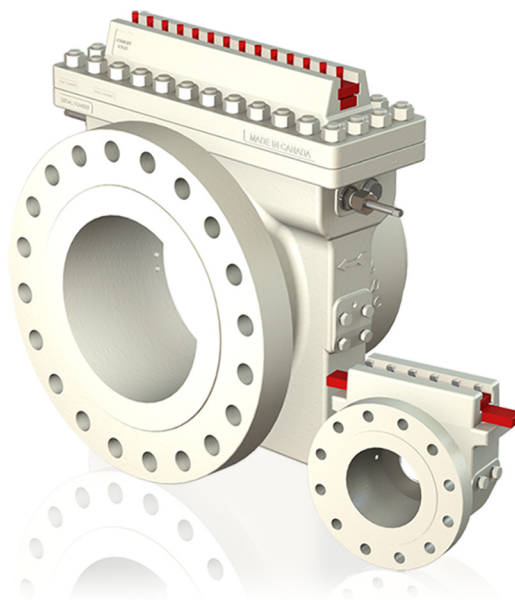


FPD201

Single-chamber orifice fitting

Measurement made easy



Introduction

ABB's FPD201 single-chamber orifice fitting is a proven system for safely and quickly inspecting and changing orifice plates in conformance with strict Oil & Gas industry guidelines.

These operating instructions provide installation, operation and maintenance procedures for the FPD201 single-chamber orifice fitting.

For more information

Further publications for the FPD201 single-chamber orifice fitting are available for free download from www.abb.com/measurement or by scanning this code:



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1 Health & Safety

1.1 Document symbols

Symbols that appear in this document are explained below:



DANGER – Serious damage to health / risk to life

This symbol in conjunction with the signal word 'DANGER' indicates an imminent danger. Failure to observe this safety information will result in death or severe injury.



WARNING – Bodily injury

This symbol in conjunction with the signal word 'WARNING' indicates a potentially dangerous situation. Failure to observe this safety information may result in death or severe injury.



CAUTION – Minor injuries

This symbol in conjunction with the signal word 'CAUTION' indicates a potentially dangerous situation. Failure to observe this safety information may result in minor or moderate injury. The symbol may also be used for property damage warnings.



NOTICE – Property damage

This symbol indicates a potentially damaging situation. Failure to observe this safety information may result in damage to or destruction of the product and / or other system components.



IMPORTANT (NOTE)

This symbol indicates operator tips, particularly useful information or important information about the product or its further uses. The signal word 'IMPORTANT (NOTE)' does not indicate a dangerous or harmful situation.

1.2 Safety precautions

Be sure to read, understand and follow the instructions contained within this manual before and during use of the equipment. Failure to do so could result in bodily harm or damage to the equipment.



WARNING – Bodily injury

Pressurized equipment

Installation, operation, maintenance and servicing of pressurized equipment must be performed:

- by suitably trained personnel only
- in accordance with the information provided in this manual
- in accordance with relevant local regulations

1.3 Potential safety hazards



WARNING – Bodily injury

To ensure safe use when operating this equipment, the following point must be observed:

- Orifice fittings and their components present both heavy lifting and tip-over hazards. Operators must wear suitable PPE at all times and have strategies in place for safely lifting, moving and storing orifice fittings and their components.

Safety advice concerning the use of the equipment described in this manual or any relevant Material Safety Data Sheets (where applicable) can be obtained from the Company, together with servicing and spares information.

1.4 Product recycling and disposal (Europe only)



IMPORTANT (NOTE) For return for recycling, please contact the equipment manufacturer or supplier for instructions on how to return end-of-life equipment for proper disposal.

1.5 Lifting and handling

This product requires mechanical lifting devices and techniques.



WARNING – Bodily injury

- All safety activities associated with lifting techniques and equipment must be in accordance with local laws and the receiving company's HSE policies and procedures, and must be followed without exception.
- Extreme care must be exercised throughout the operation to prevent both injury to personnel and damage to the meter. Proper rigging and lifting techniques must be followed.
- Do not stand under suspended loads. Improper handling may cause injury and / or damage.
- **SAFETY FIRST.**

This product is delivered to its destination in a wooden crate or strapped to a wooden pallet and is easily moved using a standard forklift. There are scenarios, however, where a meter run or fitting must be moved without the aid of a frame. In both cases, care must be taken to assess the weight of the package and ensure that the machinery and lifting aids are appropriate to the items being handled. Crate, pallet and / or meter run weights are documented on the commercial invoice or packing slip accompanying the shipment.

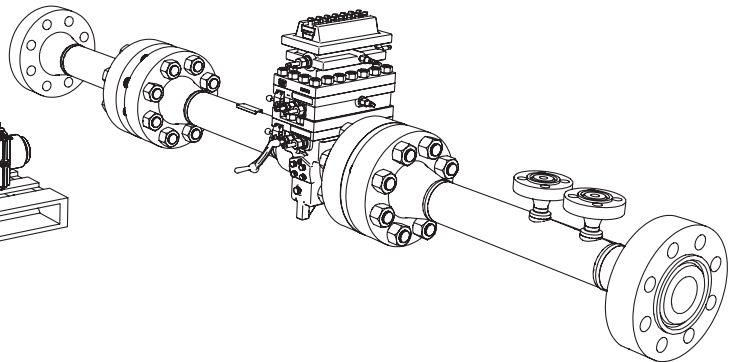
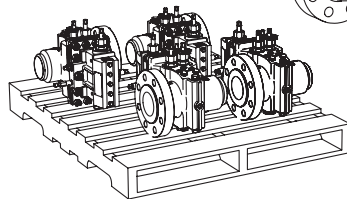
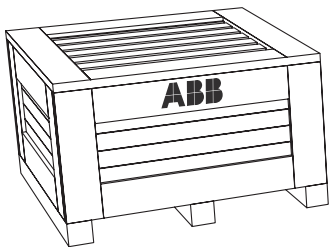


Fig. 1.1 Product packaging

1.5.1 Lifting / moving products in crates and on pallets

Select an appropriate forklift based on the weight of the package being handled. Use fork extensions if necessary.

