ONICON
Measurement Solutions

Seametrics Application Guidelines

TABLE OF CONTENTS

TABLE OF CONTENTS cont.

TABLE OF CONTENTS cont.

TABLE OF CONTENTS cont.

GENERAL COMMENTS

- Nearly all flow meters must be installed so that there is enough run of straight pipe before and after the location of the flow meter. This is intended to allow the straight pipe run to “smooth out” any turbulence produced by the presence of objects such as, but not limited to, valves, diffusers, chemical injectors, pumps and changes in pipe direction. This type of turbulence can produce error in the reading of most flow meters.
- The error can be quite large. The error produced by a partially opened gate, or butterfly valve can be as much as 50-60%. The error produced by a chemical injector can be significant as well. A chlorine injector-diffuser can produce enough entrained undissolved chlorine bubbles to produce an error in the 10-20% range.

GENERAL COMMENTS cont.

- In order to achieve proper accuracy, follow the recommendations in the instruction manual for the model meter you have, or are discussing as straight pipe requirements will vary. Depending on circumstances, and specific applications, you may need more straight pipe run than recommended.
- If you can't provide enough straight pipe run to smooth out the turbulence, you may have to live with the effects it creates. This does not mean that the meter's reading is meaningless, however. In the majority of applications, it will likely be a repeatable reading. In applications where the meter is a control device, operating a valve or controlling chemical injection, repeatability of reading is more critical than accuracy. You may get excellent results . A highly aerated flow cannot be measured reliably by most manufacturers meters.

APPLICATION QUESTIONS

- **What is the pipe size?**
- **What is the pipe type (material)?**
- **What is the pipe schedule?**
- **What is the fluid?**
  - How clean is the water?
  - Is it a chemical?
  - What is the conductivity?
  - What is the viscosity?
- **What is the estimated flow range?**
- **What is the fluid temperature?**
- **What is the pressure?**

APPLICATION QUESTIONS cont.

- **What are the pipe conditions?**
- **Rules of Thumb**
  - Rules of thumb AG/EX90
- **Is the pipe full?**
- **Accuracy required?**
- **Available power: AC, DC or none?**
- **Is a display needed?**
- **Are they sending a signal to another device?**
  - Do they need an output?

APPLICATION QUESTIONS cont.

- Type of installation. (In-line vs. insertion; Mag vs. mechanical)
- Is type of fitting an issue? (Tee, saddle, weld)
- Will the meter be used for billing purposes?
- Are there regulations involved?
- Budget?
- Installation positioning

PIPE SIZE

- **Size of the pipe will help determine what meter will work.**
  - Pipe sizes above 12” will need to be insertion meters.
  - Smaller than 1” limits you to our smaller line of meters.
  - 2”-12” is our broadest range of product offering, so further questions are need to decide which meter is best.

PIPE TYPE (MATERIAL)

- Pipe material will determine operating parameters and can affect accuracy. Wall thickness and pipe I.D.
- Actual O.D. of the pipe can impact what fitting is best, particularly saddles that have a size range.

FLUID

- **If water, how clean is it. If dirty water make sure to define what they mean by dirty water. (Suspended solids, slurry, etc.**
    - What is the source of water; ground or surface. Ground water tends to be cleaner and you have more options. Surface water is typically being pumped from a lake, pond or river source and tends to be dirtier. Mags are better.
    - Any dirty water, however defined, does better with mag meters that have no moving parts.
    - A high number of suspended solids does better with a flanged, or full bore mag.

FLUID Cont.

- **If chemical, what is the chemical, percentage and temperature.**
  - You will need to check the compatibility table on our website under Support & Resources. Knowing the material of the pipe also helps. If PVC for example, then a PVC meter will likely work. You will still have to check other wetted components like, O-rings, electrodes, etc. for compatibility.
  - Be careful when checking the compatibility chart. Higher temperatures can affect how the chemical reacts with various materials.
  - What is the percentage mix? Don't assume a higher concentration makes it worse.
  - NEVER MAKE ASSUMPTIONS WHEN IT COMES TO CHEMICALS, FERTILIZERS OR PESTICIDES!

FLUID Cont.

- **If chemical where is being introduced or injected in to the pipe?**
  - When a mag meter, by any manufacturer, is used in a chemical injection application (including fertigation) **the injection point must be placed downstream of the magmeter OR far enough upstream for complete mixing to occur before the fluid reaches the meter.** When unmixed chemical or fertilizer alternates with water passing through the meter, the rapid changes in conductivity may cause spikes and drops in the meters reading resulting in inaccurate measurement. The magmeter will restabilize, however, with a steady flow of fluid of uniform conductivity.

Caution: In chemical injection or fertigation applications, install chemical injection point downstream of magmeter, or far enough upstream to allow complete mixing of fluids before the meter.

FLUID Cont.

- **Is the fluid conductive?**
  - If mag application you will need to know the conductivity.
  - Mags do not do well with low conductivity, such as oil based fluids. Our mag meters need 20 micro-siemens, or higher, although our mag meters have been known to work well in the mid to low teens
  - If the surface water is primarily snow melt, it may have a very low conductivity.
  - Conductivity should not affect mechanical meters.
- **Is viscosity an issue?**
  - Changing and high viscosity fluids are usually better with mags
  - Higher viscosity fluids can work with mechanical meters if the viscosity doesn't vary or the temperature is consistent. Once the mechanical meters are calibrated to the fluid they should be pretty reliable.

