



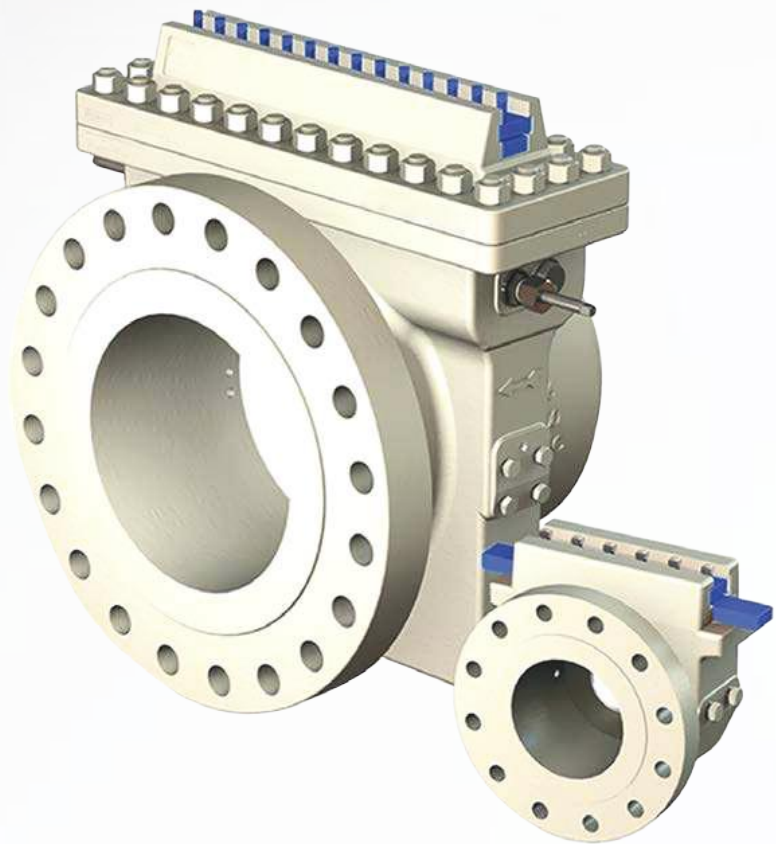
Technology Solutions

TEK-DP1610A

Single Chamber Orifice Fitting



FLOW



Minimum complexity with maximum efficiency
Measurement made easy

Features

Easy plate removal and replacement

- No need to shut down pipeline

High-pressure solution for up to ANSI 2500 rating

- Rated to 10,000 psi (698 bar)

Maintenance can be performed at any time

- No need to wait for annual shutdown

Economical orifice installation

- Plate serviceable without removing fitting from pipeline

Pressures up to ANSI 2500 rating

- For pipe sizes at least 24" (2ft.)

Comprehensive testing and documentation package

- Supplied as standard

Introduction

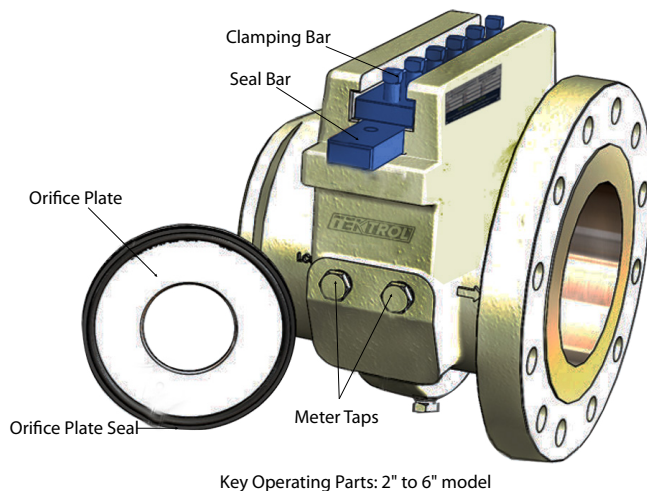
Tek-DP 1610A Single Chamber Orifice Fittings are proven systems for safely and quickly inspecting and changing orifice plates.

Orifice meters used in the Oil & Gas industry are typically of either the single chamber or dual chamber design. Single-chamber orifice fittings have an orifice plate that can be replaced without removing the fitting from the pipeline. However, before the plate can be withdrawn, the flow must be stopped and the pipeline vented.

