



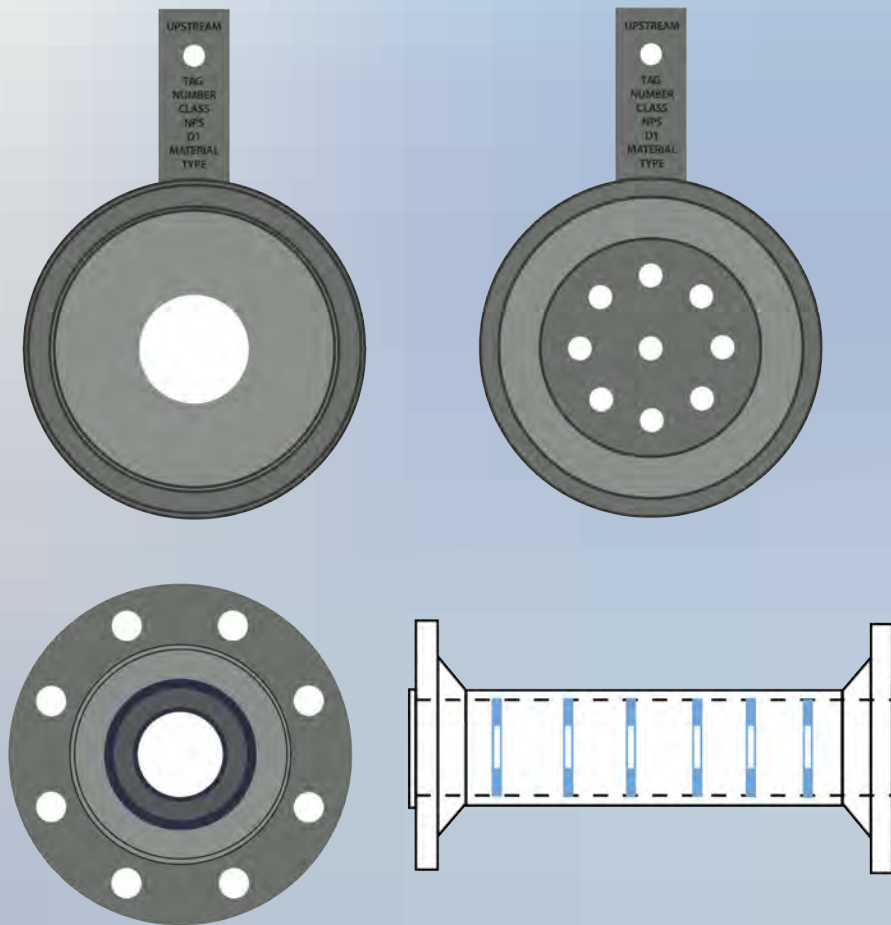
# *TEK-Dp 1610F*

## *Restriction Orifice*

---

## Instruction Manual

Document Number: IM-1610F



[www.tek-trol.com](http://www.tek-trol.com)

---

**NOTICE**

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.

For technical assistance, contact

Customer Support

796 Tek-Drive

Crystal Lake, IL 60014

USA

Tel: +1 847 857 6076

© **COPYRIGHT Tek-Trol LLC 2021**

No part of this publication may be copied or distributed, transmitted, transcribed, stored in a retrieval system, or translated into any human or computer language, in any form or by any means, electronic, mechanical, manual, or otherwise, or disclosed to third parties without the express written permission. The information contained in this manual is subject to change without notice.