Center the forks so the load is evenly distributed. Ensure the load is balanced and secure prior to lifting. Use extra strapping to secure unstable loads.

Drive the forks into the load as far as possible. Avoid contact with any parts of the load that may extend past the edge of the pallet. Tilt the load back slightly, then lift.

Keep the load as low as possible while traveling, keep an even pace and avoid fast starts and sudden stops.

1.5.2 Lifting / moving meter runs

Select an appropriate lifting device and lifting straps based on the weight of the meter run being handled.

Determine the meter run's center of gravity and position the lifting straps as shown in Fig. 1.2, ensuring the meter run is balanced when lifted. Ensure the lifting straps are wrapped in opposing directions to prevent the meter run from rotating and swinging.

Ensure the load is completely controlled when lifting. Keep the load as low as possible while traveling, keeping an even pace, avoiding fast starts and sudden stops.

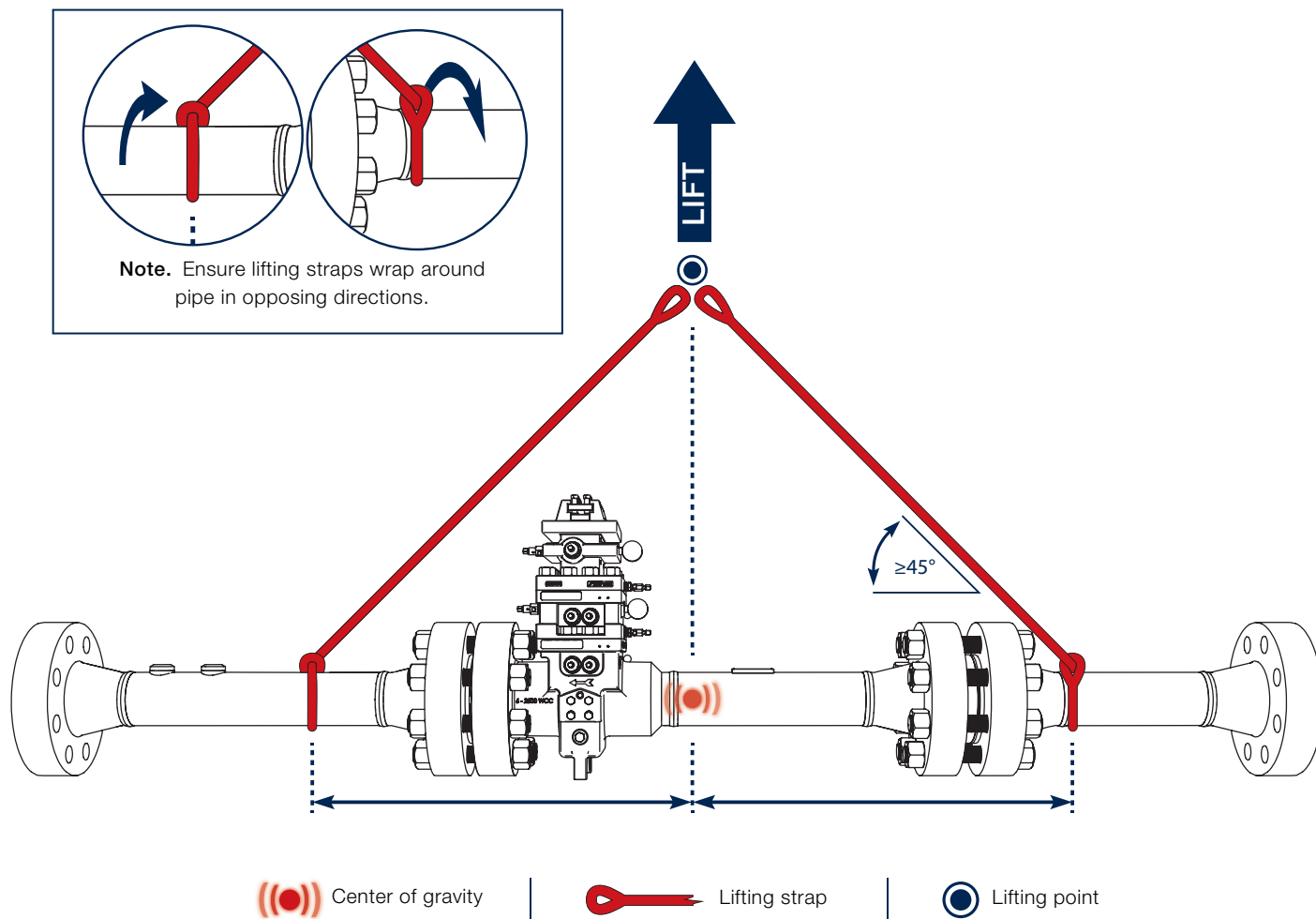


Fig. 1.2 Lifting meter runs

i IMPORTANT (NOTE)

Fig. 1.2 does not reflect all configurations. Centers of gravity may not be exactly as shown.

1.5.3 Lifting / moving orifice fittings

Select an appropriate lifting device and lifting straps based on the weight of the fitting being handled. Position the forks as narrowly as possible to create a single lifting point.

Wrap the lifting strap around the fitting, under the shoulder of the upper chamber as shown in Fig. 1.3.

! NOTICE – Property damage Do not position the lifting strap under the plate carrier operator gears – lifting from this position may result in significant damage and inoperability.

Ensure the load is completely controlled when lifting. Keep the load as low as possible while traveling, keeping an even pace, avoiding fast starts and sudden stops.

