



Technology Solutions

# TEK-DP 1610D

## Integral Orifice Assemblies



FLOW



## Introduction

The TEK-DP 1610D Integral Orifice Assemblies is used in combination with a Transmitter to accurately measure liquid, gas, or steam flow in ½", 1", and 1 ½" (approximately DN 15, DN 25, and DN 40) size pipes. The TEK-DP 1610D Integral Orifice Assemblies in combination uses the differential pressure created by the orifice to measure, with high accuracy, process flows in ½", 1", and 1 ½" size pipes.

## Features

- Very high accuracy when equipped with associated piping.
- Process-wetted materials available for use with both corrosive and noncorrosive fluids.
- Various process pipe end connections available.
- Can be used with any differential pressure transmitter having standard process connections. The transmitter can be either integrally coupled or remotely connected.
- A 3-Valve Manifold is recommended for mounting between the Model TEK-DP 1610D Integral Orifice Assemblies and transmitter.
- Process-wetted material meets NACE Standard MR-01-75.
- Self-centering orifice plate design.
- No-flow-through transmitter body.
- Orifice plate manufacture consistent with ASME, ISO, and AGA-3 standards.

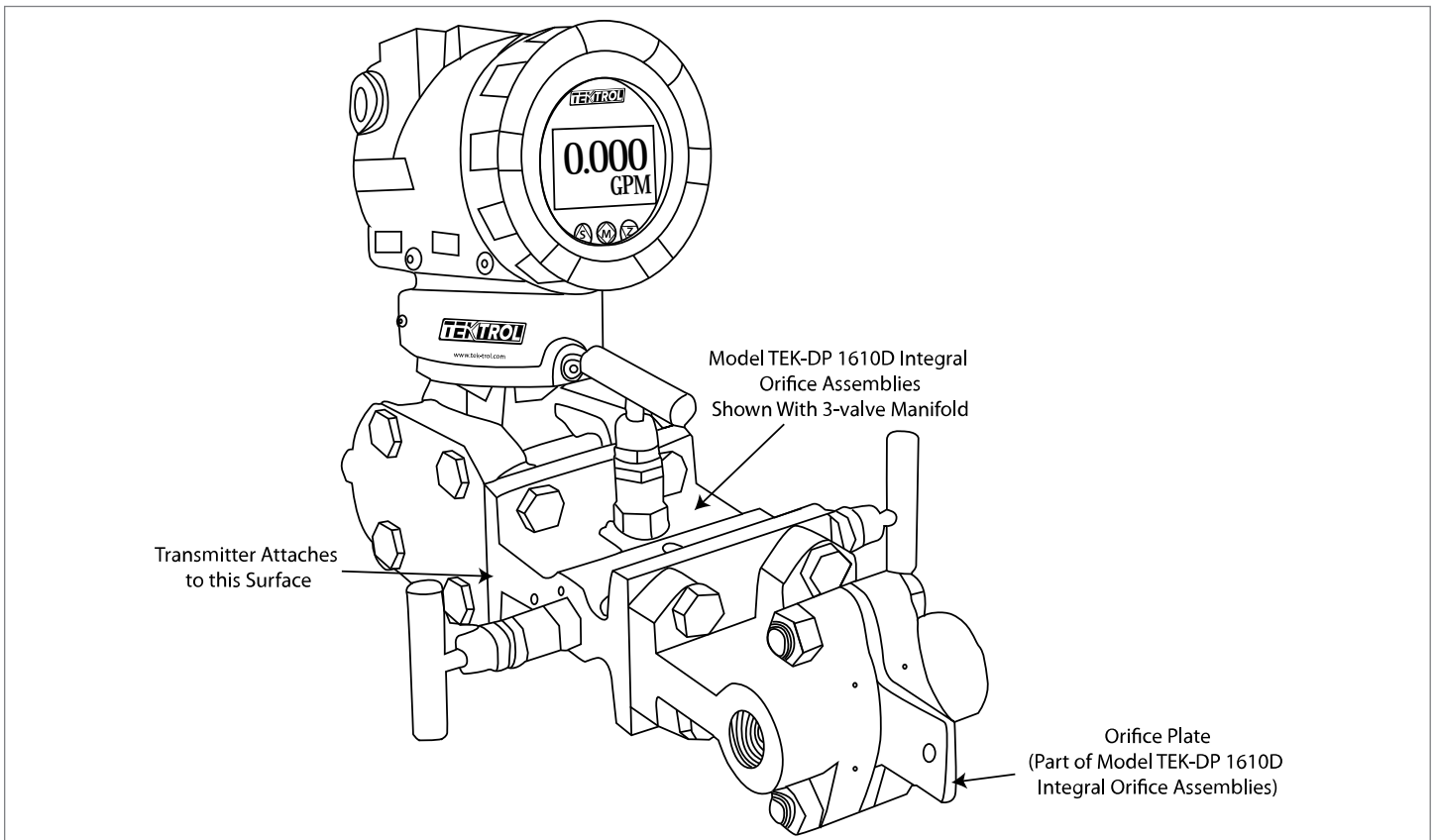


Fig 1: TEK-DP 1610D Integral Orifice Assemblies

## Convenient sizing

The Model TEK-DP 1610D Integral Orifice Assemblies is suitable for liquid, gas, and steam applications. By choosing the correct combination of assembly size and orifice bore, almost any desired flow rate, with either turbulent or laminar flow conditions, can be measured.

## Handles Wide Ranges of Flow Rates

The flow rate ranges handled by these TEK-DP 1610D Integral Orifice Assemblies (Each range depends on the specific combination of assembly size and orifice bore) are those frequently found in chemical and petrochemical plants, research projects, and highaccuracy metering applications.

