Quick Start Guide

Tek-DP 1690B
Flow Conditioner

Plate Type Conditioners

AGA /API
Type Tube Bundle

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Quick Start Guide

1. Before you begin

This guide provides basic guidelines to assist you in quickly getting started.

Make sure only qualified personnel perform the installation.

Remove pressure and drain the pipe assembly prior to installing or removing the orifice plate.

If the process fluid is caustic or otherwise hazardous, follow the instruction closely to prevent mishap.

2. Unpack

Tek-DP 1690B Flow Conditioner

3. Dimensional Drawing

Tube Bundle / Straightening Vane Flow Conditioners.

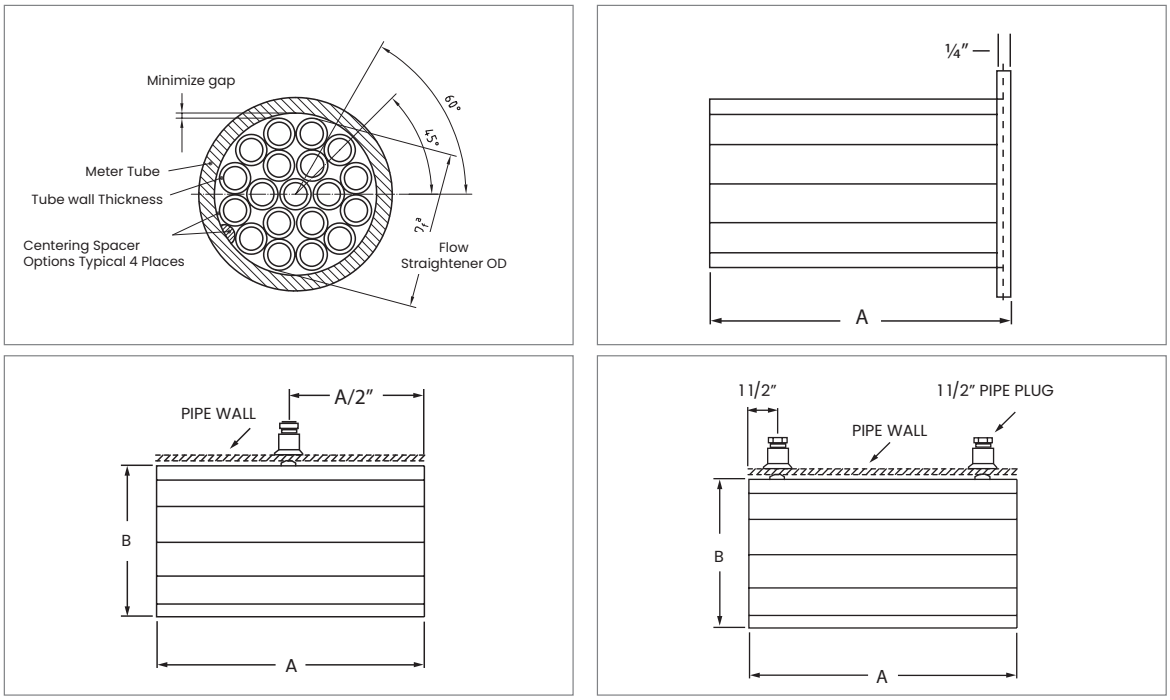


Fig. 1 Tube Bundle Type (bolt in style and centre ring / top hat style – top right)