FLOW RANGE

- **What is the estimated flow range?**
  - High flows are usually not an issue with any meter.
  - Make sure to get the minimum flow range. This is where issues tend to come up as it may impact the decision between a meter reading as a percent of full-scale. or a percent of reading or rate.

Example of full-scale versus reading accuracy

- **Reading: Assume a flow range is 10 GPM to 1,000 GPM and quoted accuracy is +/- 1% of reading. At 1,000 GPM accuracy would be +/- 10 GPM. At 10 GPM accuracy would be +/- .1 GPM.**
- **Full-scale: Assume a meter with the same flow range and accuracy is +/- 1% of full-scale. At 1,000 GPM accuracy would be +/- 10 GPM, same as above, but at 10 GPM, accuracy would be +/- 10 GPM.**

TEMPERATURE

- Temperature rating varies across models and may affect which one is recommended.
- Temperature can also affect a chemical's compatibility with a given material.
- Be careful when someone asks if we have hot water meters. Usually this question is in regards to an MJ style meter. Our MJH meters are rated for 194°F. There are suppliers who have a unit rated for 250°F. Depending on requirements, we have a number of meters that are rated to 200°F.

PRESSURE

- Pressure requirements may dictate what model to go with.
- Most applications are under 150 PSI.
- Seametrics offers meters ranging from 150 PSI up to 200 PSI. (The SES is rated to 500 PSI)

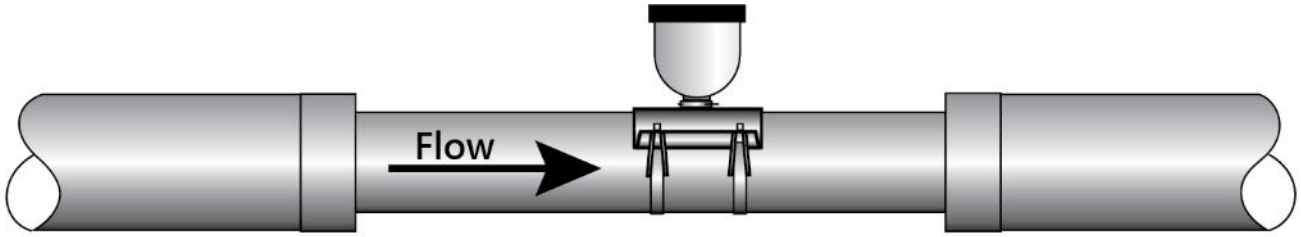
GENERAL PIPE CONDITIONS

- How much straight pipe is available?
- Is the pipe full?
- Are there any disturbances upstream, (more critical than downstream) and if so, what are they?
- Are there any disturbances downstream, and if so, what are they?
- Is the flow highly aerated?
- Is the pipe vertical or horizontal?

STRAIGHT PIPE CONDITION

- **Straight pipe requirements**
  - 10/5
    - EX800, EX100, EX200, IP800, IP100, IP200, WJ, WTP, WTS
  - 5/5
    - SPX, SPT, SES, SEB
  - 2/1
    - AG3000, iMAG4700, WMP
  - No up/down
    - PE, MJ, MJH, MJN, MJP

REDUCED PIPE CONDITION



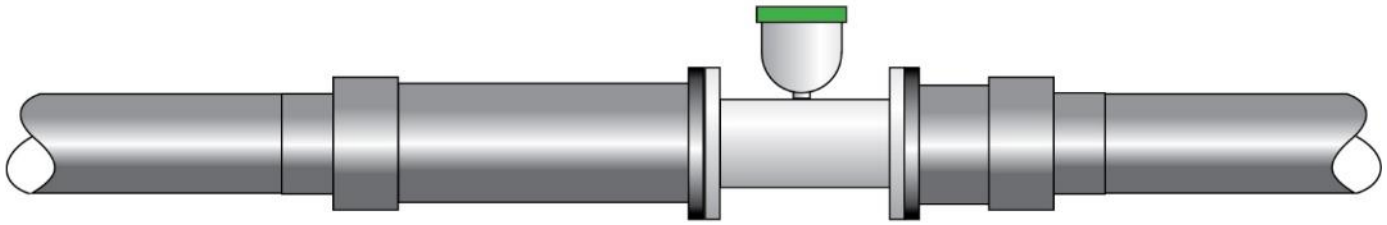
Reduced Pipe

- **Reduced pipe presents no additional concerns and requires no additional straight pipe.**

REDUCED PIPE CONDITION cont.

- **Reduced pipe requirements**
  - 10/5
    - EX800, EX100, EX200, IP800, IP100, IP200, WJ, WTP, WTS
  - 5/5
    - SPX, SPT, SES, SEB
  - 2/1
    - AG3000, iMAG4700, WMP
  - No up/down
    - PE, MJ, MJH, MJN, MJP