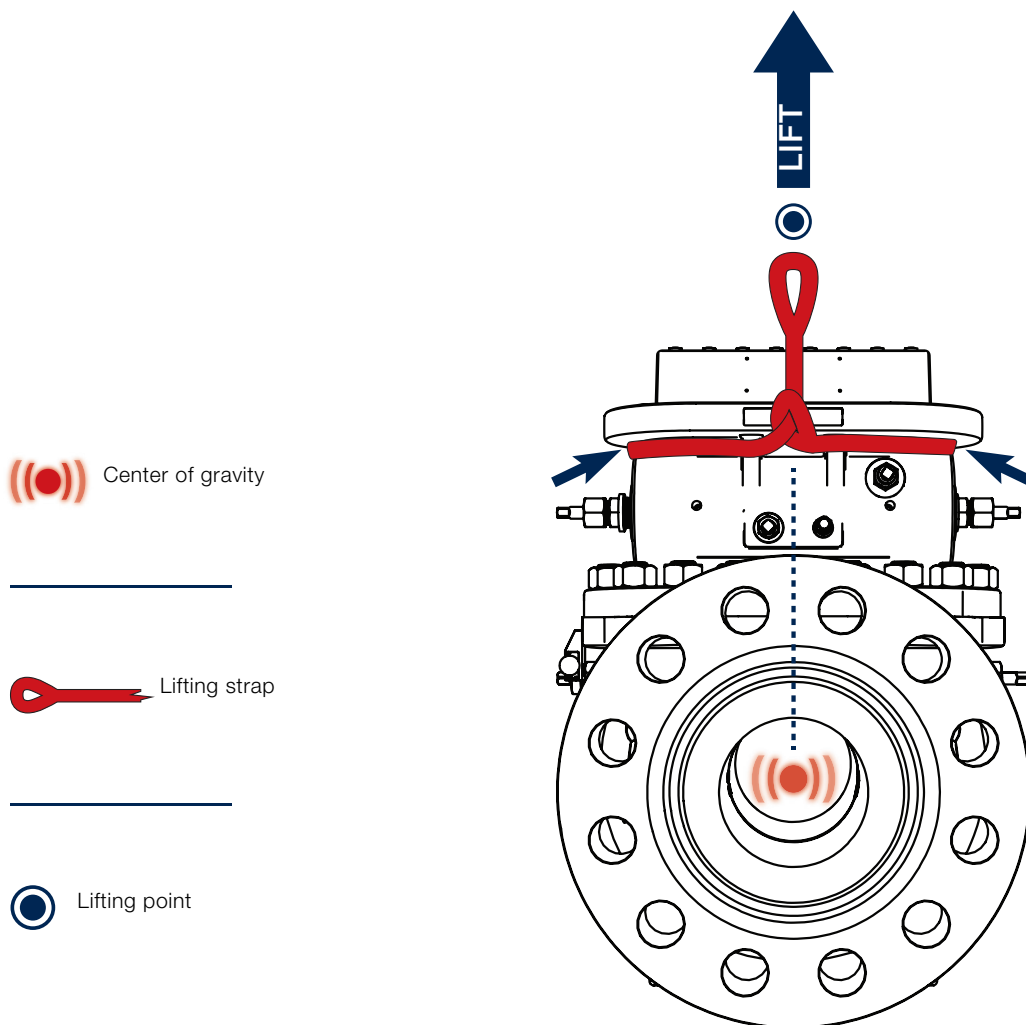


Fig. 1.3 Lifting orifice fittings

i IMPORTANT (NOTE)
Fig. 1.3 does not reflect all configurations. Centers of gravity may not be exactly as shown.

2 Installation recommendations

The single chamber orifice fitting is typically installed in conjunction with upstream and downstream meter run sections (tubes). This is essential to meet the recommendations of both AGA Report 3 and ISO 5167. To obtain the best measurement results, follow the recommended piping configurations and installation requirements of either of these two standards, together with the following recommendations:

1. Ensure that operators are competent and properly trained to operate this and all other pressurized equipment.
2. Ensure that the system is designed to send clean fluids, free of solids, to the orifice plate. In some cases, a filter installed upstream of the flow meter and in accordance with the flow profile specifications of the AGA or ISO standard may be required.
3. Ensure that the system is designed to provide the following, wherever required:
 - protection against excessive pressure
 - fire suppression
 - protection from degrading or otherwise unstable fluids
 - access limitation while under pressure or vacuum
4. When installing the fitting or meter run, ensure that the flow arrow on the outer surface of the fitting corresponds to the direction of flow in the line.
5. Attention to clearances is essential. Refer to the dimensional drawings and tables for details. Ensure sufficient operating clearance above the top of the fitting for removal of the plate carrier. For 8 to 16 in. models, additional clearance at the sides of the fitting is necessary for pinion gear rotation and operating wrench removal.
6. When used to measure wet gas, mount the fitting vertically to prevent dam formation against the orifice plate.
7. Wherever possible, install instrument sensing lines sloping upwards to the measurement instrument. If this cannot be accomplished, use seal pots to chemically seal the sensing lines to eliminate hydrostatic head errors.
8. To prevent damage to the orifice plate, ensure that the orifice plate and plate carrier are removed from the fitting prior to pressure testing the system.
9. Before inserting the orifice plate and plate carrier into the fitting, ensure that the lower cavity of the fitting is free of debris. If debris has accumulated, remove the lower drain plugs and rod-clean the lower section.

3 Operation

The FPD201 single-chamber orifice fitting enables accurate placement of an orifice plate in a pipeline, together with easy removal and replacement. The flow of a gas or liquid through the orifice plate creates the differential pressure that is measured and used to calculate the flow rate through the pipeline.

Referring to Fig. 3.3, the orifice fitting is in normal metering mode when:

- the plate carrier and orifice plate are concentric to the pipeline
- the clamping bar is tight

Pressure sensors connected to the meter taps read the differential pressure across the orifice plate and transmit the readings to a flow computer or chart recorder.