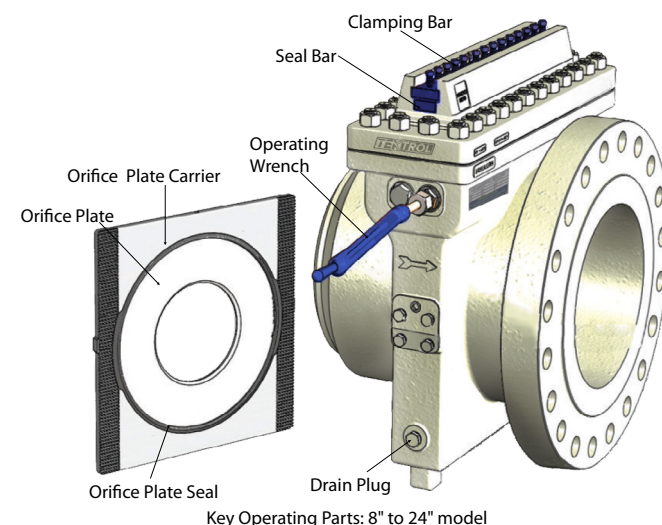
Each product has been fully FEA (Finite Element Analysis) tested at the design stage, ensuring maximum safety to the user and the system.

The Tek-DP 1610A has undergone a series of rigorous test cycles ensuring the repeatability of the seals and equipment. During product assembly, each product is fully pressure-tested to satisfy industry safety and European pressure guidelines. Units are designed.

Manufactured in compliance with ASME 16.34 and ASME 16.5, ASTM specifications, AGA-3 Latest Edition and ISO-5167.



Key Operating Parts: 2" to 6" model



Key Operating Parts: 8" to 24" model

Measuring Principle

The Tek-DP 1610A Smart Orifice Meters work on the principle of differential pressure measurement. Based on Bernoulli's theory of conservation of mass and energy in a closed pipe, the obstruction to the flow of fluid leads to an increase in the flow velocity (i.e. $V_2 > V_1$), thereby creating a pressure drop. The fluid flow rate depends on the static pressures at upstream and downstream, minimum cross sectional area and temperature. It is calculated by applying the law of conservation of mass and energy.

The relation between the differential pressure and flow rate is represented as the below expression-

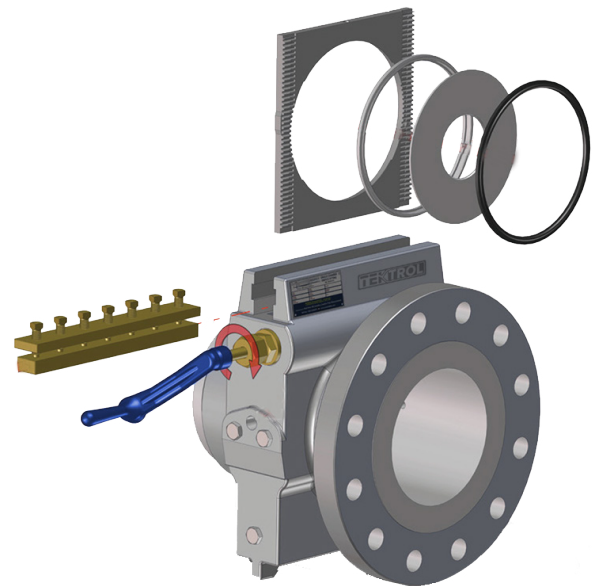
$$\Delta p \propto Q^2$$

The differential pressure generated, Δp , is proportional to the square of mass flow rate, Q . In simple terms, for a given size of restriction, higher the differential pressure, Δp , higher is the flow rate, Q .

1610A Single Chamber Orifice Fitting

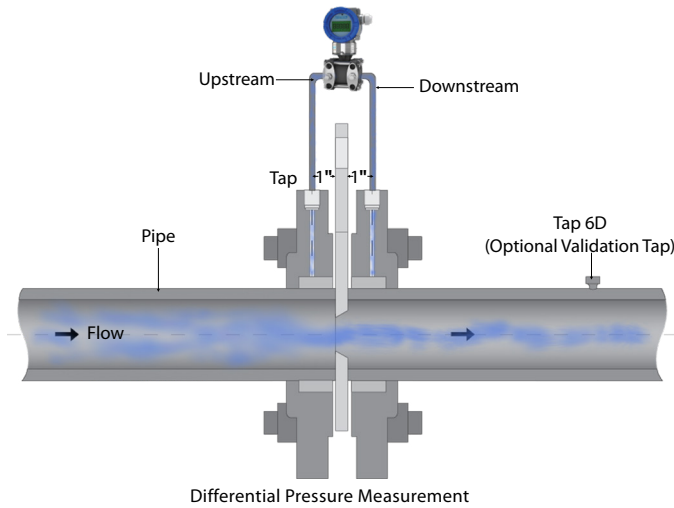
The Tek-DP 1610A Single Chamber Orifice Fittings are the single chamber devices designed for precise flow measurement in oil and gas applications with a simple plate removal technique. These fittings are suitable in liquid flow measurement as well. Tek-Trol ensures that each single chamber fitting undergoes rigorous testing under pressure conditions to provide maximum safety to the user and the system.