Table of Contents

<b>1</b>	<b>Safety Instructions</b>	<b>2</b>
1.1	Intended Use	2
1.2	Certification	2
1.3	Safety Instructions from the Manufacturer	2
1.3.1	Disclaimer	2
1.3.2	Product Liability and Warranty	2
1.3.3	Information Concerning the Documentation	3
1.4	Safety Precautions	3
1.5	Packaging, Transportation and Storage	3
1.5.1	Packaging	3
1.5.2	Transportation	4
1.5.3	Storage	4
1.5.4	Nameplate	4
<b>2</b>	<b>Product Description</b>	<b>5</b>
2.1	Restriction Orifice Installation	5
<b>3</b>	<b>Operation</b>	<b>6</b>
<b>4</b>	<b>Installation Method / Instructions</b>	<b>6</b>
4.1	Introduction	6
4.2	Safety Precautions	6
4.3	Equipment and Tools Required (Minimum)	7
4.4	Restriction Orifice Selection Type Confirmation	7
4.5	Installation Steps	7
4.5.1	Preparation	7
4.5.2	Shutting Down the System	7
4.5.3	Installing the Restriction Orifice (RO)	7
4.5.4	Post-Installation Checks	8
4.5.5	Start-up Procedures	8
4.5.6	Maintenance and Inspection	8
4.5.7	Troubleshooting	8
4.5.8	Final Remarks	8
<b>5</b>	<b>Typical Applications</b>	<b>9</b>
5.1	Typical Single Stage Installation	9
<b>6</b>	<b>Typical Applications</b>	<b>10</b>
	<b>Restriction Orifice Typical Separator Installation (using a multistage unit)</b>	<b>11</b>
<b>7</b>	<b>Confirmation of Type Specification</b>	<b>11</b>

## 1 Safety Instructions

### 1.1 Intended Use

The Tek- DP 1610F Restriction Orifice is used to achieve a controlled or restricted flow of a flowing process fluid.

### 1.2 Certification

All Tek -Trol DP 1610 series restriction orifice devices are inspected before delivery, material certificates are available for each unit when required.

Multi-Element R.O. units have pipe with flanges each end and are built to ASME B31.3 requirements and are normally supplied with the following documents where applicable:

- ASME Radiography Certificate - (Weld Neck Flanged - Multi element units only).
- ASME Hydrotest Certificate - (1.5 X Working Pressure Flanged - Multi element units only).
- ASME Dye Penetrant Test - (Slip on Flange Types - Multi element units only).
- Restriction Orifice Pressure / Flow Reduction Calculations - (Multi-Element Units both Liquids and Gas in same device).
- Welding Certification as required with ASME controlled in house procedure. (Carbon Steel, Standard Stainless or Duplex Steels - other requirements available during order process).
- Materials Conformity Statement where required for single restriction plate orifice units, or multi element types.

### 1.3 Safety Instructions from the Manufacturer

#### 1.3.1 Disclaimer

The manufacturer will not be held accountable for any damage that happens by using its product, including, but not limited to direct, indirect, or incidental and consequential damages.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

The manufacturer has the right to modify the content of this document, including the disclaimer, at any time for any reason without prior notice, and will not be answerable in any way for the possible consequence of such changes.

#### 1.3.2 Product Liability and Warranty

The operator shall bear authority for the suitability of the device for the specific application. The manufacturer accepts no liability for the consequences of misuse by the operator. Wrong installation or operation of the devices (systems) will cause the warranty to be void. The respective Terms and Conditions of Sale, which forms the basis for the sales contract shall also apply.

### 1.3.3 Information Concerning the Documentation

To prevent any injury to the operator or damage to the device it is essential to read the information in this document and the applicable national standard safety instructions. This operating manual contain all the information that is required in various stages, such as product identification, incoming acceptance and storage, mounting, connection, operation and commissioning, troubleshooting, maintenance, and disposal.

## 1.4 Safety Precautions

You must read these instructions carefully prior to installing and commissioning the device. These instructions are an important part of the product and must be kept for future reference. Only by observing these instructions, optimum protection of both personnel and the environment, as well as safe and fault-free operation of the device can be ensured.

For additional information that are not discussed in this manual, contact the manufacturer

### **Warnings and Symbols Used**

The following safety symbol marks are used in this operation manual and on the instrument.



---

Indicates that operating the hardware or software in this manner may damage it or lead to system failure.