## Highly Accurate Measurements

The orifice assembly can be supplied with associated piping welded to it. This piping can have a variety of end connections (For installation into the user's process piping). All essential parts are bored to assure a precise inside diameter which is highly concentric with the orifice bore. This permits a Beta ratio (ratio of orifice bore to pipe ID) that is tightly controlled. The results are measurements that are far more accurate than could otherwise be obtained.

## Available in a Variety of Materials, Sizes, and Configurations

The orifice plate and body assembly are available in several metals to meet the requirements of almost any process, including NACE material standards. (Only AISI Type 316 Stainless Steel construction is available when the TEK-DP 1610D Integral Orifice Assemblies is supplied with associated piping.) The assembly is available in ½", 1", and 1 ½" pipe sizes. The process piping can be either screwed or welded to the body.

Several standard orifice bore diameters are available for each assembly size. In addition, non-standard bore sizes, between beta ratio limits of 0.1 and 0.8, can be supplied.

## Simplified Installation

The TEK-DP 1610D Integral Orifice Assemblies becomes part of the process piping. The transmitter is bolted directly onto the orifice assembly; thus, no transmitter piping is required.

The transmitter can be isolated or bypassed by the addition of a three-valve bypass manifold. This permits the zeroing, calibration check, and maintenance of the transmitter without either interrupting the flow or removing the TEK-DP 1610D Integral Orifice Assemblies from the process line. Both the bypass manifold and the transmitter are bolted together as a unit, and the pair is mounted directly onto the orifice assembly.