Orifice plate condition is critical to accurate metering. The orifice plate must be removed and inspected for damage, general wear and particulate build-up regularly. Prior to beginning the orifice plate removal procedure, the operator must confirm that the pipeline and orifice fitting are completely depressurized.

3.1 Key operating parts

2 to 6 in. models of the FPD201 single-chamber orifice fitting have no moving parts. 8 to 30 in. models have an orifice plate carrier that is raised and lowered using the included wrench. The simplicity of all sizes reduce the chances of operator error.

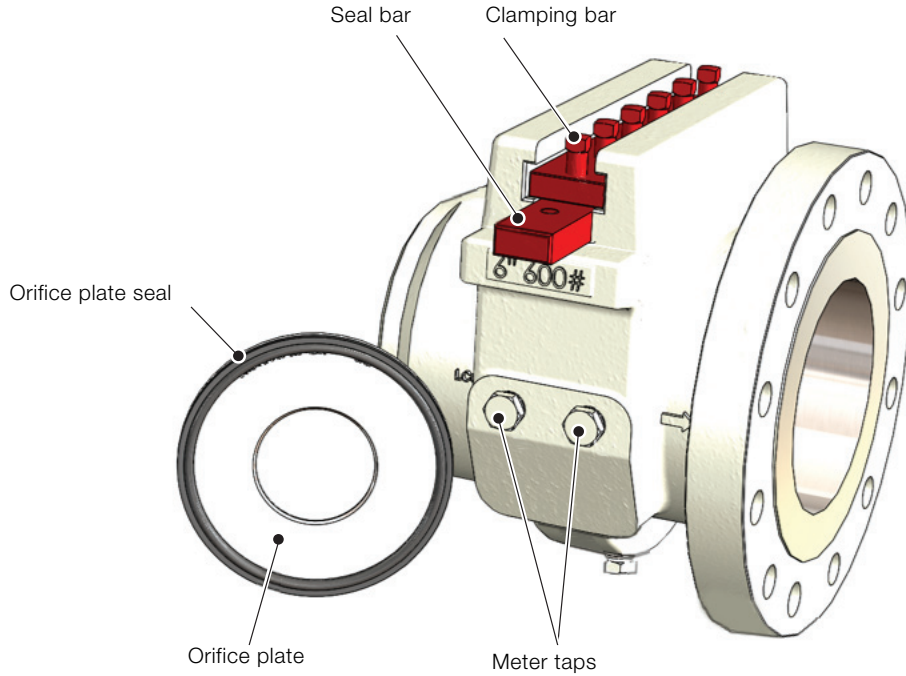


Fig. 3.1 Key operating parts – 2 to 6 in. models

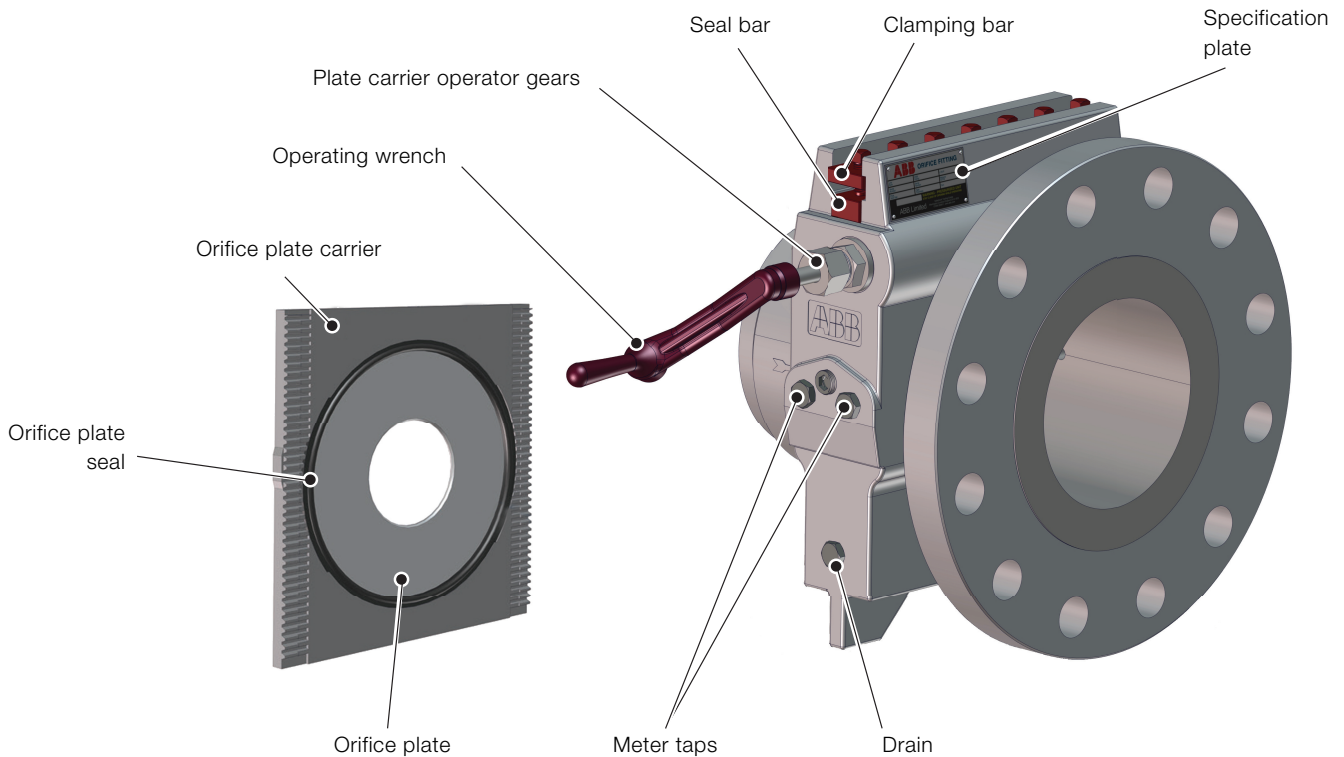


Fig. 3.2 Key operating parts – 8 to 16 in. models

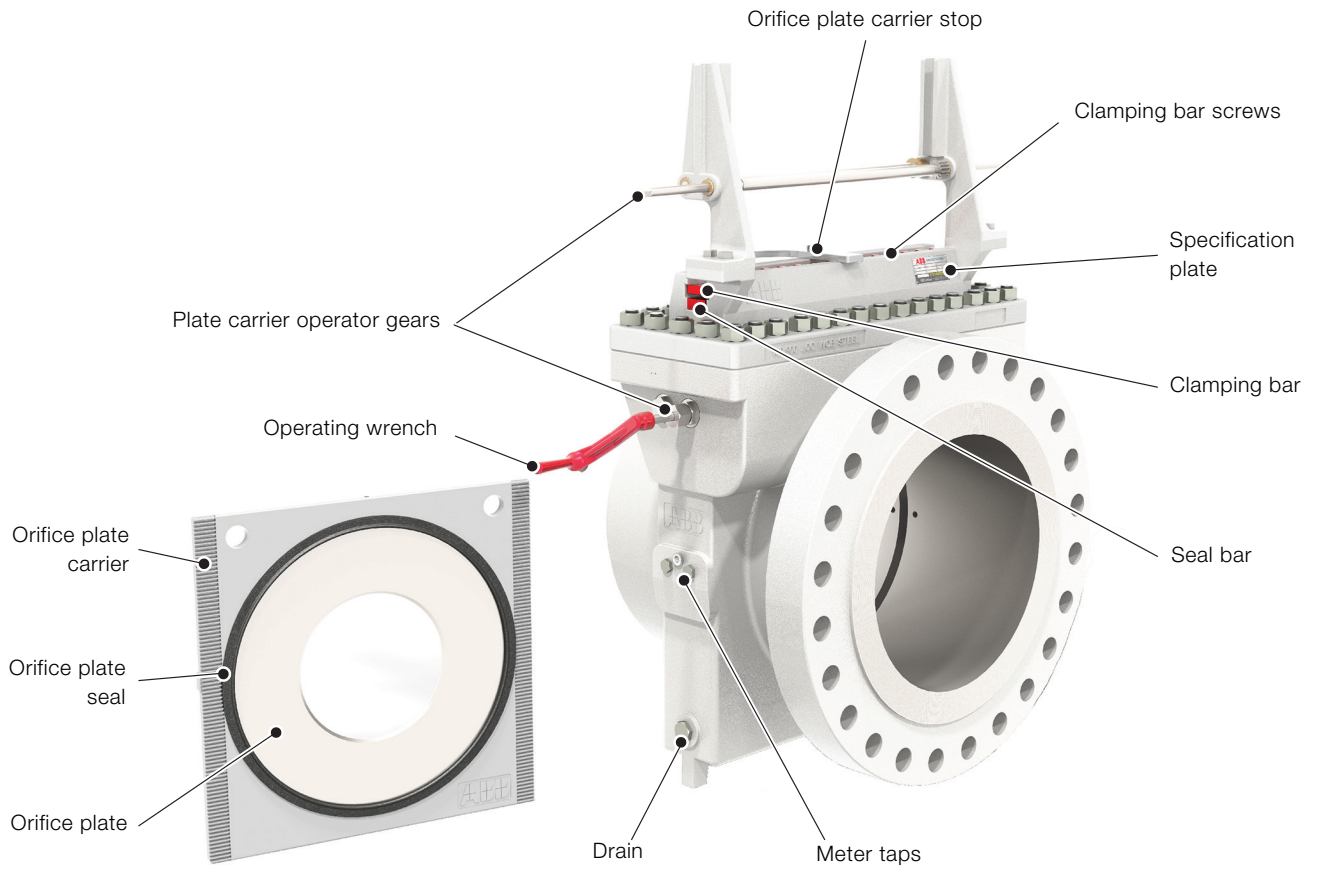



Fig. 3.3 Key operating parts – 16 to 30 in. models

4 Orifice plate – removal

4.1 2 to 6 in. models