---

## 1.5 Packaging, Transportation and Storage

### 1.5.1 Packaging

The original package consists of

1. Tek-DP 1610F Restriction Orifice
2. Documentation



---

Unpack and check the contents for damages or sign of rough handling. Report damage to the manufacturer immediately. Check the contents against the packing list provided

---

### 1.5.2 Transportation

- Avoid impact shocks to the device and prevent it from getting wet during transportation.
- Verify local safety regulations, directives, and company procedures with respect to hoisting, rigging, and transportation of heavy equipment.
- Transport the product to the installation site using the original manufacturer's packing whenever possible.

### 1.5.3 Storage

If this product is to be stored for a long period of time before installation, take the following precautions:

- Store your product in the manufacturer's original packing used for shipping.
- Storage location should conform to the following requirements:
  - Free from rain and water
  - Free from vibration and impact shock
  - At room temperature with minimal temperature and humidity variation
- Before storing a used flow meter remove any fluid from the flow meter line completely. Properties of the instrument can change when stored outdoors.

### 1.5.4 Nameplate

The nameplate lists the order number and other important information, such as design details and technical data.



#### **NOTE**

---

Check the device nameplate to ensure that the device is delivered according to your order. Check for the correct Beta Ratio, Pipe ID, and TAG number if printed on the nameplate.

---

## 2 Product Description

Restriction Orifice (RO) devices is used to achieve a controlled or restricted flow of a flowing process fluid and operates without moving parts unlike flow control valves that may be damaged by out-of-range flows.

Single or multiple restriction orifice designs offer a defined restriction to the process flow and a calculated pressure head drop from the upstream to the downstream side of the device. The permanent pressure loss developed by the device is the intended pressure drop for which it is sized to control the flow and final pressure at the unit outlet side say from 1000PSIG to 5 PSIG for both liquids and gas using multistage units.

The device being used or purchased from Tek-Trol must be selected and confirmed by Tek DPro Engineering Staff before installation since the pressure drop flow calculation is based on the client's individual process conditions and it is advisable to use the unit in the location and pressure and temperature ranges it has been designed to operate at.

It is forbidden to use the device in alternate locations without contacting the company engineering staff to verify safe operation and applicability.

### 2.1 Restriction Orifice Installation

The design and sizing of the Tek DPro restriction orifice has been reviewed by a specialist for stress and noise related evaluations plus applicability for use in your application and confirmed at the quotation stage supply. Tek-DPro Restriction Orifice (R.O) Systems are designed with a substantial plate thickness to withstand the high differential pressures applied, manufactured with a bore in the center and either inserted between two flanges of a pipe (single unit), or in a multiple plate / stage device.

The following installation parameters should be confirmed before installation:

1. Inspect the shipping container that the R.O. unit has been supplied in for any damage, if so, report the incident back to after sales service with the serial number and also, if possible, a photograph. Inspect the R.O. unit itself for damage if any has occurred and confirm back to after sales service.
2. Confirm that the data sheet supplied with the unit meets the pressure and temperature parameters for the application and that the serial / tag numbers are intact and meets the technical specification data sheet or purchase order details.
3. Inspect the flanges where the restriction orifice plate (single) is to be installed for scratches / damage and make sure that the correct gaskets are used for the application (client responsibility).
4. Make sure the installation is per local regulations for pressure containment devices i.e., pressure ratings are correct for the required pressure and

temperature and the steel type is also confirmed for the pipeline and orifice unit (single plate type).

5. For multi-stage units which are supplied in a housing consisting of a pipe and flanged assembly based on the client's originally supplied data sheet parameters, inspect the flanges for scratches, review the hydrotest certificate to confirm the operating pressure meets the install location pressure and temperature requirements.
6. Install the multistage restriction orifice unit between the users flanges without applying a bend force to the housing or use the R.O. to align the receiving flanged pipes. Support the installation piping with a stanchion if possible either side of a multi-element R.O.
7. All multi element /stage units are designed to withstand the high restriction forces applied to the stated pressure and pressure reduction limits, note: Do not use / install the unit in any location that it has not been specified or designed for. This could cause a catastrophic failure of the elements and at worst case a support pipe housing failure.