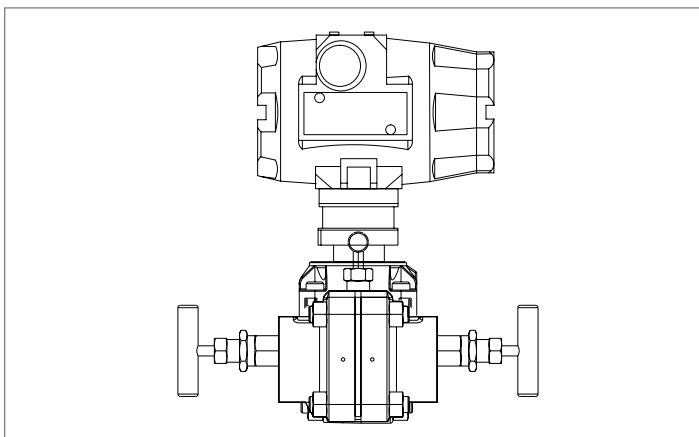


Fig 2: TEK-DP 1610D with 3-Valve Manifold Front View

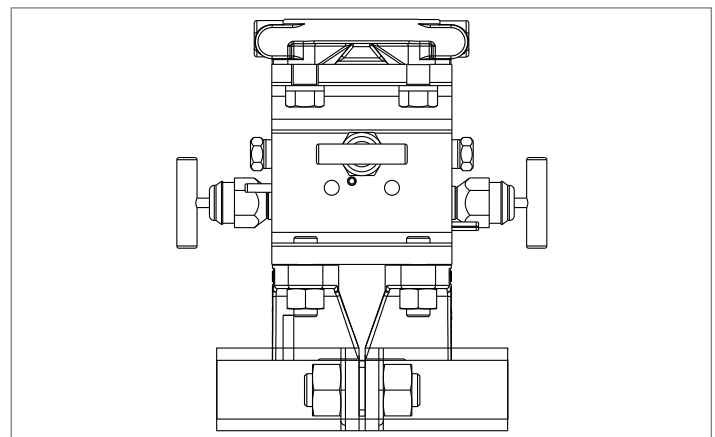


Fig 3: TEK-DP 1610D with 3-Valve Manifold Top View

## Functional Specifications

### Mounting

The TEK-DP 1610D Integral Orifice Assemblies is inserted into the user's process line and becomes a permanent part of the piping. The transmitter bolts onto the orifice assembly body.

### Pressure Taps

- Corner

### Orifice Inlet Edge

- Bore Diameter up to 0.06" (1.5mm)
  - Quadrant Edge
- Bore Diameter above 0.06" (1.5mm)
  - Square Edge

### Pipe Bores

Size	Pipe Schedule	With Assoc. Piping (a)	Without Assoc. Piping (b)
		in(mm)	in(mm)
½"	1 ½" (40mm)	⅔" (16.76mm)	⅝" (15.8mm)
1"	1 ½" (40mm)	1 ⅛" (27.76mm)	1 ⅛" (26.64mm)
1 ½"	3" (80mm)	1 ½" (39.65mm)	1 ½" (38.10mm)

a. When piping is supplied, ID of both ends of pipe at orifice assembly is precision bored to indicated diameters.

b. When pipe is supplied by user, nominal ID of commercial size is indicated.

### Standard and Nonstandard Orifice Bore Beta Ratios (β), Based on Pipe

Type Orifice Plate	Beta Ratios for the Following Orifice Assembly Size					
	½"		1"		1 ½"	
	Orifice Bore	Beta Ratio	Orifice Bore	Beta Ratio	Orifice Bore	Beta Ratio
	in(mm)		in(mm)		in(mm)	
With Standard Bore Diameters	0.0200" (0.508mm)	0.03030	0.242" (6.15mm)	0.2214	0.382" (9.70mm)	0.2447
	0.0350" (0.889mm)	0.05303	0.341" (8.66mm)	0.3120	0.538" (13.67mm)	0.3447
	0.0600" (1.524mm)	0.09091	0.478" (12.14mm)	0.4373	0.751" (19.08mm)	0.4811
	0.100" (2.54mm)	0.1515	0.655" (16.64mm)	0.5993	1.018" (25.86mm)	0.6521
	0.160" (4.06mm)	0.2424	0.832" (21.13mm)	0.7612	1.180" (29.97mm)	0.7559
	0.250" (6.35mm)	0.3788				
	0.350" (8.89mm)	0.5303				
With Non-standard Bore Diameters	All Metal: Sizes between Beta ratio limits of 0.1 and 0.8 can be supplied.					

## Process End Connections

### Assembly Without Associated Piping

Body connections for ½", 1", or 1 ½" pipe; NPT or BSPT pipe tap, or prepared for socket welding, as specified.

### Assembly With Associated Piping

½", 1", or 1 ½" pipe is welded to body; outer ends are either threaded (NPT or BSPT), prepared for welding, or flanged (ANSI; Class 150, 300, or 600), as specified. Pipe lengths are approximately 18 pipe diameters upstream and 7 pipe diameters downstream.

## Performance Specifications

(Refer to associated transmitter specifications for transmitter accuracy)

### Flow Coefficient Uncertainty

The following table lists flow coefficient uncertainties at various orifice bore Reynolds Numbers when using standard bore orifice plates. The flow coefficient uncertainty can be reduced by a flow calibration of the orifice assembly.