The single chamber fittings are manufactured in accordance with latest ANSI, AGA3/API, and ASTM standards for pressure tap integrity, positive plate seal, seal protrusion, and eccentricity. These single chamber orifice fittings can be installed in vertical or horizontal lines and are available in a wide range of pipe sizes from 2" to 48". These fittings allow ease of orifice plate replacement or inspection in a depressurized flow line without physically removing the meter from the line. The Tek-DP 1610A Single Chamber Orifice Fittings are best used in the applications where replacing the orifice plate under pressure conditions is risky and a nominal shutdown time is acceptable. The plate removal procedure does not require removal of the flange bolts or spreading of flanges. This prevents potential leakage of process fluid and safeguards the operators.



Single Chamber Orifice

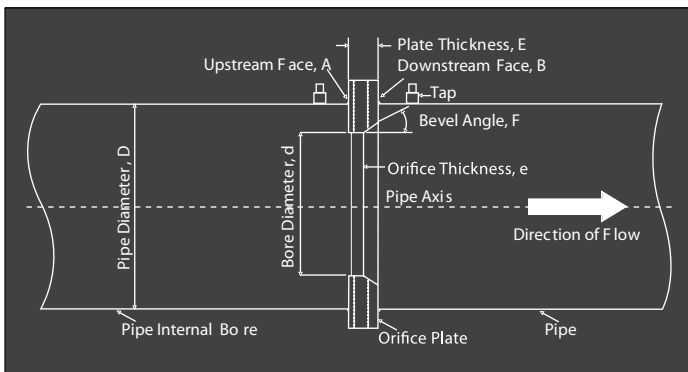
Tek-Trol's Single Chamber Orifice Fittings are proven systems of safety and quickly inspecting and changing orifice plates.



Differential Pressure Measurement

Operation

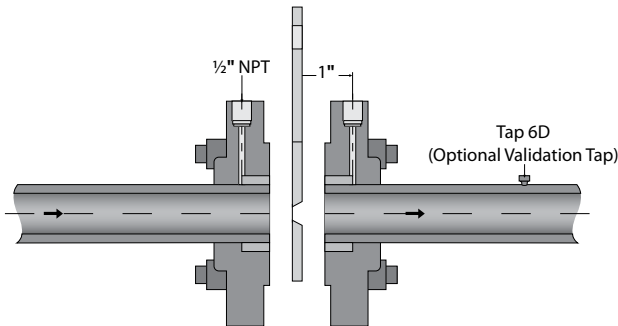
The complete orifice meter assembly is comprised of an orifice plate that is positioned between the two flanges with the help of an orifice plate carrier and other essential components such as the flow conditioner, pressure taps, and the transmitter. The orifice plate acts as a restriction to the flow of the fluid.



Operation of an Orifice Flow Meter

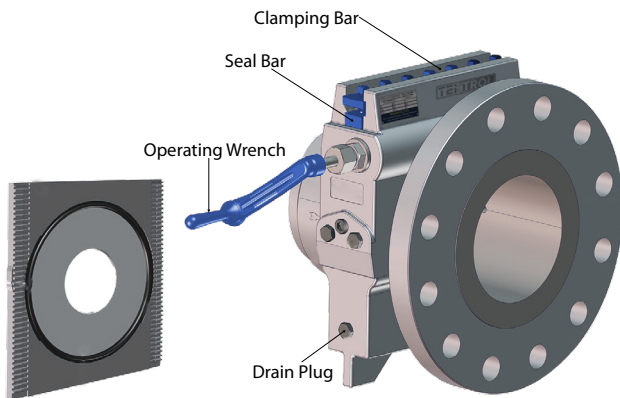
The fluid in motion passes through an abrupt obstruction created by the orifice plate. This results in a sudden pressure drop, which varies with the flow rate. As the fluid converges to pass through the bore, its velocity increases. The flow continues to converge at the downstream of the plate until it reaches the vena contracta point (the point of maximum convergence) and then expands to rejoin the pipe wall. The pressure taps measure static pressures of the upstream and downstream flow. The differential pressure is proportionate to the flow rate and can be determined by the equations defined in defined in AGA 3 and ISO 5167 standards.

The location, size and construction of the orifice meter pipe taps can affect the meter's accuracy. Tek-Trol Orifice Fittings are supplied with two ½" NPT taps per side as standard, two additional ½" NPT taps can be provided as optional to connect additional field devices.



Taps sizes for 2" and 3" fitting are 0.375" inside diameter and for 4" and larger sizes these taps are center bored to .500" inside diameter. Fittings are manufactured with Tap located 1" from the face of the orifice plate with accuracy/tolerance in line with AGA 3 requirements.