### 3 Operation

Restriction Orifice plates and designs follow Bernoulli's principle with additional calculation software algorithms devised by Tek-DPro to precisely calculate the outlet pressure required based on process conditions.

The multi-stage unit is supplied to US national welding standards and pressure vessel design with ASME based hydrotesting and radiography where required other international welding / NDT standards are available also where required a document package should include these documents, please call after sales service if these documents are not, or have not been supplied.

## 4 Installation Method / Instructions

### 4.1 Introduction

This manual provides detailed instructions for the proper installation of a restriction orifice used in gas or liquid flow control systems. A restriction orifice is used to regulate fluid flow rates / pressure within a pipeline. When the unit is received, please check for damage to the transportation container and report this back to Tek-Trol. If any damage to the unit is found caused by transport etc. Also contact the factory / aftersales department.

### 4.2 Safety Precautions

Before starting the installation process, ensure that you adhere to all safety guidelines and regulations. Always wear appropriate personal protective equipment (PPE), work in well-ventilated areas, and follow authorized and agreed standard safety practices.



#### 4.3 Equipment and Tools Required (Minimum)

- Restriction Orifice plate or Multi Element restriction orifice system (check correct size and materials plus pressure rating etc.)
- Gaskets and seals
- Studs, nuts, and bolts
- Wrenches and sockets
- Torque wrench
- Pipe thread sealant
- Flange alignment tools
- Pressure gauge
- Manifold set (for gas systems)
- Lockout/tagout equipment
- PPE (gloves, safety glasses, etc.)

#### 4.4 Restriction Orifice Selection Type Confirmation

Check selected Restriction Orifice plate based on supplied data sheet factors such as flow rate, fluid type, and pressure plus engineering drawings supplied based on client requirements. Ensure that the Restriction Orifice plate material and pipe where installed is compatible with the fluid being handled from a pressure standpoint and corrosion resistance.

#### 4.5 Installation Steps

##### 4.5.1 Preparation

Review the system specifications and design to determine that the optimal location for the restriction orifice plate conforms to the design.

Ensure that you have all the necessary equipment and tools ready for installation together with any work permits needed etc.

Identify the upstream and downstream sides of the pipeline where the single restriction orifice plate or multi element restriction orifice type will be installed.

##### 4.5.2 Shutting Down the System

Follow proper lockout/tagout procedures to isolate the system from the flow source.

Depressurize the pipeline gradually and safely if an existing installation.

##### 4.5.3 Installing the Restriction Orifice (RO)

Remove any existing flange covers, bolts, and nuts.

Place the restriction orifice plate between the flange's orientation does not matter on square edge plates or place the multi element R.O between the existing flanges in the space allocated.

Use appropriate gaskets and seals to ensure a tight seal between the orifice plate or multi-element R.O and the mating flanges, this is key to a good installation. Insert and hand-tighten the studs or bolts into the flange holes.

Use a wrench and socket to tighten the nuts and bolts if used evenly and gradually in a crisscross pattern.

Follow torque specifications recommended by the bolting manufacturer to ensure proper sealing without over-tightening.

#### 4.5.4 Post-Installation Checks

Inspect the installation for proper alignment and sealing.

Verify that all bolts and nuts are tightened to the recommended torque values. Ensure that the orifice plate or multi element R.O. is secure and centered within the pipeline properly.

#### 4.5.5 Start-up Procedures

Gradually open the isolation valve to allow fluid to flow through the orifice plate.

Monitor pressure and flow rate using appropriate instruments (pressure gauges, flow meter if available etc. check outlet pressure conforms to the design specification).

Check for any leaks around the R.O. and flanges.

#### 4.5.6 Maintenance and Inspection

Regularly inspect the R.O system for signs of corrosion, erosion, or damage.

Replace gaskets or seals as needed to maintain proper sealing integrity.