### Flow Coefficient Uncertainty for Standard Bore Orifice Plates

Size	Beta Ratio	Orifice Bore Reynolds Number (RD)	Uncertainty with Associated Piping			Uncertainty without Associated Piping (a)		
½" (Quadrant Edge)	0.03030 to 0.09091	<1500 ≥1500	±5%		±3%	±5%		±5%
	0.1515	< 500 ≥1500	±5%		±1.25%	±5%		±2.5%
0.2424 to 0.5303		<1500 ≥1500	±5%		±0.75%	±5%		±1.5%
1" (Square Edge)	0.2214 to 0.5993	<1500 ≥1500	±5%		±0.75%	±5%		±1.5%
	0.7612	<1500 1500 ≥ RD <10 000 ≥10 000	> ±5%	±5%	±1.5%	> ±5%	±5%	±3%
1 ½" (Square Edge)	0.2447 to 0.4811	<1500 ≥1500	±5%		±0.75%	±5%		±1.5%
	0.6521 to 0.7559	<1500 1500 ≥ RD <10 000 ≥10 000	> ±5%	±5%	±1.5%	> ±5%	±5%	±3%

a. Using Schedule 40 pipe for ½" and 1" sizes, and Schedule 80 pipe for 1 ½" size.

## Physical Specifications

### Material of Construction

Part	Material	ASTM Designation
Orifice Plate 0.167" (4.2mm) thick	316 SS Hastelloy™ C	A-240 B-626
Body (a)	316 SS Hastelloy™ C (Grade CW-2M)	A-351-CF8M A-494
Bolts	Gr. B7 (Standard) (b) Gr. B7M (NACE) (b) 17-4 PH	A-193 A-193 A-564
Nuts	Gr. 2H (with B7 Bolts) (b) Gr. 2HM (with B7M Bolts) (b) 17-4 PH	A-194-2H A-194-2HM A-564
Gasket	Glass Reinforced PTFE	-
With Associated Piping or Optional Remote Connectors		
Pipe (c)	316 SS	A-312
Pipe Flanges	316 SS	A-182-F316
Remote Connectors	316 SS Hastelloy™ C-276	A-182-F316 B-564

a. 316 SS only with Associated Piping.

b. Alloy Steel.

c. ½" and 1" Pipes are Schedule 40; 1½" Pipe is Schedule 80

### Orifice Plate Identification

One side of the handle has "INLET" and the plate material stamped on it; the other side has the part number and bore diameter.

### Approximate Mass

Size	Without Piping		With Piping and Flanges	
	kgs	lbs	kgs	lbs
½"	2	4	3	7
1"	2.5	5	5.5	12
1 ½"	3.5	8	12	26