EXPANDED PIPE CONDITION



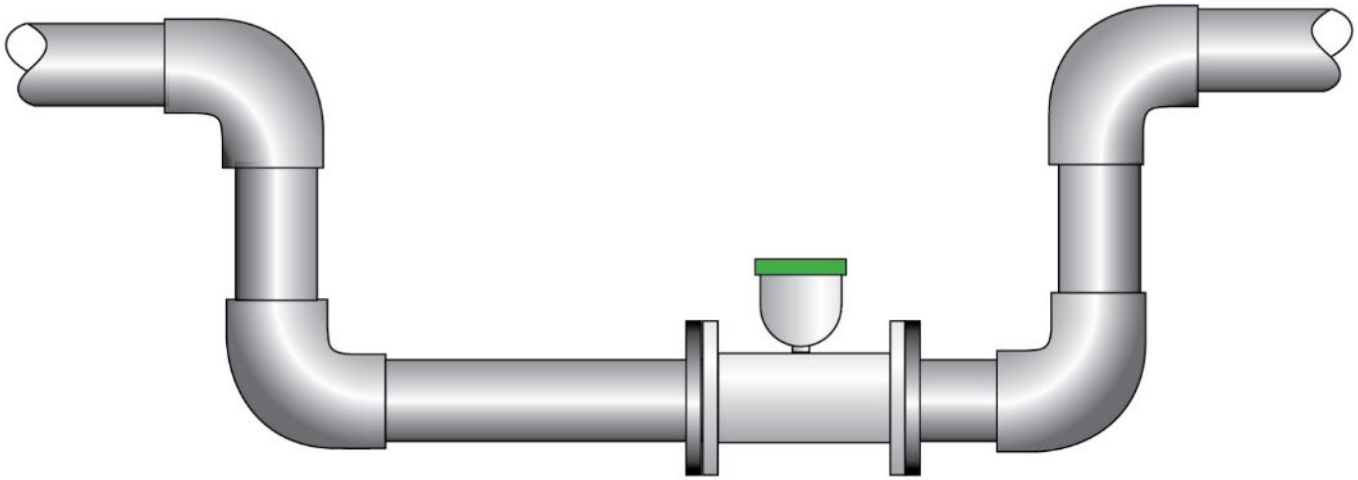
Expanded Pipe

- Expanded pipe creates a jetting effect and requires additional straight pipe.

EXPANDED PIPE CONDITION cont.

- **Expanded pipe requirements**
  - 20/5
    - EX800, EX100, EX200, IP800, IP100, IP200, WJ, WTP, WTS
  - 10/5
    - SPX, SPT, SES, SEB
  - 5/1
    - AG3000, iMAG4700, WMP
  - No up/down
    - PE, MJ, MJH, MJN, MJP

TWO ELBOWS, IN PLANE



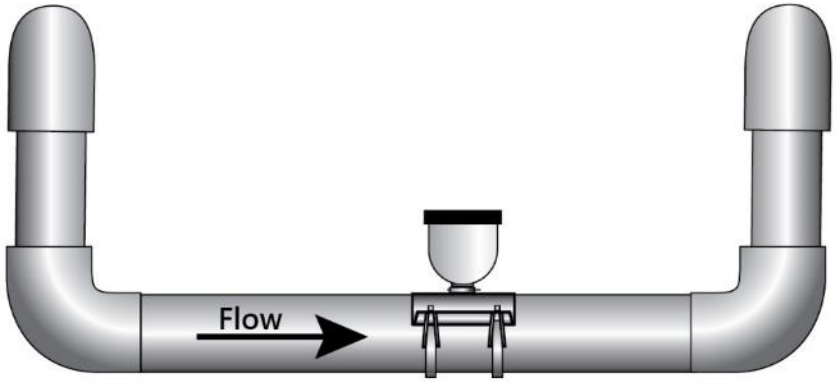
Two Elbows, in Plane

- Two elbows in plane present additional concerns and requires additional straight pipe.

TWO ELBOWS, IN PLANE cont.

- **Two elbows in plane requirements**
  - 15/5
    - EX800, EX100, EX200, IP800, IP100, IP200, WJ, WTP, WTS
  - 10/5
    - SPX, SPT, SES, SEB
  - 2/1
    - AG3000, iMAG4700, WMP
  - No up/down
    - PE, MJ, MJH, MJN, MJP

TWO ELBOWS, OUT OF PLANE



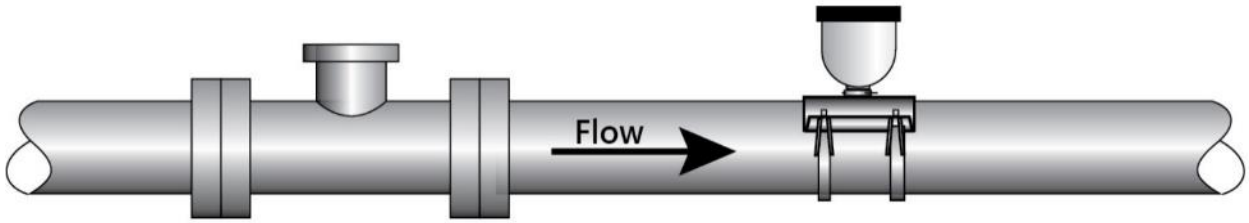
Two Elbows, Out of Plane

- **Two elbows out of plane present additional concerns and requires more additional straight pipe than two elbows in plane.**

TWO ELBOWS, OUT OF PLANE cont.

- **Two elbows out of plane requirements**
  - 20/5
    - EX800, EX100, EX200, IP800, IP100, IP200, WJ, WTP, WTS
  - 10/5
    - SPX, SPT, SES, SEB
  - 2/1
    - AG3000, iMAG4700, WMP
  - No up/down
    - PE, MJ, MJH, MJN, MJP

SPIRALING FLOW CONDITION



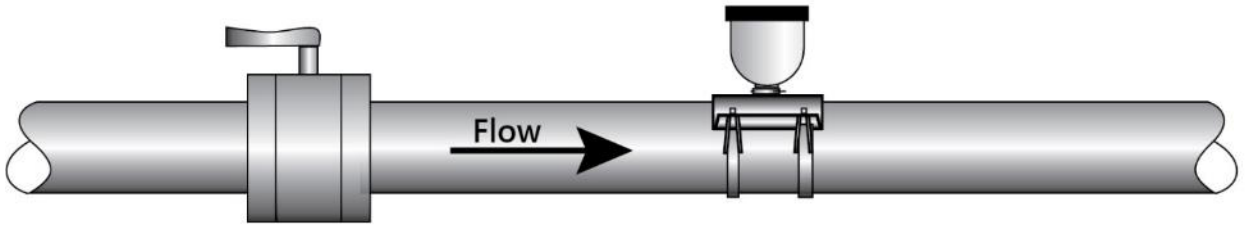
Spiraling Flow Propeller Meter

- **A Spiraling flow propeller meter, installed upstream, presents additional concerns and requires additional straight pipe.**

SPIRALING FLOW cont.