#### 4.5.7 Troubleshooting

If issues arise, such as incorrect flow reductions or leaks, refer to troubleshooting guides provided by the factory / manufacturer.

#### 4.5.8 Final Remarks

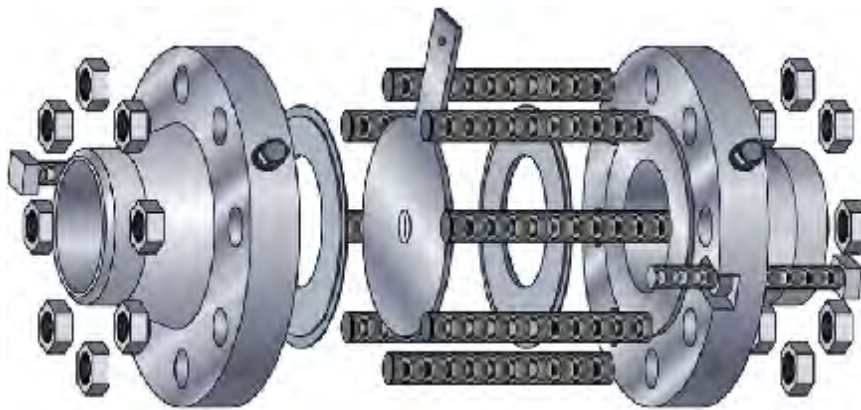
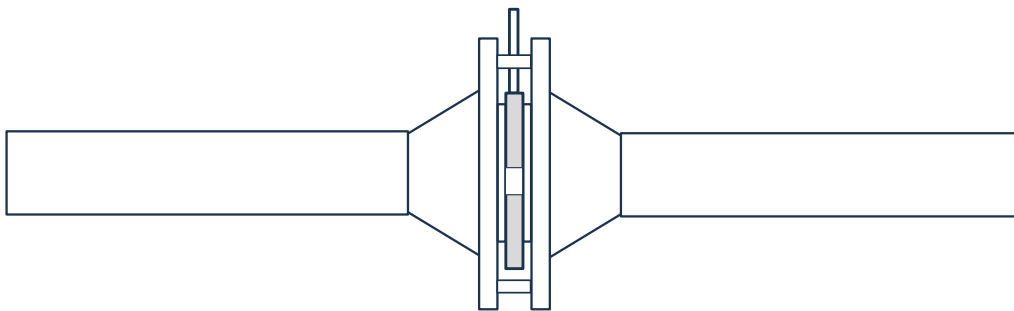
Proper installation of a restriction orifice is essential for accurate flow control and measurement. Following these guidelines will help ensure a safe and effective installation process.

Note: If in doubt, consult with experts or the factory for further guidance.

## 5 Typical Applications

- Installed downstream of blow-down valves systems to ensure a controlled flow rate in the blowdown piping or blowdown header.
- They are installed in minimum flow bypass lines around centrifugal pumps.
- Can be installed in Wellhead Separator control applications – (install details in this document)
- Restriction Orifice units are sometimes used to restrict excess flow in a ruptures case.
- Injection, cooling (using Joule Tompson effect), and fluid flushing systems.
- Sampling mixer.
- The steam let down.
- Use as a simple static mixer
- N2 purge to provide constant gas seal parameters.
- Flow Control improvement

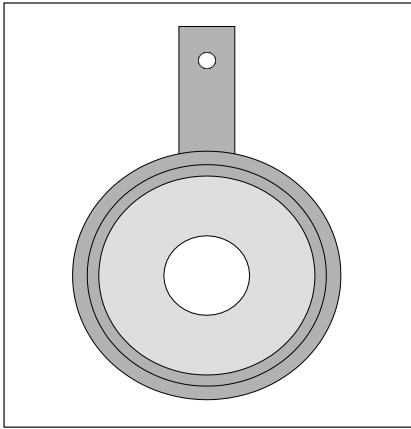
### 5.1 Typical Single Stage Installation