 **WARNING – Bodily injury** Ensure the orifice fitting and pipeline are completely depressurized before proceeding.

Referring to Fig. 4.1:

1. Loosen the clamping bar screws and remove the clamping bar.
2. Remove the seal bar complete with orifice plate.
3. Remove the orifice plate and seal assembly from the plate carrier and extract the orifice plate from the seal.

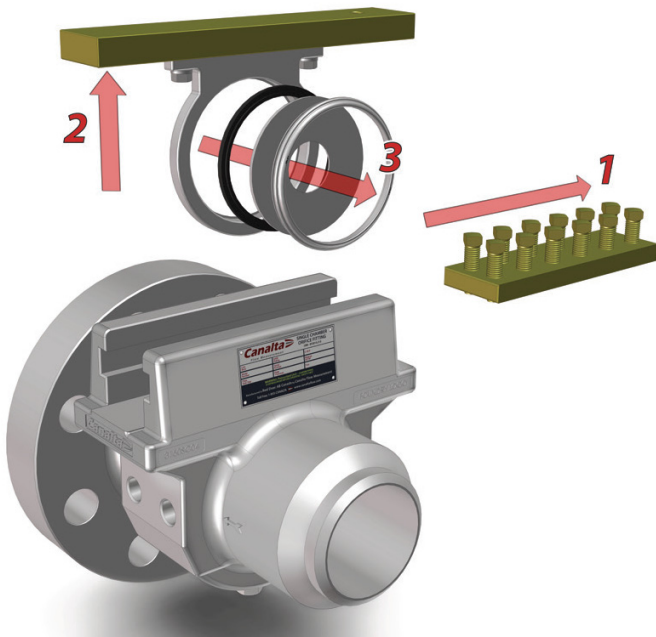



Fig. 4.1 Orifice plate removal – 2 to 6 in. models

4.2 8 to 16 in. models

 **WARNING – Bodily injury** Ensure the orifice fitting and pipeline are completely depressurized before proceeding.

Referring to Fig. 4.2:

1. Loosen the clamping bar screws and remove the clamping and seal bars.
2. Raise the orifice plate carrier assembly using the operating wrench and remove the orifice plate carrier assembly from the fitting.
3. Remove the orifice plate and seal assembly from the plate carrier and extract the orifice plate from the seal.