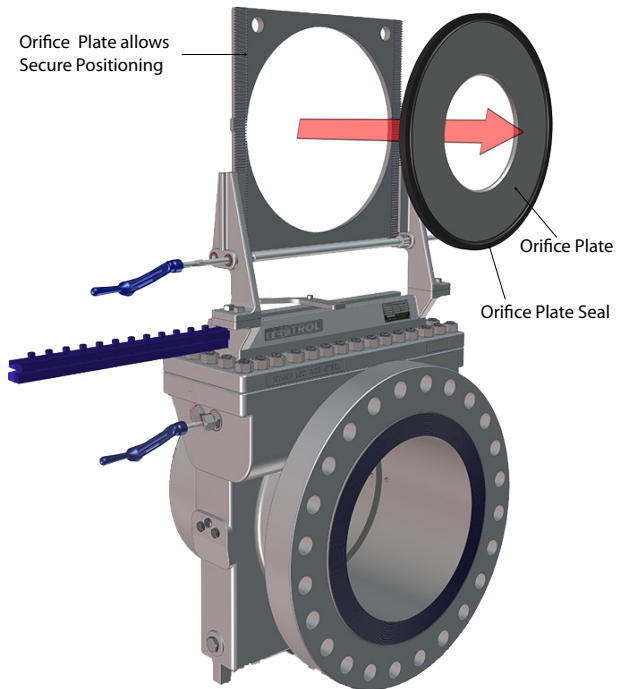
For the smaller models of size 2" to 6", by removing bolts and a clamping bar, the operator can "manually extract" the orifice plate from the fitting, inspect and replace in a short time. However, 8" and larger models incorporate a rack and pinion gear system to handle the sizable weight of large orifice plates and carriers.



Key Operating Parts: 8" to 24" model

The "unique design" of the Tek-DP 1610A Single Chamber Orifice transfer metering allows for accurate and secured positioning of the plate every time it is replaced after inspection ensuring unchanged meter performance.

The standard O-ring seals used in these fittings provide superior sealing capability by eliminating the requirement of gasket maintenance and possibility of screw breakage. However, gaskets are available to use when required.



Unique Design for Secure positioning for Orifice Plate

Features

- Highly reliable and field-repairable
- Plate carrier assembly for easy plate replacement
- Ensures plate remove without spreading the flanges
- Short operational downtime
- Eliminates liquid or gas leakage possibility
- Offers versatility of line sizes

AGA 3/ ISO Compliant Test Report

ORIFICE FITTING REPORT

Customer: _____ Project: _____
 Order Number: _____ Study Heat No: _____
 Equipment Name: _____ Line Size: _____
 Overall Length: _____ ANSI Class: _____
 Serial Number: _____ Material: _____

INSPECTED TO: _____
 AGA 3, 4th Ed. (1998) / ISO 91
 AGA 1.347 (N1) Ed. 02 / (00-86)

PLANE	UPSTREAM POINTS			DOWNSTREAM POINTS		
	A	B	C	D	E	F
1						
2						
3						
4						
AVERAGE						
TEMP.						
ROUGHNESS						

Date: _____
 Inspector: _____
 QA Manager: _____

756 Tek Drive, Crystal Lake, IL 60014
 Phone: +1 847-857-4076 +1 847-455-7428 Fax: +1 847-855-6147

Technical Specifications

Body Materials

A216 WCB, A216 WCC, A352 LCC, A358 CF8M, A995 Gr4A, A995 Gr6A, Custom materials available

Internal Parts

AISI 4130 Carbon Steel, 316 or A351 Stainless Steel

Orientation

Vertical or horizontal

Tap Connections

Two ½" NPT per side standard, 4 pairs available as options

Fitting Sizes and ANSI Class

2" to 48", 150 to 2500 ANSI, Larger sizes available on request

Operating Temperature

Standard -20 °F to 100 °F (-28 °C to 37 °C), optional -40 °F to 1200 °F (-40 °C to 648 °C)

Process Media

Liquids and Gases

Line Bore I.D. Tolerance

In conformance with AGA 3 and ISO-5167 Latest Edition

Eccentricity Repeatability

In conformance with AGA 3 and ISO-5167 Latest Edition

Applications

- Oil and gas custody transfers
- Water, wastewater treatment plants
- Shale liquid production
- Chemically active and corrosive liquid transfers

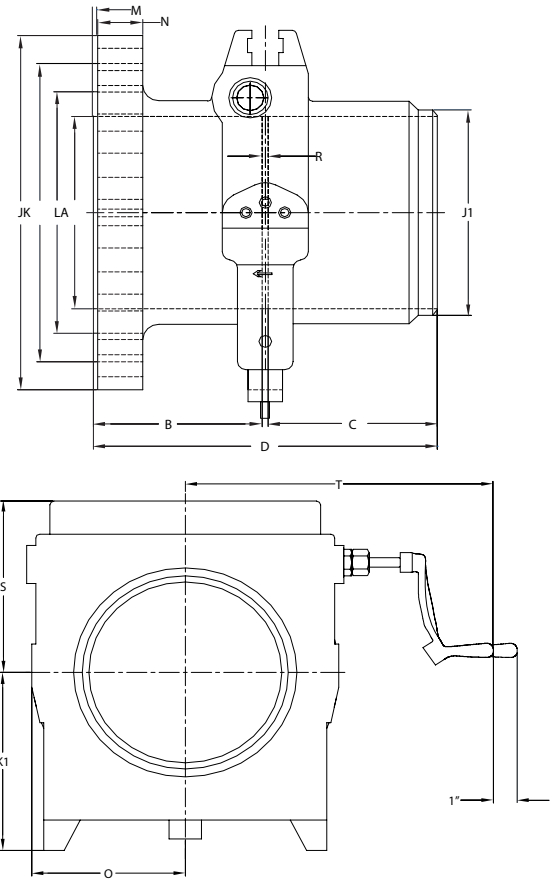
Tek-Trol can supply the following items for a complete metering solution:

- Orifice fitting with meter tube including straightening vane/profiler
- DP transmitters and process transmitters
- Flow computers and enclosure
- Spare parts for service and commissioning
- Product service training

Dimensional Drawing

Single Chamber Fitting

Flange neck Design (Weld neck Upstream, Flange Downstream)



***Note:** Dimensions are subject to vary at time of manufacturing based on final Beta selected. Dimensional drawing with a final engineering sizing sheet will be provided within 1-2 weeks of order acceptance.

Installation Guidelines

- Install the orifice meter between the upstream and downstream meter run sections. Place the fitting in line with the two flange taps, positioning the instruction plate facing upward.
- It is possible to install the fitting in either horizontal or vertical position. Ensure that the flow arrow on the outer surface of the fitting corresponds to the direction of flow in the pipeline.
- Use of vertical mount is recommended for wet gas measurement to prevent moisture formation against the orifice plate.
- Ensure that the lower cavity of the fitting is free of dust and debris, before inserting the orifice plate into the fitting.

Orifice Plates and Seals

Tek-Trol's Orifice Plates and Seals play a key role in maintaining the performance and durability of orifice flow meters. Tek-Trol's all orifice plates comply with AGA-3/API 14.3 or ISO 5167-1 standards to ensure maximum accuracy. The orifice plates are responsible to create a restriction in the fluid flow path for generating a differential pressure, which is measured across the plate through two taps located on the Single Chamber Orifice Fitting near the constriction. Types of orifice plates include concentric, eccentric, and segmental orifice plates. Tek-Trol's orifice plates and seals are compatible with all orifice fitting variants Single Chamber, Dual Chamber and Orifice Flange Unions. The seals, crucial to maintain the leak-proof connections, are available in all plate sizes and types (soft seat valve seals, O-ring seals). All universal orifice plates are manufactured within the strict tolerances as specified in AGA3 latest edition along with AGA3 compliant Orifice Inspection Plate reports.



Universal Type Orifice Plate

The Universal Type Series provides orifice plates without a handle, which are manufactured for use in orifice plate holders in case of Single Chamber and Dual Chamber Orifice Fittings. Tek-Trol's fail-safe concentric design of universal type orifice plates eliminates the possibility of improper plate orientation and positioning.

Tek-Trol supplies orifice plates in standard 304SS and 316SS corrosion-resistant material in a range of plate sizes from 1" to 48" to fulfil application needs. The orifice plates are also available in custom materials such as Duplex, Super Duplex, Monel, Inconel, and Hastelloy. The seals, crucial to maintain the leak-proof connections, are available in all plate sizes and types (soft seat valve seals, O-ring seals).

Features

- Robust design, Easy to install & Cost effective
- Proven leak-proof connection when used with seals
- Available in all sizes and materials
- Separable seals for 8" and below sizes
- Special DVS bonded seals for 10" and above sizes

Technical Specifications

Size

1" to 48", Larger line size available on customer request

Material

SS304L, SS316L, Duplex, Super Duplex, Monel, Inconel, and Hastelloy (Other material available on application)

Bore

Concentric, Eccentric, Quadrant

Surface Finish

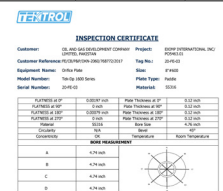
Better than 25 micro inches as per AGA3

Universal Orifice Plates

Line Size (In)	Plate O.D.	Plate Thickness (In)
¾	1.125	⅛
1	1.312	⅛
1½	2	⅛
2	2.437	⅛
2½	2.812	⅛
3	3.437	⅛
4	4.406	⅛
6	6.437	⅛
8	8.437	¼
10	10.687	¼
12	12.593	¼
14	14	¼
16	16	⅜
18	18	⅜
20	20	⅜
24	24	½
26	26	½
30	30	½

Bonded Plates

Line Size (In)	Plate O.D.	Plate Thickness (In)
12	12.079	¼
14	14.563	¼
16	16.563	⅜
18	18.563	⅜
20	20.563	⅜
24	24.500	½
26	26.750	½
30	30.750	½
34	35.228	½
26	38	½
42	44	¾

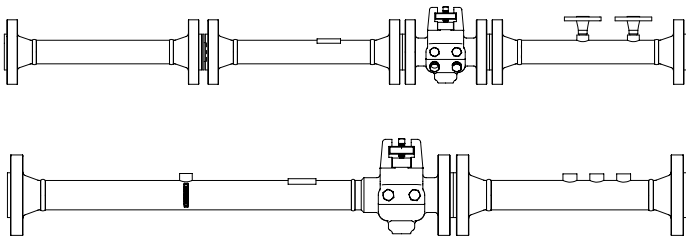


Meter Runs

Tek-Trol's standard and custom fabricated meter runs are compatible with all orifice fitting models to meet specific performance needs of challenging metering applications. These meter runs adhere to the highest quality specifications set by AGA-3/API 14.3 and ISO 5167-1 to ensure adequate length, precise alignment, and smooth finish for enhanced measurement reliability.