## 6 Typical Applications

Restriction orifices can be classified into four different types:

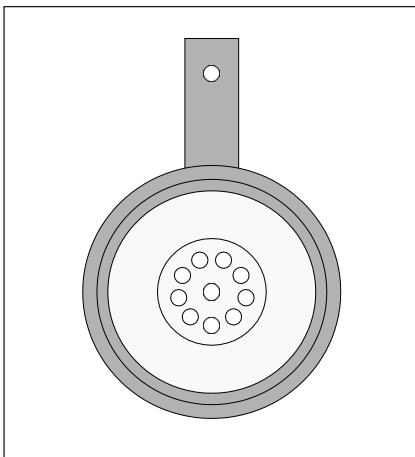
### Single Stage Simple Restriction Orifice



The first type of RO is the single-stage restriction orifice that provides the simplest pressure drop. It is usually a plate with a single orifice bore of required size / beta ratio and intended pressure loss.

It is usually machined with a square-edged plate edge designed to resist the maximum DP with sufficient headroom.

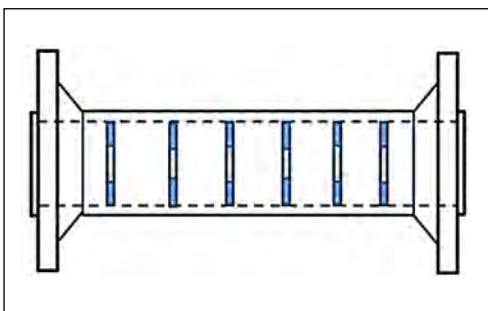
### Multi-hole Single Stage Restriction Orifice



The second type of RO is a multiple-hole single-stage restriction device. The extra holes help to reduce fluidic noise and resonance generated due to a high velocity across the reduction. This type of restriction orifice can have the same area ratio as a single hole unit and offer the same pressure reduction parameters, however the multiple holes help to distribute the flow streams to reduce the overall noise.

Usually, when a high-velocity flow at the RO inlet is distributed through multiple holes designs, a reduction in overall noise value occurs. This type of RO is commonly used to help to reduce cavitation problems, since the flow distribution across several holes is known to improve cavitation factors which in return can reduce overall noise levels.

### Multi-Stage Restriction Orifice System



The third unit type is a Multi-Stage Restriction Orifice with multi-element pressure reduction / flow control capability. The restriction unit is built with either single orifice hole multiple orifice plates or multi-hole multi-stage designs with different hole sizes so that the pressure and flow rates can be controlled effectively to help prevent cavitation occurring in a pressure reduction system and to

reduce the flow to manageable values.

Figure 1. next shows one typical pressure reduction application as applied to a separator outlet in the oil and gas industry as currently being used by Oil and Gas midstream operators to help prevent valve damage in out of range occurrences.

Restriction Orifice Typical Separator Installation (using a multistage unit).