# Dimensional Drawings

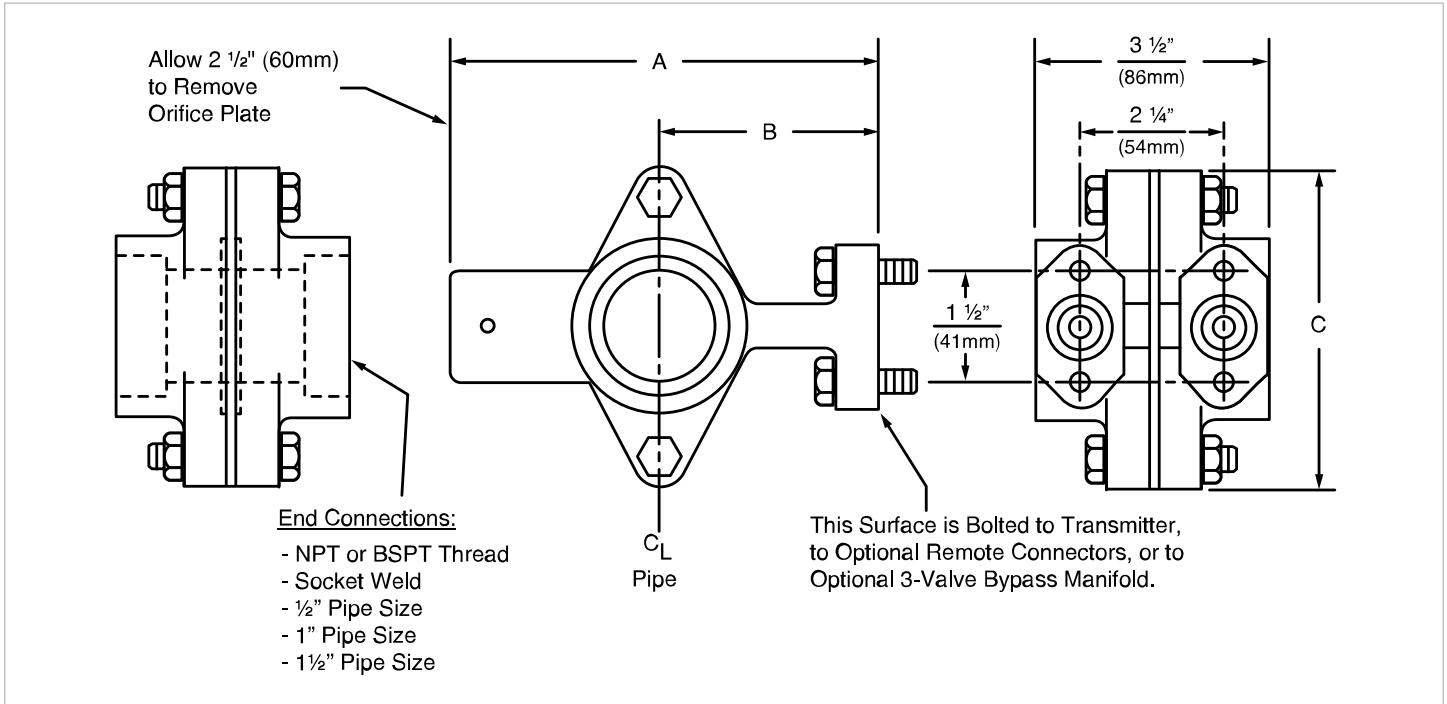


Fig 4: Assembly without Associated Piping

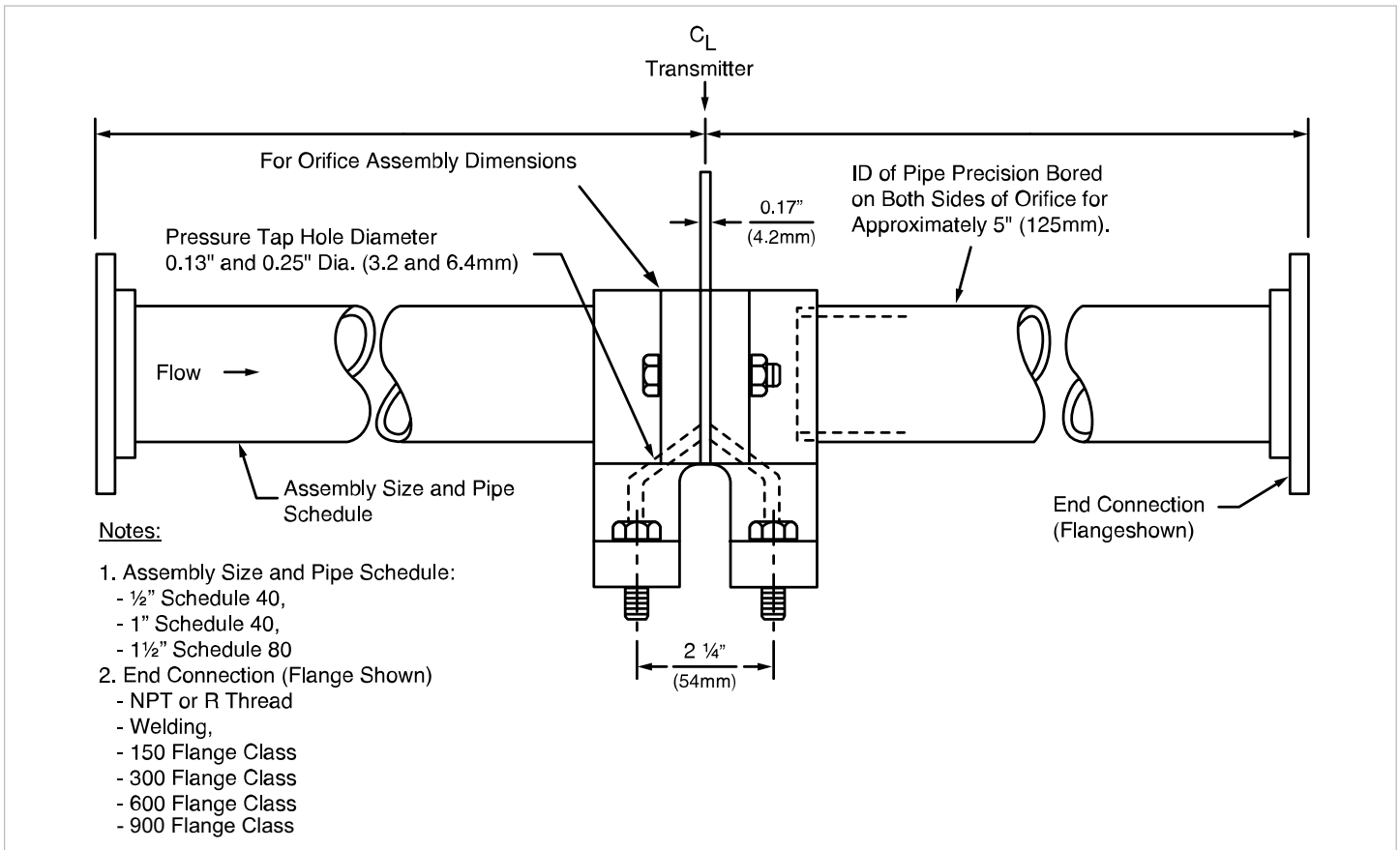


Fig 5: Assembly with Associated Piping

**\*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.

## Model Chart

Example	Tek-DP 1610D	015	A	01	G	05	A	XX	D	A	01	#	TEK-DP 1610D-015-A-01-G-05-A-XX-D-A-01
Series	Tek-DP 1610D												Integral Orifice Assemblies
Pipe Size		015 025 040											½" 1" 1 ½"
Meter Body			A X										316L SS Special
Pipe Schedule				01 XX									STD (Standard Pipe SCH) Special
Process Connection					A B C D E F G X								Slip On RF Weld Neck RF Slip On RTJ Weld Neck RTJ Beveled End Socket NPTF Special
Pressure Rating						01 02 03 04 05 XX							150# 300# 600# 900# Threaded Special
Orifice Plate Material							A B X						316 SST Alloy C-276 Special
Beta								XX					Special
Mounting									D R X				Direct Mount Remote Mount Special
Additional Meter Taps (D/S)										A B C X			None Temperature Tap (3D) Validation/Diagnostic Tap (6D) Special



Flow Transmitters/ Computers										01	None (Customer Supplied)	
										02	Tek-Bar 3110 (Liquids) - Smart DP	