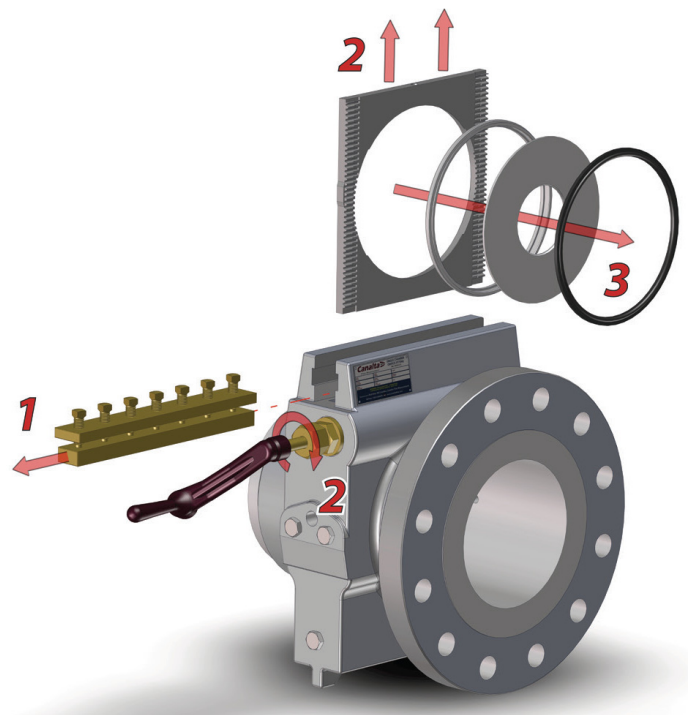


Fig. 4.2 Orifice plate removal – 8 to 16 in. models



WARNING – Bodily injury Ensure the orifice fitting and pipeline are completely depressurized before proceeding.

Referring to Fig. 4.3:

1. Loosen the clamping bar screws and remove the clamping and seal bars.
2. Raise the orifice plate carrier assembly by rotating the lower operating gear until the plate carrier engages the upper operating gear. Rotate the upper operating gear to fully raise the orifice plate carrier assembly and remove it from the fitting.
3. Remove the orifice plate and seal assembly from the plate carrier and extract the orifice plate from the seal.

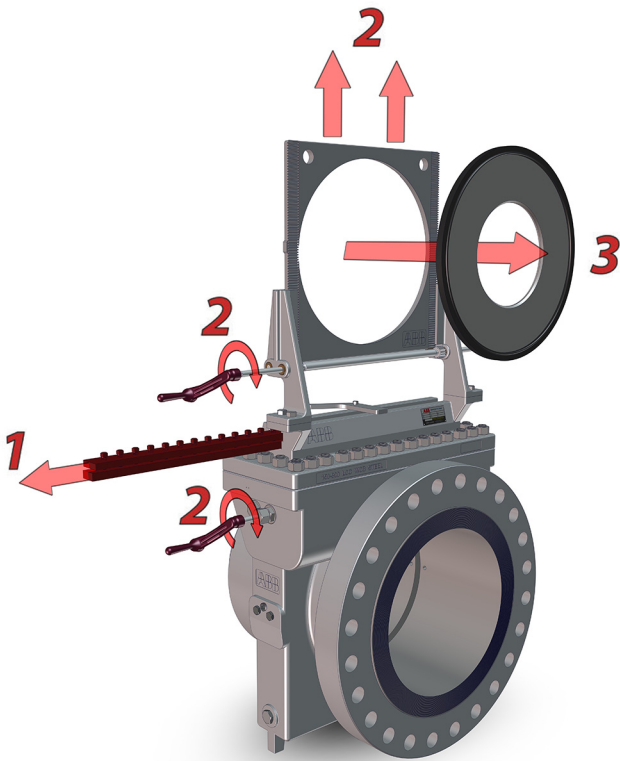


Fig. 4.3 Orifice plate removal – 16 to 30 in. models

5 Orifice plate – inspection

Regular orifice plate inspections are crucial to measurement accuracy. ABB recommends that the orifice plate is removed from the orifice fitting and inspected monthly. AGA-3 / API 14.3 sections 2.4.1 and 2.4.2 outline orifice plate parameters that can be affected by service conditions. Damage, excessive wear and build-up can lead to a reduction in flow meter accuracy.

Pay particular attention to dirt, grease or ice accumulation, pitting due to corrosion, nicks, dings and other impact damage, as well as general wear and erosion of the normally sharp bore edges. Replace the orifice plate as necessary.