- **Spiraling flow (propeller upstream) requirements**
  - 30/5
    - EX800, EX100, EX200, IP800, IP100, IP200, WJ, WTP, WTS
  - 15/5
    - SPX, SPT, SES, SEB
  - 5/1
    - AG3000, iMAG4700, WMP
  - No up/down
    - PE, MJ, MJH, MJN, MJP

BUTTERFLY VALVE CONDITION



Butterfly Valve

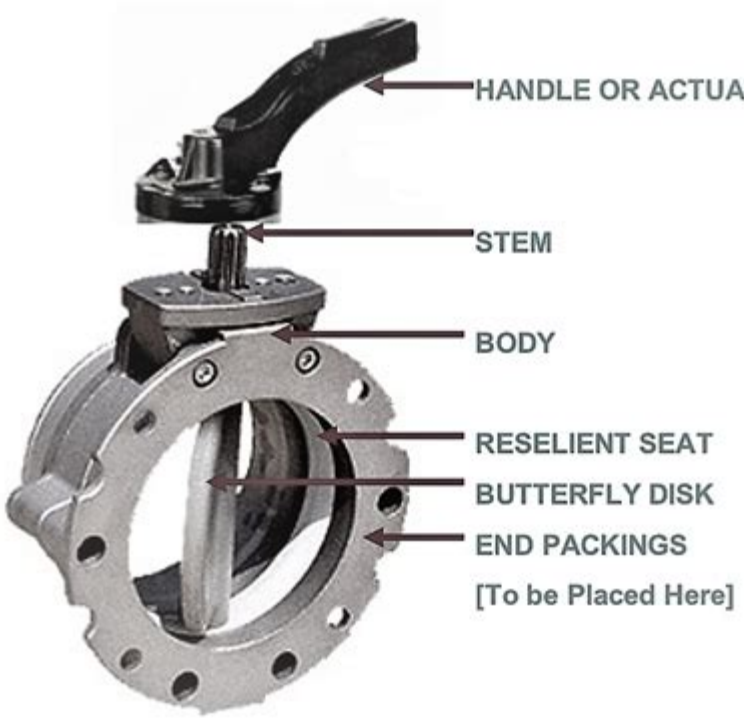
- **A partially opened butterfly valve, installed upstream, presents additional concerns and requires additional straight pipe.**

BUTTERFLY VALVE cont.

- **Swirling flow (Partially open valve upstream) requirements**
  - 50/5
    - EX800, EX100, EX200, IP800, IP100, IP200, WJ, WTP, WTS
  - 25/5
    - SPX, SPT, SES, SEB
  - 5/1
    - AG3000, iMAG4700, WMP
  - No up/down
    - PE, MJ, MJH, MJN, MJP

BUTTERFLY VALVE cont.

Butterfly Valve Example



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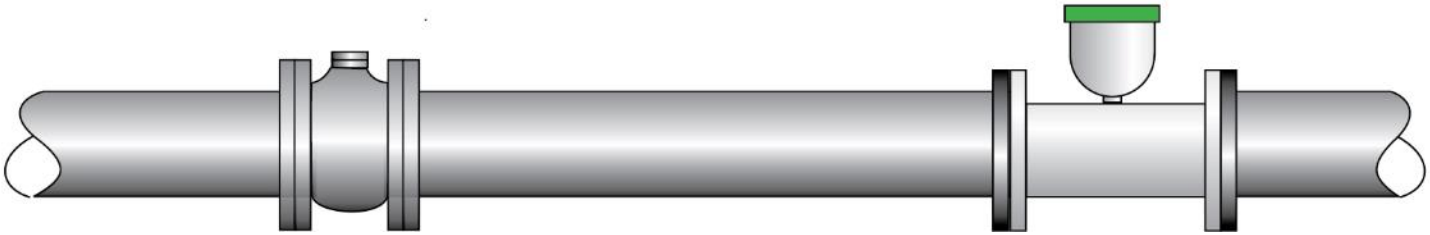
CHECK VALVE CONDITION



Check Valve

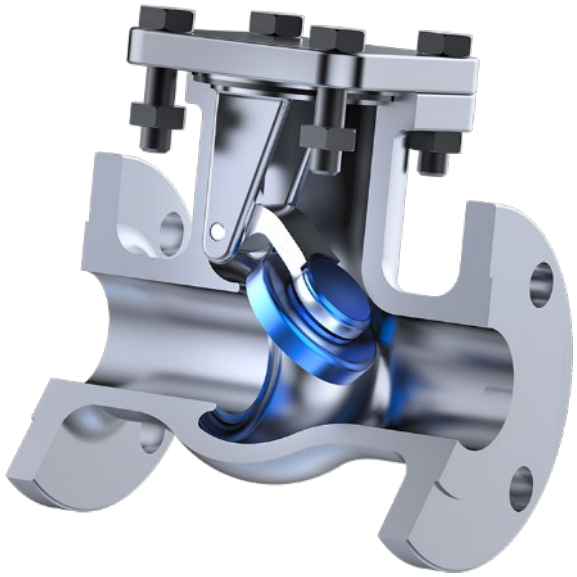
- A partially opened check valve, installed upstream, presents additional concerns and requires additional straight pipe.