Tek-Trol's meter-runs are manufactured to meet the appropriate upstream/downstream straight pipe length, surface requirements, roundness, and flow tolerance. As manufactured in a single unit, these pre-assembled meter runs allow rapid installation and reduce start up costs. These rigorously tested and inspected meter-runs are exceptionally accurate, extremely reliable, and ready for service.

Tek-Trol's two section meter runs are compatible with all styles of orifice fittings and plate holders. These accurate, dependable instruments have a section of meter tube on either sides of the orifice fitting. Each tube adheres to an upstream and downstream of the minimum length prescribed by API 14.3. Longer upstream meter tube provides adequate length for stabilizing the flow before it passes through the orifice plate.



Tek-Trol's three section meter runs incorporate an additional component, a flow conditioner, which helps reducing the overall upstream meter tube length. The flow conditioner plate inserted on the upstream effectively minimizes swirls and turbulence to ensure steady flow profile. These meter runs are utilized in highly turbulent flow and congested places where maintaining the standard upstream length is impossible.

Tek-Trol can provide custom meter run packages that meet specific application needs like pipe size from 1" to 48", pipe materials such as A216 WCB, A216 WCC, A352 LCC, and operating pressure from 150 ANSI to 2500 ANSI.

Material Selection

Tek-trol uses special cold drawn seamless tubing or honed pipe in the fabrication of meter tubes. The strict requirements for internal roundness and surface finish preclude the use of standard commercial pipe in most cases. Tek-trol maintains a large inventory of this special pipe to rapidly complete your order.

Fabrication

Fabrication of your instrument includes attaching the orifice fitting to the meter tube to make an integral primary measuring element. For welding operations, Tek-trol uses automatic welding machines and rotating positioners. Highly skilled, "code qualified" welders are employed to turn out highest quality on each job. Special internal jigs and fixtures are used to insure smooth inlet and outlet surfaces without steps or offsets. All welds receive expert grinding by experienced craftsmen.

Inspection/Testing

Tek-Trol maintains rigid inspection procedures during manufacturing of meter tubes. Micrometer and internal surface roughness readings recorded and supplied with each meter tube. Customer or third party inspectors are welcome to verify these readings. Radiography of welds is another service that is available.

Meter Tube Tolerances

The I.D. for the upstream should be within $\pm 0.25\%$ within the initial diameter from the plate. The rest of the upstream should be within $.5\%$ with the result being a maximum difference of $.5\%$ between any 2 diameters. The tolerances of downstream can be 1% of upstream. I.D. roughness varies with size and beta ratio. Designing of meter tubes should be for the maximum allowable beta ration. All Tek-trol standard meter tubes are manufactured to meet tolerances recommended by API. Chapter 14, Section 3, Part 2 (14.3) April 2000/AGA. #3. The tubing and pipes allocated for meter tubes should have a uniformed internal surface that is smooth and meets the standard diameter/roundness tolerances.

Features

- Ensure optimum compatibility with all products
- Eliminates the measurement inaccuracies recorded in small orifice line installations
- Inserts sufficient pipe length to reduce distortions due to pipe roughness
- Eliminates the possibility of plate misalignment
- Avoids possible leak points

Technical Specifications

Body Materials

A216 WCB, A216 WCC, A352 LCC, A358 CF8M, A995 Gr4A, A995 Gr6A, Custom material available on request

Internal Parts

AISI 4130 Carbon Steel, 316 or A351 Stainless Steel

Pipe Sizes

1" to 48", Custom size available on request

Operating Pressure

150# to 2500# ANSI

Operating Temperature

Standard at -20 °F to 100 °F (-28 °C to 37 °C),
Optional -40 °F to 1200 °F (-40 °C to 648 °C)

Orientation

Vertical or horizontal

Process Products

Liquids and Gases

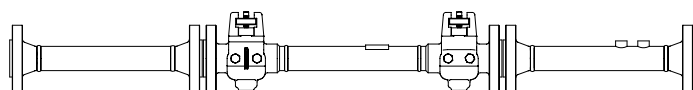
Meter Tube Surface Roughness

For meter runs with nominal diameters of 12" or smaller:

- The maximum meter-tube roundness shall not exceed 300 micro inches Ra if the diameter ratios are equal to or less than 0.6.
- The maximum meter-tube roundness shall not exceed 250" Ra if the diameter ratios are equal to or less than 0.6.
- The maximum roundness shall not be less than 34" for all diameter ratios.