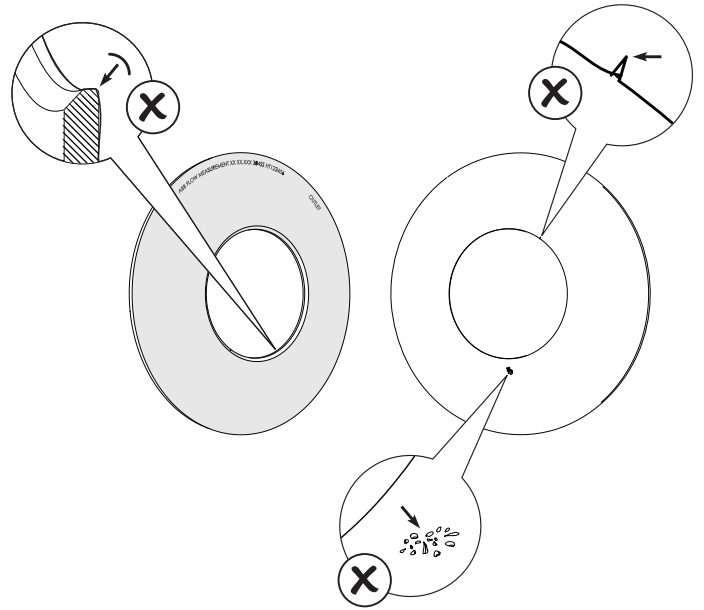


Fig. 5.1 Examples of unacceptable damage to the orifice plate

Orifice plate seals must also be inspected to reduce the possibility of bypass. Pay attention to dirt or grease accumulation, cracks, tears or cuts and swelling. Replace seals as necessary.

6 Orifice fitting – quick inspection and assessment

When the clamping and seal bars have been removed from the orifice fitting, visually inspect the interior of the fitting.

Pay attention to the condition of the interior surfaces of the orifice fitting, the pinion gear (8 to 16 in. models only), seal bar face and O-ring. Excessive corrosion, fluid build-up or other visible damage may indicate the need for more extensive maintenance and replacement of parts. Similarly, on 8 to 16 in. models only, excessive resistance when turning gear shafts during operation may indicate the need for the replacement of parts.

7 Orifice plate – refitting

7.1 2 to 6 in. models

! NOTICE – Property damage When refitting the orifice plate, proper positioning of the orifice plate and plate carrier is crucial to both correct operation and metering accuracy.

Referring to Fig. 7.1:

1. Install the orifice plate into the seal and fit the seal and orifice plate assembly to the plate carrier, ensuring that the orifice plate bevel faces downstream.
2. Ensure that the seal bar O-ring or gasket is clean and in position then insert the seal bar and plate carrier assembly into the fitting, ensuring that the index hole is placed over the seal bar alignment pin.
3. Slide the clamping bar into position and tighten the clamping bar screws.
4. Ensure that the meter tap and drain plugs are correctly tightened.
5. Repressurize and return the line to service.

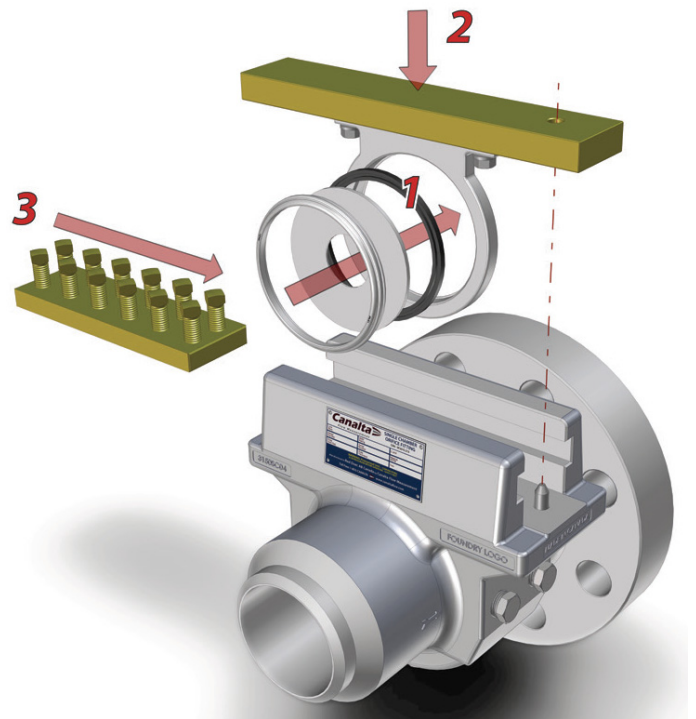


Fig. 7.1 Orifice plate refitting – 2 to 6 in. models

7.2 8 to 16 in. models

! NOTICE – Property damage When refitting the orifice plate, proper positioning of the orifice plate and plate carrier is crucial to both correct operation and metering accuracy.

Referring to Fig. 7.2:

1. Install the orifice plate into the seal and fit the seal and orifice plate assembly to the plate carrier, ensuring that the orifice plate bevel faces downstream.
2. Insert the plate carrier assembly into the fitting and lower it using the operating wrench.
3. Slide the seal and clamping bars into position and tighten the clamping bar screws.
4. Ensure that the meter tap and drain plugs are correctly tightened.
5. Repressurize and return the line to service.

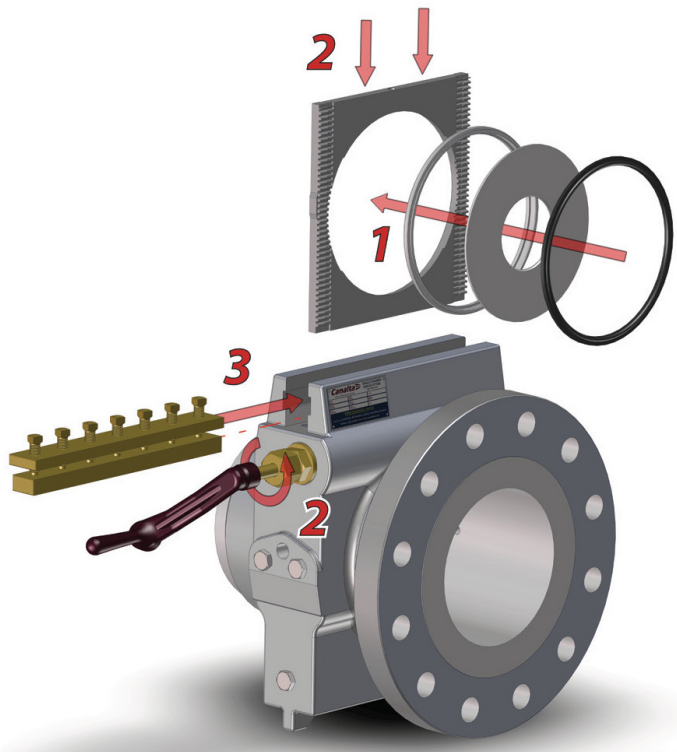


Fig. 7.2 Orifice plate refitting – 8 to 16 in. models

7.3 16 to 30 in. models

! NOTICE – Property damage When refitting the orifice plate, proper positioning of the orifice plate and plate carrier is crucial to both correct operation and metering accuracy.

