSTALLATION

- **Tug** Pull Ring to check Spring Retainer installation **or**
- **Push** and **rotate** PRV Dust Cover until the Spring Retainer clicks into place



VERIFY SHIPPING LOCK AND DECAL INSTALLATION

- **Ensure** the Shipping Lock is fully engaged with tabs in the vertical position **and**
- **Check** that the IFD Decal is positioned near the IFD sensor