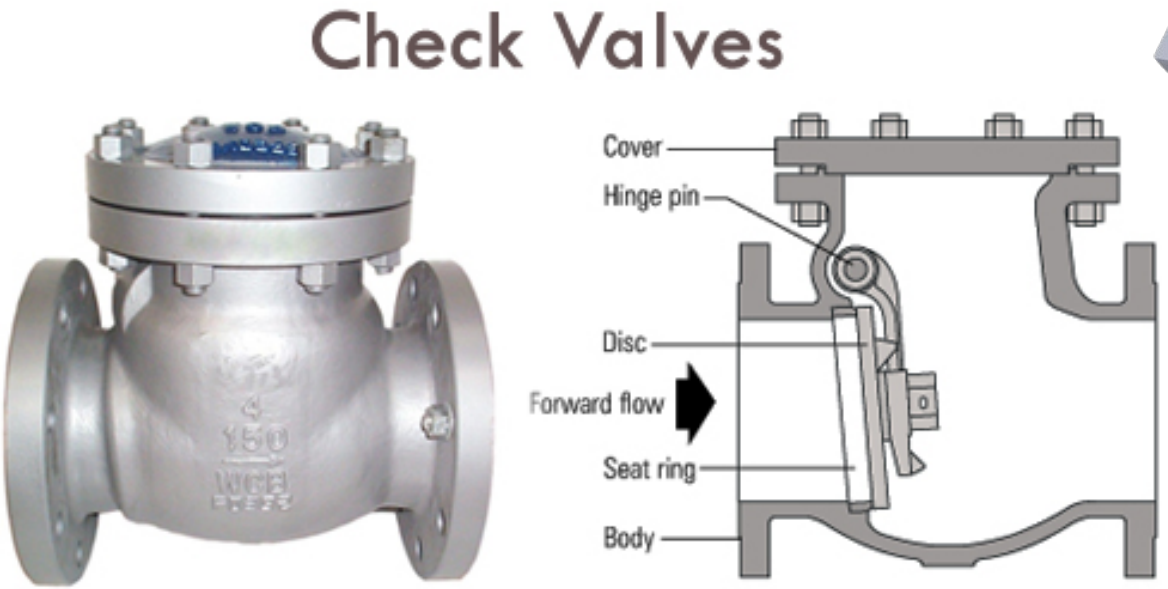
CHECK VALVE cont.

- **Swirling flow (Partially open valve upstream) requirements**
  - 50/5
    - EX800, EX100, EX200, IP800, IP100, IP200, WJ, WTP, WTS
  - 25/5
    - SPX, SPT, SES, SEB
  - 5/1
    - AG3000, iMAG4700, WMP
  - No up/down
    - PE, MJ, MJH, MJN, MJP

CHECK VALVE cont.

- **Check Valve Example**





GATE VALVE CONDITION

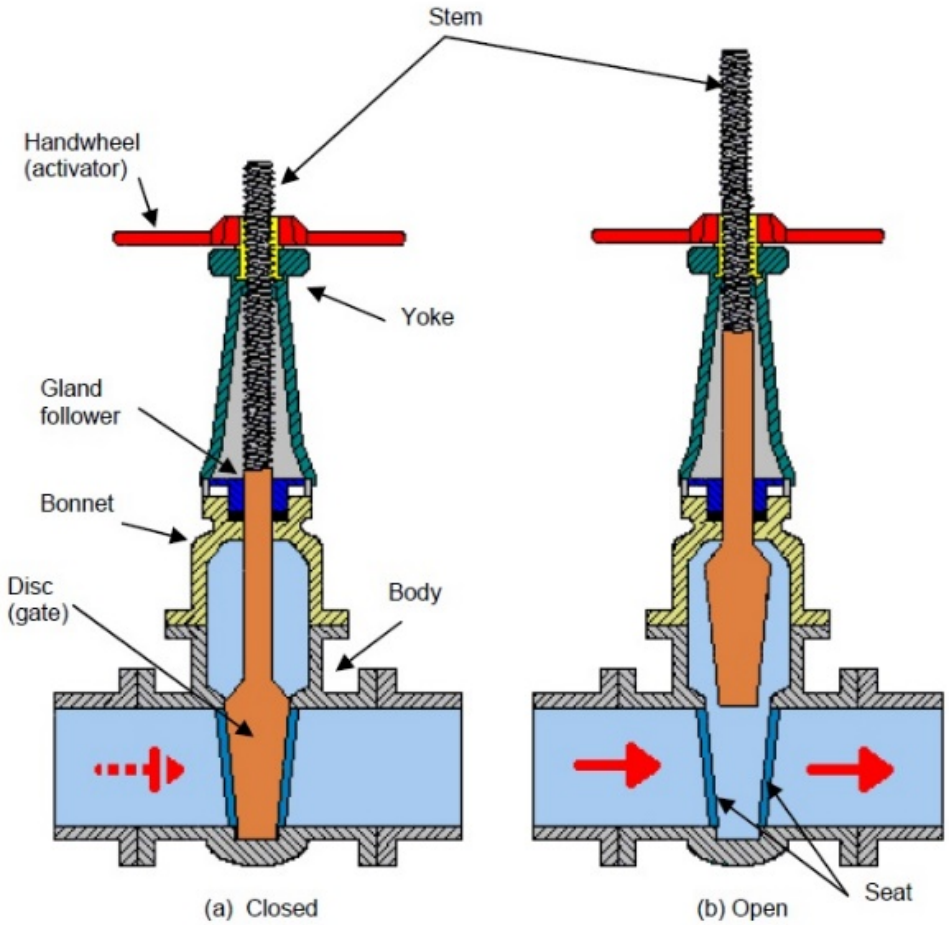
- A partially opened gate valve, installed upstream, presents additional concerns and requires additional straight pipe.