Referring to Fig. 7.3:

1. Install the orifice plate into the seal and fit the seal and orifice plate assembly to the plate carrier, ensuring that the orifice plate bevel faces downstream.
2. Engage the plate carrier assembly with the upper plate carrier operator gear and rotate the upper, then lower, operator gears to lower the plate carrier assembly into the fitting.
3. Slide the seal and clamping bars into position and tighten the clamping bar screws.
4. Ensure that the meter tap and drain plugs are correctly tightened.
5. Repressurize and return the line to service.

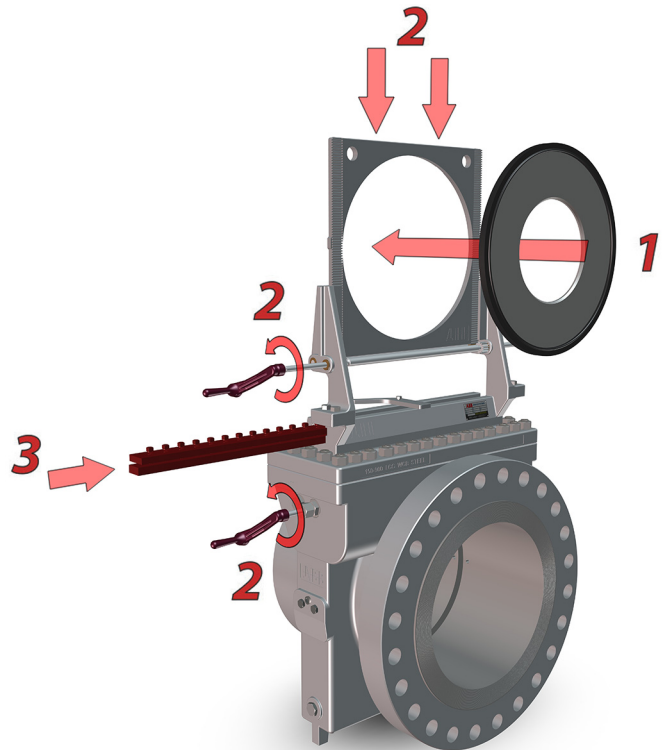


Fig. 7.3 Orifice plate refitting – 16 to 30 in. models

8 Preservation and storage

Take the following measures to preserve and store orifice fittings that are not currently in service:

Store in dry conditions, preferably indoors to prevent rust and corrosion.

Fit the end caps supplied with the fitting.

Apply rust inhibitor inside the bore every 3 to 6 months.

Hydrostatic testing is required before entering service if stored for more than 1 year. Replace / re-lubricate seals as required.

9 Specification

Body configuration

Flange x flange

Flange x weld

Weld x weld

Flanges to FF, RF and RTJ are available in the following formats:

ANSI 16.5 or 16.47

Techlok and SPO

Grayloc®

API 6A

or to specific client specification

Design codes

NACE MR-01-75

ASME B31.1 Power Piping

ASME B31.3 Liquid Petroleum Transportation Piping Systems

PED 97/23/EC Pressure Equipment Directive

Measurement standards

ISO 5167

API MPMS 14.3.2 (AGA Report No. 3)

Standard materials of construction

Body casting

ASTM A216 WCB, WCC

ASTM A352 LCC

ASTM A351 CF8M

ASTM A995 Gr.4A, Gr.6A

Other materials are available on request

Internal components

Stainless steel 316 / 316L

Stainless steel A351 CF8M

Carbon steel AISI430

Pressure tappings

1 or 2 sets per side; 1/2 in. NPT female

Flanged end pressure tappings available to suit ANSI rating of meter

External bolting

ASTM A194 Gr.4 (Zinc coated)

ASTM A320 L7 (Zinc coated)

Other materials are available on request, including optional coatings such as PTFE, Xylan and Xylar

Seals

Seal bar

HNBR O-ring (standard); gasket (optional)

Shafts (8 in. [DN200] and larger only)

PTFE packing (standard); HNBR O-ring (optional)

Orifice plate

Type 'K' 2000 edition formed HNBR seal on a 316 SS retainer ring

Dual ring HNBR O-rings standard on a 316 SS retainer ring

PTFE snap seal two-piece virgin PTFE assembly

Orifice plates

Industry-standard orifice plate thicknesses as per the guidelines set out within ISO 5167 and API 14.3.

Maximizing performance

To ensure absolute metering accuracy, it is recommended that industry practice is followed and meter tubes are purchased and manufactured to complement the orifice fitting. This ensures concentricity between the pipe and the fitting and eliminates uncertainties associated with misalignment.

ABB can supply the following items for a complete metering solution:

orifice fitting with meter tube including straightening vane / profiler

DP transmitters and process transmitters

flow computer and enclosure

spare parts for service and commissioning

product service training

Temperature rating

-29 to 38 °C (-20 to 100 °F) standard

-40 to 649 °C (-40 to 1200 °F) option

Pressure rating

Size in. (mm)	ANSI pressure class (fully-rated)
2 (50) to 24 (600)	150, 300, 600, 900, 1500

Note. 600, 900 and 1500 flanges are available as RF or RTJ. 150 and 300 flanges are available as RF only.

DS/FPD201-EN Rev. A

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