Zanker Type Plate

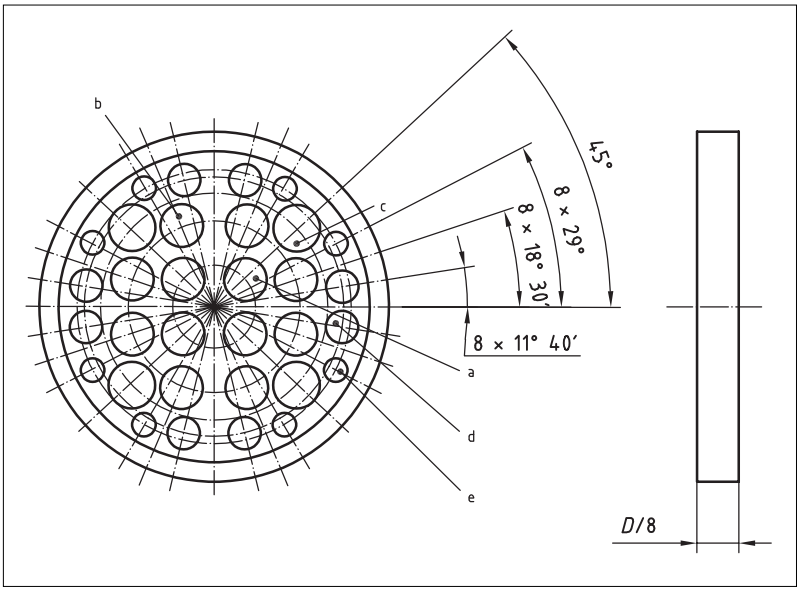


Fig. 2. Zanker Type Conditioning Plate

Nova Type Plate

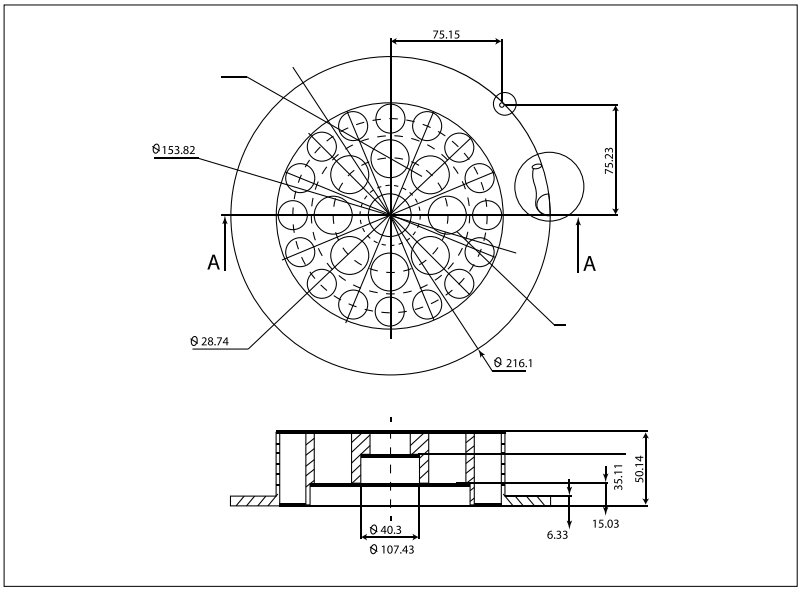


Fig. 3 Nova Type Conditioning Plate

4. Installation

Tek-Trol supplied Zanker plates have five grades of holes, as described in Fig. 1 and Table 1., below and at the end of this document listed as variants.

The smaller holes are concentrated near the plate edge because the major formation of eddies and swirl is near to the wall. This radial reduction of hole diameter assists in stabilizing the velocity distribution across the flow area. The geometry of the holes is expressed in terms of plate diameter (i.e., pipe internal diameter).

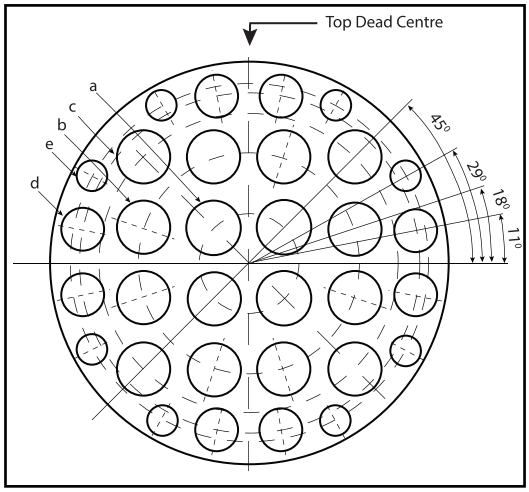
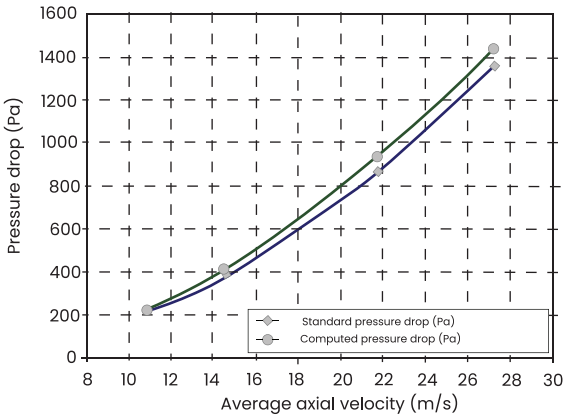