GATE VALVE cont.

- **Swirling flow (Partially open valve upstream) requirements**
  - 50/5
    - EX800, EX100, EX200, IP800, IP100, IP200, WJ, WTP, WTS
  - 25/5
    - SPX, SPT, SES, SEB
  - 5/1
    - AG3000, iMAG4700, WMP
  - No up/down
    - PE, MJ, MJH, MJN, MJP

GATE VALVE cont.

- **Gate Valve Example**



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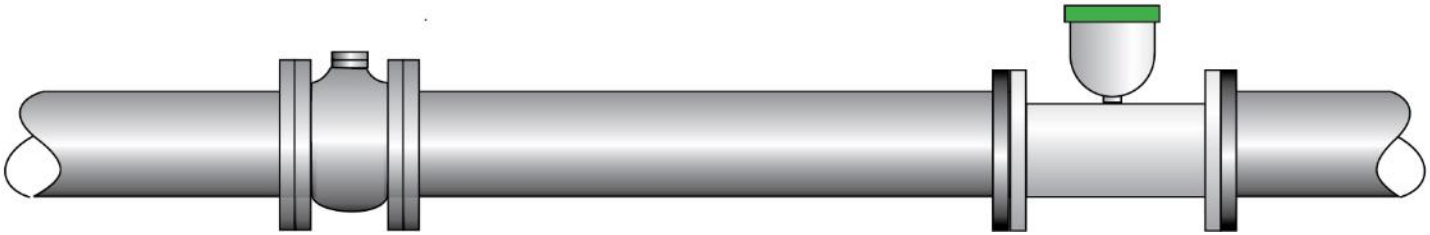
PROPORTIONAL VALVE CONDITION



Proportional Valve

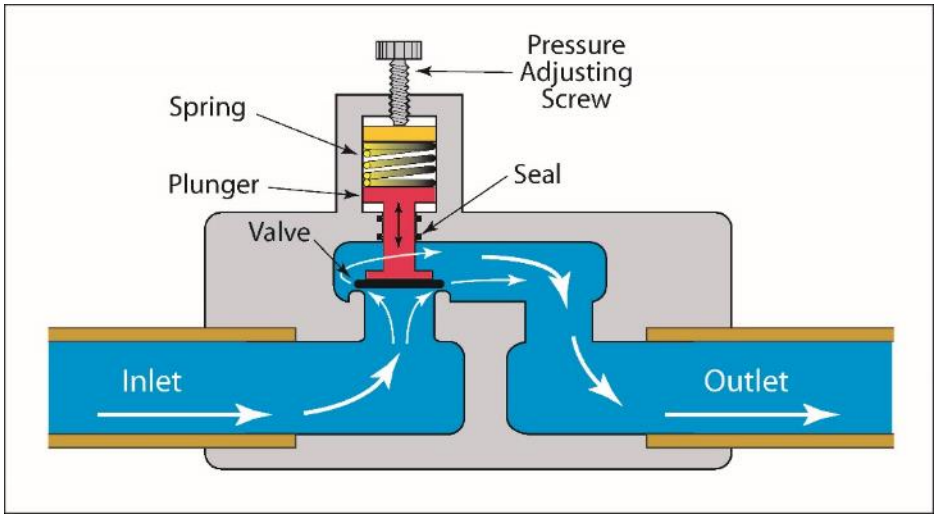
- A partially opened proportional valve, installed upstream, presents additional concerns and requires additional straight pipe.

PROPORTIONAL VALVE cont.

- **Swirling flow (Partially open valve upstream) requirements**
  - 50/5
    - EX800, EX100, EX200, IP800, IP100, IP200, WJ, WTP, WTS
  - 25/5
    - SPX, SPT, SES, SEB
  - 5/1
    - AG3000, iMAG4700, WMP
  - No up/down
    - PE, MJ, MJH, MJN, MJP

PROPORTIONAL VALVE cont.

- Proportional or pressure reducing valves cause major disruptions to the flow profile and requires additional straight pipe.



AG/EX90 RULES OF THUMB

- The best way to view this meter is that there are three different linearization programs built in to the meter based on up stream conditions These programs help us achieve a linear meter response.
- To assist customers in achieving the best performance, you are recommending the linearization program that best matches the application or installation.
- The program is selected during initial set-up and referred to in the meter program as Straight Pipe, 10/2 and 5/2, referencing up stream/down stream pipe lengths. (Straight pipe is defined as 20up/2down.)
- The goal is for these programs to get the meter within specified tolerance, or close enough that they can then use the Adjustment Feature to “dial” the meter in for an acceptable installation.

AG/EX90 RULES OF THUMB cont.

- Guidelines and questions should be similar for both new installations and propeller replacement installations. Keep in mind that many of the installed propeller meters were not originally installed in an ideal location to begin with. If the propeller was not installed under the best conditions, then we are trying to get our meter to perform as close to spec as possible, but it may be off depending on how severe installation conditions are.