For meter runs with nominal diameters larger 12":

- The maximum meter-tube roundness shall not exceed 600 micro inches Ra if the diameter ratios are equal to or less than 0.6.
- The maximum meter-tube roundness shall not exceed 500 micro inches Ra if the diameter ratios are equal to or less than 0.6.
- The maximum roundness shall not be less than 34" for all diameter ratios.



Features

- Ensure optimum compatibility with all products
- Eliminates the measurement inaccuracies recorded in small orifice line installations
- Inserts sufficient pipe length to reduce distortions due to pipe roughness
- Eliminates the possibility of plate misalignment
- Avoids possible leak points

Technical Specifications

Design Code

ISO-5167, API 14.3 (AGA-3)

Configuration

2 Pc or 3 Pc design

Surface Finish

- For meter runs with nominal diameters of 12" or smaller: 250 micro inches with a minimum roughness of not be less than 34 micro inches
- For meter runs with nominal diameters larger than 12": 500 micro inches or better with minimum roughness not less than 34 micro inches for all Beta ratio.

Line Size

2" to 48" (Larger line size available on application)

Pressure

150# to 2500# (Higher pressure available on application)

Pipe Material

Carbon Steel, Stainless Steel, Duplex, Low Temp Steel and other material available

Studs, Nuts

Carbon steel, Stainless with/without Teflon/ Hot Dip Galvanized options.

AGA 3/ ISO Compliant Test Report

INSPECTION REPORT FOR AGA METER TUBE

Customer: _____ Project: _____
 Order Number: _____ Body Heat No: _____
 Equipment Name: Single Chamber Orifice Fittings Line Size: _____
 Overall Length: _____ ANSI Class: _____
 Serial Number: _____ Multiple: _____

METER TUBE LENGTH | Overall Length: | U/S Length: | O/S Length: | Rate To Orificator / Varies: | Rate to First O/S Outlet: |

ROUNDNESS CHECK

Dim from Fitting Inspector Sheet =	Largest Number of Orifices in Orifice Plate	(DO NOT BE SMALLER THAN 10)
U/S x Dim =	Smallest Number of Orifices in Orifice Plate	(DO NOT BE BIGGER THAN 10)
O/S x Dim =	Largest Upstream Measurement (Including Fitting)	(DO NOT BE BIGGER THAN 10)
Dim - U =	Smallest Upstream Measurement (Including Fitting)	(DO NOT BE LESS THAN 10)
Dim - V =	Largest Downstream Measurement	(DO NOT BE SMALLER THAN 10)
Dim - W =	Smallest Downstream Measurement	(DO NOT BE BIGGER THAN 10)

PLANE	UPSTREAM POINTS					DOWNSTREAM POINTS				
	F1	W1	P1	P2	P3	F4	W4	P4	P5	P6
1										
2										
3										
AVERAGE										
TEMP.										
ROUGHNESS										

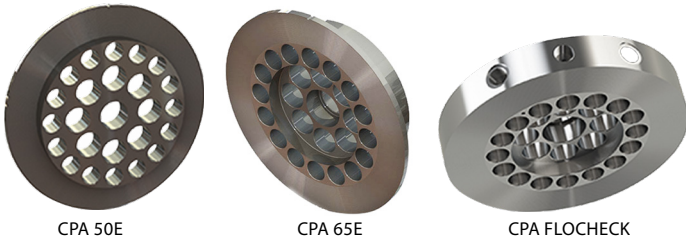
Date: _____
 Inspector: _____
 QA Manager: _____

796 Tek Drive, Crystal Lake, IL 60014
 Phone: +1 847-857-6076 +1 847-655-7428 Fax: +1 847-655-6147

Flow Conditioners

Tek-Trol's Flow Conditioner Range is meticulously manufactured for converting an irregular upstream flow to a predictable downstream flow. These flow conditioners are available from 2" to 48" pipe sizes and in a variety of materials such as duplex, 304SS and 316SS, making these suitable for all applications including extremely corrosive environments. Properly selected and installed flow conditioners eliminate swirls and turbulence; making the flow profile much more reliable. The complete flow conditioner range is suitable and essential for any fluid measurement scenario including water, crude oil, petroleum, air, light hydrocarbons and natural gas for providing stable downstream flow. This design fully develops the flow profile and significantly reduces upstream pipe length requirements.

Tek-Trol offers flange type, inserting type and ring type of flow conditioners in compliance with AGA3/API 14.3 standards to adapt with various configurations.