Fig 4. Zanker Plate

Hole grade	Number of holes	Pitch angle	Hole diameter	Pitch circle diameter
a	4	45^0	0.141D±0.001D	0.25D±0.002 5D
b	8	18^0	0.139D±0.001D	0.56D±0.005 6D
c	4	45^0	0.136.5D±0.001D	0.75D±0.0075D
d	8	11^0	0.11D±0.001D	0.85D±0.008 5D
e	8	29^0	0.077D±0.001D	0.9D±0.009D
Standard Plate Thickness			0.12D ≤ tp ≤ 0.15D	
Standard upstream pipe length			17D ≤ Lf	
Standard downstream pipe length			7.5D ≤ Ls ≤ Lf – 8.5D	

Table 1. Zanker Plate Geometry



The resultant pressure drop across Zanker plates can be compared with ISO modeling 2003 using the standard equation below which calculates the pressure drop as a function of the dynamic head:

$$\Delta P = K \frac{1}{2} \rho V^2$$

(Where K is the coefficient of discharge, estimated at a value (ISO, 2003) appx 3. p = the fluid density & V = fluid velocity.)

It is important to install the plate between approved flanges rated for the design pressure in the center of the pipe with the plate top dead center (shown in Figure 1.) and in the correct place. This methodology also applies to the Nova style plate that Tek-Trol supply if this style was purchased (Figure 2.). If the plate is installed off center "jetting" may occur and may reduce its flow conditioning performance. Figure 3., illustrates the standardized tube conditioner as per AGA / API standards. Occasionally the tube bundle is installed without flanges and placed in the pipe using a threaded tapping and bolt system to hold in place. This is also installed in a similar manner to the plate conditioner with the flanged (Top-Hat) section (if used) installed between pipeline flanges with the tubes facing downstream from the flow direction.