AG/EX90 STRAIGHT PIPE SELECTION

- **The meter has 3 selections for straight pipe:**
  - 5 up / 2 down (After an elbow in plane)
  - 10 up / 2 down (After an elbow in plane)
  - Straight pipe (20 up / 2 down) (After an elbow in plane)
- **If the installation position is in between, start by choosing the pipe configuration closest to what they have available.**
  - After selecting the closest configuration, if they feel they are not close enough, they have the ability to adjust the number up, or down by 10% to “dial” it in.

AG/EX90 REDUCED/EXPANDED PIPE cont.

- **Reduced pipe:**
  - For reduced pipe, use the same recommendations as straight pipe. (See previous slide.)
- **Expanded pipe:**
  - Start by recommending 20x upstream, if available
    - Choose Straight Pipe for configuration
    - If further adjustment is needed, use the Adjustment Feature
    - If further adjustment is still needed use the 10/2 and 5/2 Pipe Configuration.
  - If they do not have 20x upstream
    - Select 10/2 or 5/2 Pipe Configuration instead of Straight Pipe.
    - If further adjustment is needed, use the Adjustment Feature.

AG/EX90 TWO ELBOWS, IN PLANE

- **Two elbows in plane**
  - Choose Straight Pipe, 10/2 or 5/2 configuration based on the amount of straight pipe available after the elbow.
    - If available straight pipe is in between, start with the closest configuration.
    - If further adjustment is needed, use the Adjustment Feature

AG/EX90 TWO ELBOWS, OUT OF PLANE

- **Two elbows out of plane**
  - Start by recommending 20x upstream, if available
    - Choose Straight Pipe for configuration
    - If further adjustment is needed, use the Adjustment Feature
    - If further adjustment is still needed use the 10/2 and 5/2 Pipe Configuration.
  - If they do not have 20x upstream
    - Select 10/2 or 5/2 Pipe Configuration instead of Straight Pipe.
    - If further adjustment is needed, use the Adjustment Feature.

AG/EX90 SPIRALING FLOW

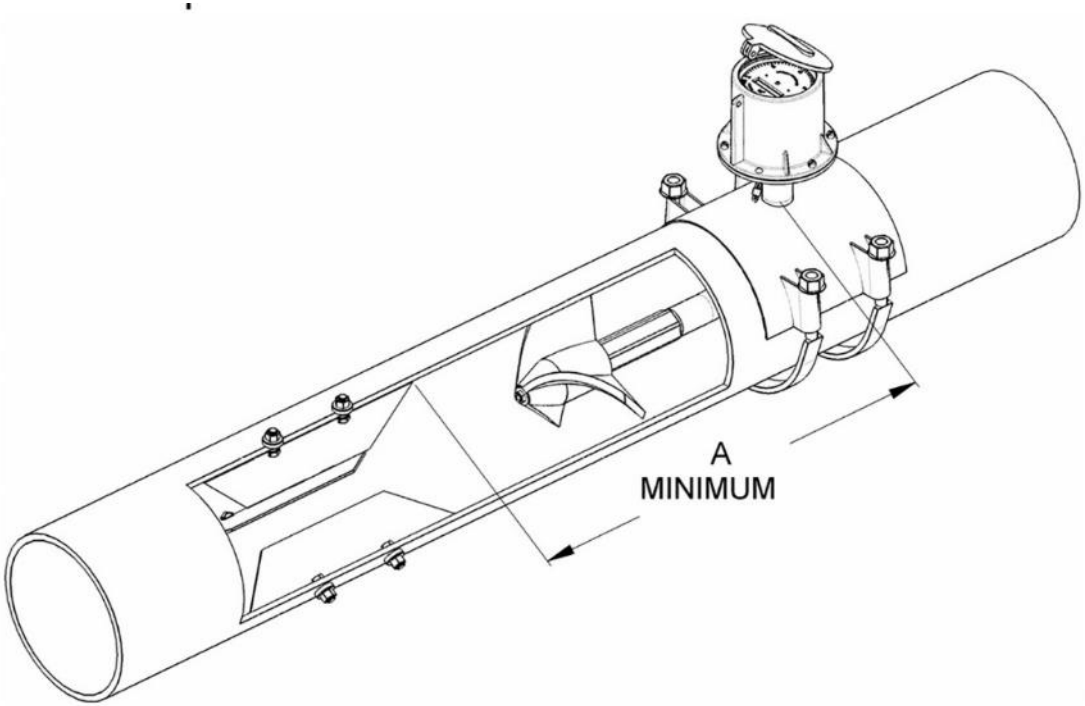
- **Spiraling flow**
  - Start by recommending 30x upstream, if available
    - Choose Straight Pipe for configuration
    - If further adjustment is needed, use the Adjustment Feature
    - If further adjustment is still needed use the 10/2 and 5/2 Pipe Configuration.
  - If they do not have 30x upstream
    - Select 10/2 or 5/2 Pipe Configuration instead of Straight Pipe.
    - If further adjustment is needed, use the Adjustment Feature.

AG/EX90 SWIRLING FLOW

- **Swirling flow (Partially opened valve)**
  - Start by recommending 50x upstream, if available
    - Choose Straight Pipe for configuration
    - If further adjustment is needed, use the Adjustment Feature
    - If further adjustment is still needed use the 10/2 and 5/2 Pipe Configuration.
  - If they do not have 50x upstream
    - Select 10/2 or 5/2 Pipe Configuration instead of Straight Pipe.
    - If further adjustment is needed, use the Adjustment Feature.