Features

- Easy to install, field repairable
- Cost effective
- Minimize swirls and turbulence
- Eliminate effects of flow disturbance
- Reduces upstream meter run length
- Suitable in all liquid and gas applications with no upper limit on Reynolds number

Technical Specifications

Line Size

2" to 48", Larger size available on request

Process Media

Natural gas, air, crude oil, water, light hydrocarbons

Performance

In accordance with AGA3/API 14.3, ISO 5167

Maximum Pressure

ANSI 1500

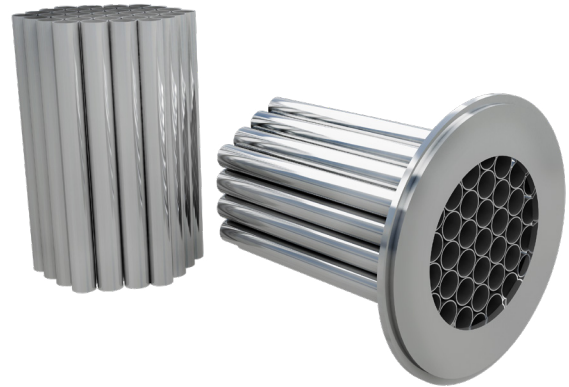
Body Material

Stainless Steel (304, 316 and duplex)

Straightening Vanes

Tek-Trol's straightening vanes are designed to be installed in the upstream orifice meter runs to serve dual purpose: (1) They convert complex, turbulent flow into a smoothed, reliable flow pattern and (2) They reduce upstream pipe length requirements.

Tek-Trol's straightening vanes are available in standard corrosion resistant materials including 304, 316 stainless steel and carbon steel making them suitable for wide types of gas and fluid applications. These straightening vanes are manufactured in both line-mounted and flanged models, in strict compliance with API 14.3 and ISO 5167 standards. The line-mounted model is inserted in upstream pipe and secured with the help of screws. The flanged type model is flanged between upstream line flanges.



Straightening Vanes

Features

- Reduce swirls and turbulence
- Condition upstream flow profile
- Reduce upstream meter run length
- Enhance measurement accuracy

Technical Specifications

Line Size

2" to 48", Larger size available on request

Process Media

Natural gas, air, crude oil, water, light hydrocarbons

Performance

In accordance with AGA3/API 14.3, ISO 5167

Maximum Pressure

ANSI 1500

Body Material

Stainless Steel (304, 316 and duplex), Optional materials available

TekValSys-DP

Tek-Trol's extremely powerful flow validation tool, TekValSys-DP, based on Prognosis, converts a mechanical DP flow measurement device into a smart, comprehensive flow measurement solution. The TekValSys-DP can be utilized in many DP Metering applications including single-phase gases, liquids, steams, heavy oils, and water-in-oil mixtures. The TekValSys-DP can be used with any device creating differential pressure such as orifice, cone, pitot tube, venturi or flow nozzles. The system requires two additional differential pressure measurements in addition to the traditional DP transmitter.

The TekValSys-DP software available in three versions, namely, micro, light and pro, can be easily integrated into an existing DP control system. Once installed, the TekValSys-DP system provides real-time alerts of meter measurement and performance shifts, making easy monitoring and reducing maintenance overhead.



Features

World-class configuration, service, and troubleshooting tool

- Supports all differential pressure flowmeters
- Supports all smart pressure differential transmitters
- Management and simulation of captured data points

Intuitive display of process variables and diagnostics

- Enhanced data logging functionality, both on demand or time-based
- Graphical process variable trending views

Support for multiple devices

- Simultaneously connect to multiple primary and secondary devices
- Ideal tool for evaluating multiple devices simultaneously

Benefits

Reduced Financial Exposure to Measurements

- Real time alerts of non-compliance and significant measurement bias
- Avoid measurement disputes and damaged reputation
- Distinguish error or drift in DP transmitter readings from meter system issues

Reduced Maintenance Costs

- Condition-based monitoring allows condition-based maintenance
- Reduced Maintenance regime due to condition-based responses

Reduced Risk to Personal Health and Safety

- Avoid requirement to break hydrocarbon containment
- Avoid maintenance induced errors or incidents
- Reduce trips to remote and hazardous location
- Improve H & S Record

Assurance of Meter System Performance

- Improved assurance of metering system accuracy
- Definitive confidence in meter result
- Real time and historical proof of meter performance

Financial Playback could be Achieved in Matter of Days

- TekValSys DP will distinguish between a secondary instrumentation issue and a primary meter body-based physical problem avoiding unnecessary inspection and down time

Applications

The benefits of prognosis can be realized an many DP metering applications including the following:

- Single phase gas single phase liquid
- Heavy oil- TekValSys DP will identify viscosity if it is not known accurately
- Steam- TekValSys DP will indicate whether the steam is saturated or superheated
- Steam- TekValSys DP will monitor shifts in level,of saturation and indicate direction of shift from initial saturation point
- Wet Gas- Once liquid loading is identified , TekValSys DP will monitor for shifts and indicate direction of shift in liquid

<p>TekValSys DPro Trust PC</p>	
<p>TekValSys DPro Micro</p>	
<p>TekValSys DPro Cloud</p>	
<p>TekValSys DPro ROC Platform</p>	
<p>TekValSys DPro FCA</p>	
<p>TekValSys DPro integration with FloBoss / Omni</p>	