										03	Tek-Bar 3800 (MVT Steam & Compressed Gases)	
										04	Tek-FC 8000 (Natural Gas - Flow Computer)	
										05	TekValsys DPRO (Flow Validation)	
										06	TekValsys DPRO WFGM (Wet Gas)	
										XX	Special	
Options											MTR	Material Test Report EN3.1
											MC	Material Cert EN2.1
											PMI	Positive Material Indetification (NDE)
											COC	Certificate of Conformity
											HYD	Hydro Test
											XRT	X-Ray
											DPT	Dye Penetrant
											MPT	Magnetic Particle Testing
											O2C	O2 Clean
											TAG	SS Tag Plate
											UMR	Upstream Meter Run - 1PC
											DMR	Downstream Meter Run - 1PC
											CDE	Certified Drawing Electronic (As Built)
											MRB	Manufacturing Record Book
											DFT	Dry Film Thickness - Custom Paint Spec
										CPC	Custom Product Code	
										3WH	3 Way Manifolds (Type H)	
										5WH	5 Way Manifolds (Type H)	

## Popular Models

Model Number	Description
1610D-015-A-01-G-05-A-XX-D-A-01	½"
1610D-025-A-01-G-05-A-XX-D-A-01	1"
1610D-040-A-01-G-05-A-XX-D-A-01	1-½"
1610D-PLATE-0.5-XX	0.5
1610D-PLATE-1.0-XX	1
1610D-PLATE-1.5-XX	1.5
1610D-GASKET-0.5	0.5
1610D-GASKET-1.0	1
1610D-GASKET-1.5	1.5