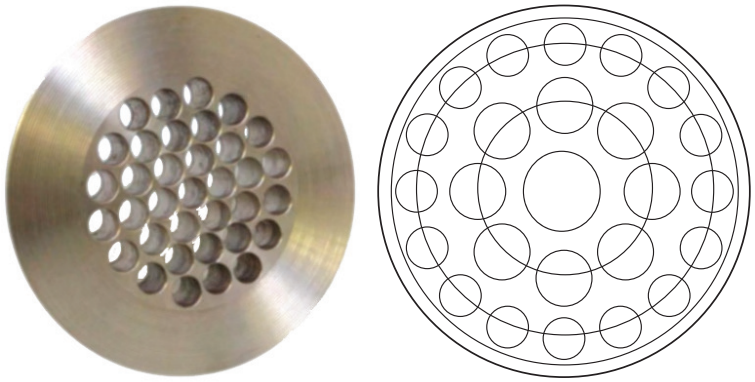


Fig 5. Nova Style Plate Design

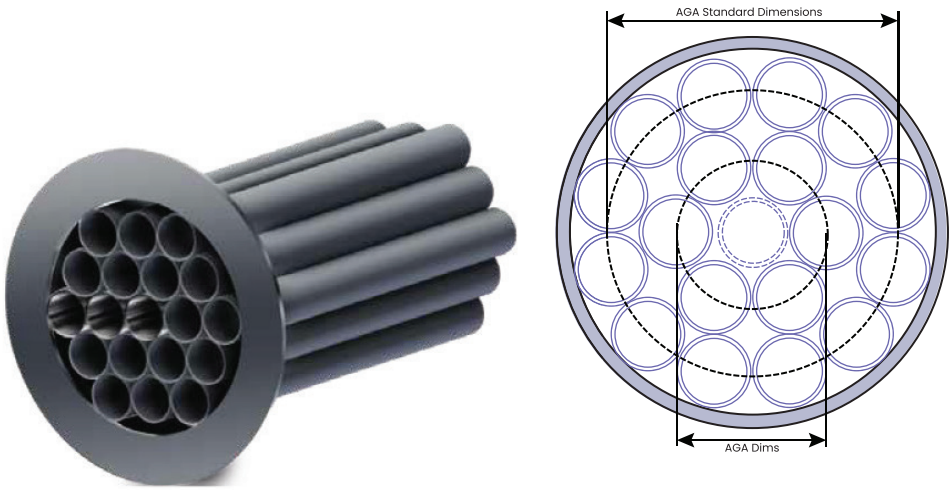


Fig 6. AGA Style Tube Bundle (with top hat) (1690 B)

The basic procedure to install as follows: (Note: Some users may use their own approved procedures in house)

Preparation: Gather all the necessary tools and equipment for the installation,ensuring they are compatible with the pipeline's material and dimensions use PPE to prevent personal injury during the install.

Pipeline Shutdown: Before any work begins, safely shut down the pipeline and ensure it is depressurized to create a safe working environment if new inspect the upstream sections for trash or residue from the manufacturing or welding processes.

Pipeline Cleaning: Thoroughly clean the interior of the pipeline to remove any debris, scale, or contaminants that could interfere with the installation if the pipeline is existing, and the installation is an upgrade etc.

Measurements: Measure the diameter of the pipeline accurately to confirm the appropriate size of the flow conditioning plate.

Plate Positioning: Confirm the ideal location within the pipeline for installing the flow conditioning plate is correct based on manufacturer recommendations. It is installed in a straight pipe section, downstream from any disturbances or fittings with a downstream section before the meter as per pre -order Tek-Trol recommendations.

Cutting the Pipeline: Make a precise cut in the pipeline at the designated installation location where the flanges are to be installed up and downstream oof the plate the flanges must be at 90 degrees to the centreline of the pipe and also any weld bead ground down. Ensure the cut is clean and straight to facilitate a proper fit and not slanted at an angle as this will prevent the proper flow conditioning process to take place.

Installation: Insert the flow conditioning plate into the pipeline section in between the flanges using the correct sealing gaskets for the ANSI rating of the flange and pipe. Secure the conditioner in place using

bolting, or other appropriate methods, depending on the plate design and pipeline material. Also make sure it is centrally mounted, or this can cause poor flow conditioning performance.

Sealing: Make sure that the installed flanges create a strong and leak-proof connection, the gasket should also be mounted on the centreline so that the gasket does not protrude inside and affect the velocity profile pressure testing may be required at the discretion of the user.

Testing and Inspection: Conduct pressure tests and visual inspections to ensure the proper installation of the flow conditioning plate and check for any potential leaks or issues per user operational procedures.

Recommissioning: After successful installation and testing and recommission the pipeline, restore the fluid flow within it making sure that any air introduced is bleed from the system effectively.

Recommended Upstream and Downstream Requirements

1. 1690 B -V Tube Bundle/ Straightening Vane Flow Conditioner

The straight lengths given in the table are the permitted lengths between the downstream end of a 19-tube bundle flow straightener (1998) (as described in 6.3.2.1) and the orifice plate given that a particular fitting is installed upstream of the 19-tube bundle flow straightener (1998) at a distance Lf from the orifice plate. The distance Lf from the orifice plate is measured to the downstream end of the curved portion the nearest (or only) bend or of the tee or the downstream end of the curved or conical portion of the reducer or expander. The recommended values give tube bundle locations that are applicable over a specified range of β.