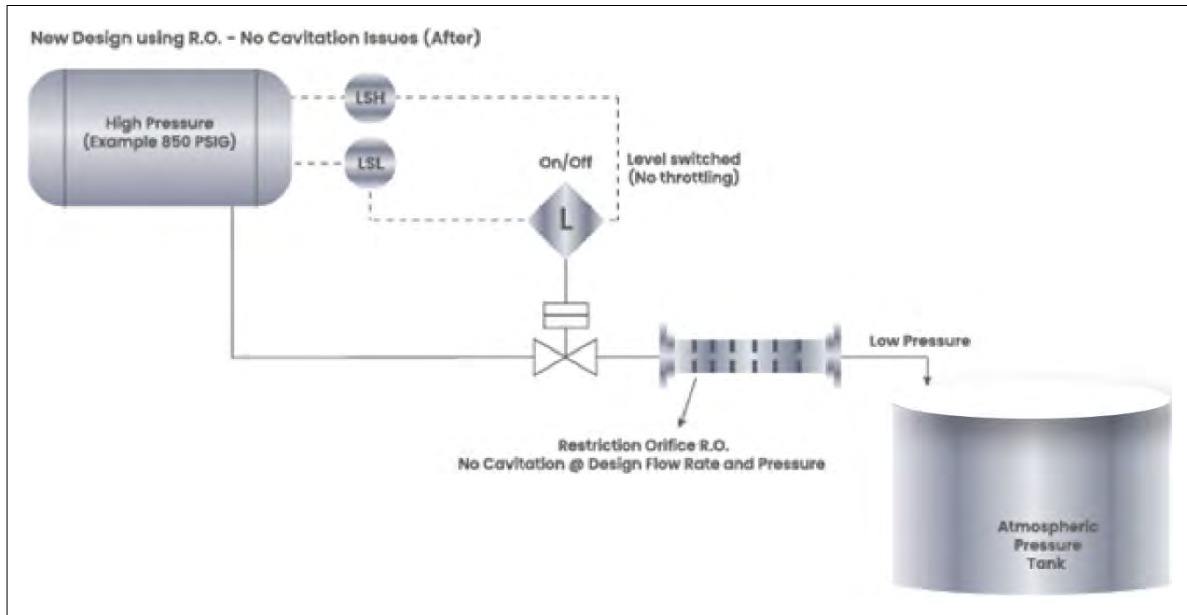


Fig. 1 Restriction Orifice Typical Separator Installation

Above Figure 1.: Shows a multi-element restriction orifice installed offering both a pressure and flow restriction to client’s requirements without cavitation, allowing the system to be fully running or shut down based on the clients upper and lower-level limits. From say 1440 PSIG to 5 PSIG as calculated by Tek-DPro. Engineering team for this application.

## 7 Confirmation of Type Specification

<b>R.O. Plate Types</b>	-Square Edge Concentric-Single or Multi-Element Units -Eccentric, Segmental – Single or Multi-Element -DP1610-Multi-Element Device, Flanged & Pressure Tested -Single-Element Plate Only (Client Installation)
<b>Plate Material</b>	-304SS, 304L SS, 316L SS -Ni, Cr, Mo Alloy Steel (A182 F11 to 91) -Monel, Hastelloy, Inconel (on request)
<b>Pressure Rating</b>	In accordance with National and International standards.
<b>Plate Thickness</b>	Calculated taking into consideration the required process pressure reductions, flow and pipe sizes, and liquid or gas process details according to clients piping requirements and standards.
<b>Mounting</b>	Flanged or clients piping requirements
<b>Nominal Pipe Diameters</b>	1 inch to 24 inches (25-600mm) (Note: Other diameters on request)
<b>Support Pipe</b>	Full NDT with Dye Penetrant, Radiography & Hydrotest (Flanged-or butt weld)
<b>Flange Rating</b>	ANSI 150, 300, 600, 900, 1500, 2500 RF/RTJ as required



TEKMATION LLC reserves the right to change the designs and/or materials of its products without notice. The contents of this publication are the property of TEKMATON and cannot be reproduced by any other party without written permission. All rights reserved. Copyright © 2017 TEKMATON LLC  
DOC#TEK/TPS/ANL/240520/1610P/101



[www.tek-trol.com](http://www.tek-trol.com)

## **Tek-Trol LLC**

796 Tek Drive Crystal Lake,  
IL 60014, USA

 +1 847-857-6076

 [tektrol@tek-trol.com](mailto:tektrol@tek-trol.com)

 [www.tek-trol.com](http://www.tek-trol.com)

Tek-Trol is a fully owned subsidiary of TEKMATON LLC. We offer our customers a comprehensive range of products and solutions for process, power and oil & gas industries. Tek-Trol provides process measurement and control products for Flow, Level, Temperature & Pressure Measurement, Control Valves & Analyzer systems. We are present in 15 locations globally and are known for our knowledge, innovative solutions, reliable products and global presence.

Flow | Level | Temperature | Pressure | Valves | Analyzers | Accessories | TekValSys