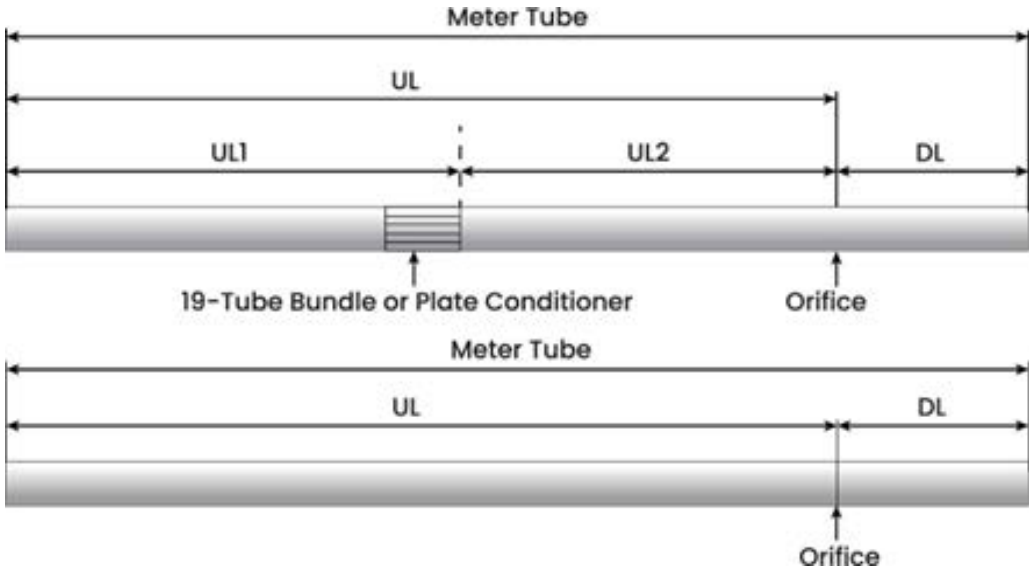


Fig 7. Basic Straight Run Layout

Quick Start Guide

Diameter Ratio β	Single 90° bend [b]				Two bend [b] in perpendicular planes (2D≥S)[c]			
	30 > L_f > 18		L_f > 30		30 > L_f > 18		L_f > 30	
1	2		3		4		5	
-	A[c]	B[d]	A[c]	B[d]	A[c]	B[d]	A[c]	B[d]
0.2	5 to 14.5	1 to n[e]	5 to 25	1 to n[e]	5 to 14.5	1 to n[e]	5 to 25	1 to n[e]
0.4	5 to 14.5	1 to n[e]	5 to 25	1 to n[e]	5 to 14.5	1 to n[e]	5 to 25	1 to n[e]
0.5	11.5 to 14.5	3 to n[e]	11.5 to 25	3 to n[e]	9.5 to 14.5	1 to n[e]	9 to 25	1 to n[e]
0.6	12 to 13	5 to n[e]	12 to 25	5 to n[e]	13.5 to 14.5	6 to n[e]	9 to 25	1 to n[e]
0.67	13	7 to n[e]	13 to 16.5	7 to n[e]	13.5 to 14.5	7 to n[e]	10 to 16	5 to n[e]
0.75	14	8 to n[e]	14 to 16.5	8 to n[e]	f	9.5 to n[e]	12 to 12.5	8 to n[e]
Recommended	13 for β ≤ 0.67	13 for β ≤ 0.75	14 to 16.5 for β ≤ 0.75	14 to 16.5 for β ≤ 0.75	13.5 to 14.5 for β ≤ 0.67	13.5 to 14.5 for β ≤ 0.75	12 to 12.5 For β ≤ 0.75	12 to 12.5 For β ≤ 0.75

Diameter Ratio β	Single 90° tee				Any fitting			
	30 > L_f > 18		L_f > 30		30 > L_f > 18		L_f > 30	
1	6		7		8		9	
-	A[c]	B[d]	A[c]	B[d]	A[c]	B[d]	A[c]	B[d]
0.2	5 to 14.5	1 to n[e]	5 to 25	1 to n[e]	5 to 11	1 to n[e]	5 to 13	1 to n[e]
0.4	5 to 14.5	1 to n[e]	5 to 25	1 to n[e]	5 to 11	1 to n[e]	5 to 13	1 to n[e]
0.5	11 to 13	1 to n[e]	11.5 to 25	3 to n[e]	fg	3 to n[e]	11.5 to 14.5	3 to n[e]
0.6	F h	7 to n[e]	12 to 25	5 to n[e]	f	7 to n[e]	12 to 16	6 to n[e]
0.67	f	8 to n[e]	13 to 16.5	7 to n[e]	f	8 to 10	13	7 to $_n$1.5[e]
0.75	f	9 to n[e]	14 to 16.5	8 to n[e]	f	9.5	f	8 to 22
Recommended	13 for β ≤ 0.54	13 for β ≤ 0.75	14 to 16.5 for β ≤ 0.75	14 to 16.5 for β ≤ 0.75	9.5 for β ≤ 0.75	9.5 for β ≤ 0.75	13 for β ≤ 0.67	13 for β ≤ 0.75

Permitted range of straight lengths between an orifice plate and a 19-tube bundle flow straightener (1998) downstream of fittings located at a distance, Lf, from the orifice plate.

Where:

•S is the separation between the two bends measured from the downstream end of the curved portion of the upstream bend to the upstream end of the curved portion of the downstream bend.

•Bends should have a radius of curvature equal to 1,5D.

•Column A for each fitting gives lengths corresponding to “zero additional uncertainty” values (see 6.3.2.3.2).

•Column B for each fitting gives lengths corresponding to “0,5 % additional uncertainty” values (see 6.3.2.3.3).

•n is the number of diameters such that the upstream end of the 19-tube bundle flow straightener (1998) is situated 1D from the downstream end of the curved or conical portion of the nearest fitting. It is desirable that the length between the upstream end of the 19-tube bundle flow straightener (1998) and the downstream end of the curved or conical portion of the nearest fitting should be at least 2,5D, except where this would not give an acceptable value for the distance between the orifice plate and the downstream end of the 19-tube bundle flow straightener (1998).

•It is not possible to find an acceptable location for a 19-tube bundle flow straightener (1998) downstream of

the fitting for all values of Lf to which the column applies.

- If β = 0,46 a value of 9,5 is possible.
- If β = 0,54 a value of 13 is possible.

2. Tek-DP 1690B-Z Zanker Plate Flow Conditions

Beyond 10D from the orifice plate, no additional uncertainty in the discharge coefficient is involved provided that the diameter step (the difference between the diameters) between any two sections does not exceed 2 % of the mean value of D obtained from the measurements specified in (ISO 5167-2 clause no 6.4.2.) Moreover, the actual step caused by misalignment and/or change in diameter shall not exceed 2 % of D at any point of the internal circumference of the pipe. If the pipe diameter upstream of the step is greater than that downstream of it, the permitted diameter and actual steps are increased from 2 % to 6 % of D. On each side of the step, the pipe shall have a diameter between 0,98D and 1,06D. Beyond 10D from the orifice plate, the use of gaskets between sections will not violate this requirement provided that in use they are no thicker than 3,2 mm and they do not protrude into the flow.

At a location which is both beyond 10D from the orifice plate and beyond the first location where an expander could be fitted in accordance with Column 10A of Table 3, no additional uncertainty in the discharge coefficient is involved provided that the diameter step (the difference between the diameters) between any two sections does not exceed 6 % of the mean value of D obtained from the measurements specified in 6.4.2.
Moreover, the actual step caused by misalignment and/or change in diameter shall not exceed 6 % of D at any point of the internal circumference of the pipe. On each side of the step, the pipe shall have a diameter between 0,94D and 1,06D.

An additional uncertainty of 0,2 % shall be added arithmetically to the uncertainty for the discharge coefficient if the diameter step (ΔD) between any two sections exceeds the limits given in 6.4.3 but complies with the following relationship:

$$\frac{\Delta D}{D} < 0.002 \left(\frac{\frac{s}{D} + 0.4}{0.1 + 0.3\,\beta^4} \right) \quad and \quad \frac{\Delta D}{D} < 0.05$$

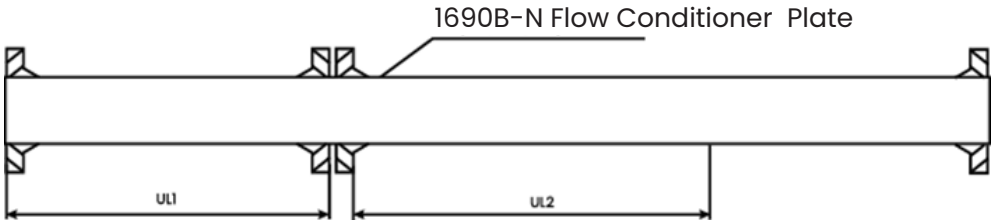
where s is the distance of the step from the upstream pressure tapping or, if a carrier ring is used, from the upstream edge of the recess formed by the carrier ring.

If a step is greater than any one of the limits given in the inequalities above or if there is more than one step outside the limits, the installation is not in accordance with this part of ISO 5167.

No diameter of the downstream straight length, considered along a length of at least 2D from the upstream face of the orifice plate, shall differ from the mean diameter of the upstream straight length by more than 3 %. This can be judged by checking a single diameter of the downstream straight length. Mating flanges would require the bores to be matched and the flanges aligned on installation. Dowels or self-centring gaskets could be used.

3. Tek-DP 1690B-N Flow Conditions Plate

The AGA3/2000/ISO-5167 standards provide guidelines indicating that when using a 1690 B N Flow Conditioner Plate, a meter run length of at least 13 times the pipe diameter (13D) or 17 times the pipe diameter (17D) is suggested. Conversely, a meter run length of 10 pipe diameters is universally recommended for different types of flow meters, such as turbine, ultrasonic, vortex, annubar, and venturi meters.



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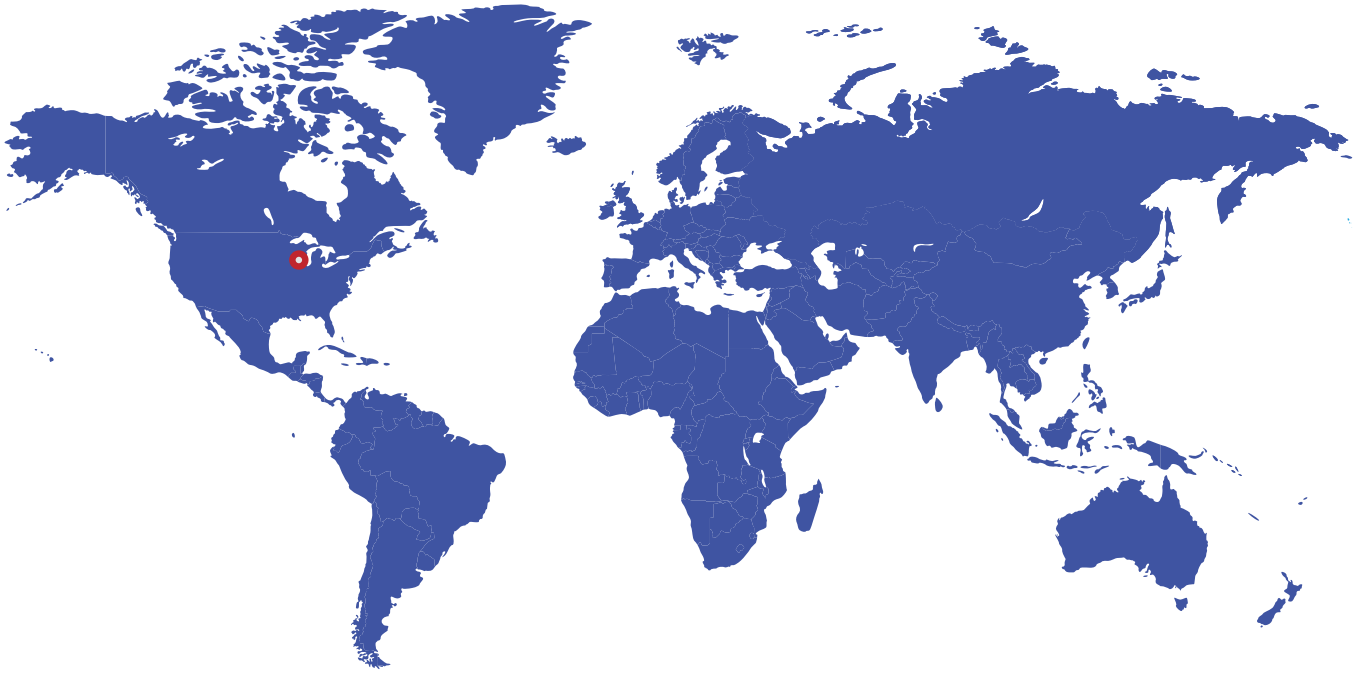

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