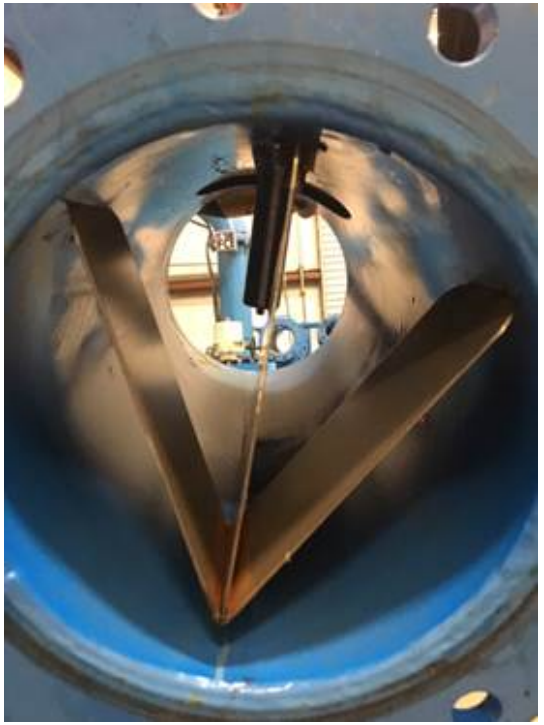
AG/EX90 STRAIGHTENING VANES

- **Straightening Vanes**
  - If the customer has standard McCrometer straightening vanes they should be OK.
    - Follow standard installation recommendations.



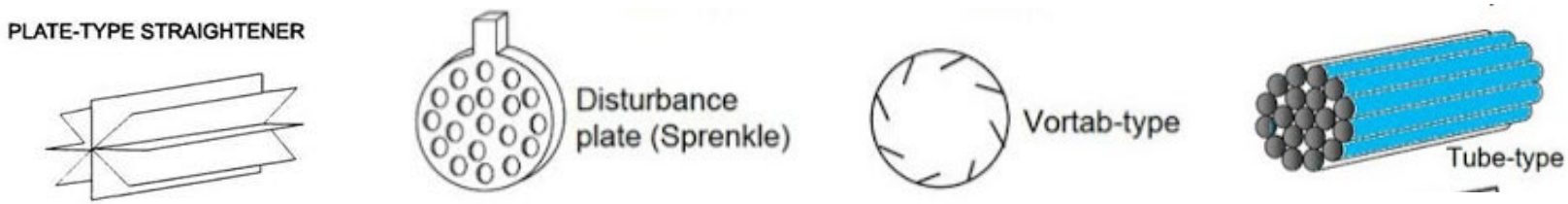
AG/EX90 STRAIGHTENING VANES cont.

- **Straightening Vanes**
  - If the customer has a non-standard McCrometer flow straightener, or straightening vanes that extend into the center of the pipe and aligned with the AG/EX90, it is recommended they remove them as they will see a shift in performance.



AG/EX90 STRAIGHTENING VANES cont.

- **Straightening Vanes**
  - If the customer has straightening vanes manufactured by a company that vanes are their primary business, such as Vortab®, or if they have tube type or orifice type plates such as a modified Zanker plate, etc. then they should be OK. (Examples below.)



    - Follow standard installation recommendations.
  - If the customer has straightening vanes that are other than standard, recommend they remove the vanes, if possible.
    - If the vanes are permanently installed in a spool, recommend they remove the spool and reinstall it with the vanes after the meter, or 180° of it's initial installation.

FULL PIPE

- **In general:**
  - Better conditions if flow is upwards in a vertical pipe as opposed to downward.
  - Vertical flow creates back pressure, giving you less chance of air pockets or disturbances.
  - Downward flow can cause disturbances (air pockets) in the flow stream and create conditions where the pipe is not completely full.
  - If the pipe is fully pressurized, ensuring the pipe is full of water, downward flow is acceptable.
  - Seametrics meters do not work in a partially filled pipe.

FULL PIPE cont.

Figure 1

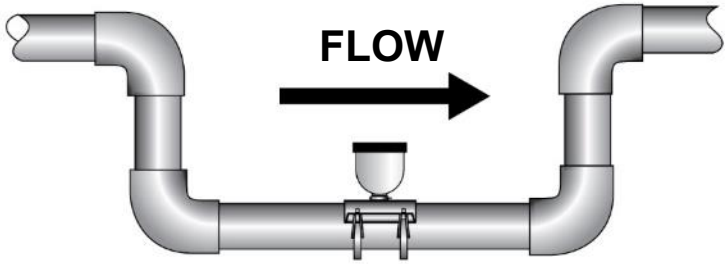
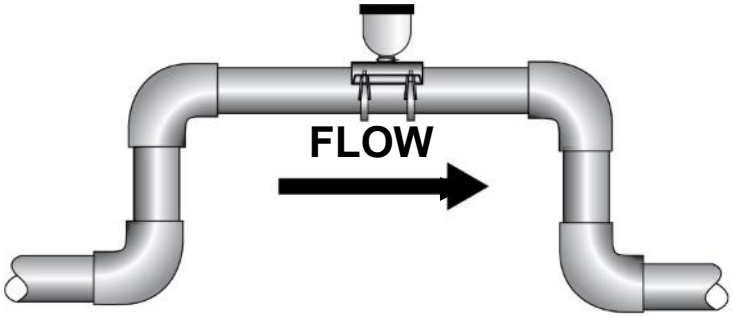


Figure 2



- Figure 1 is recommended: The upward flow, after the meter, creates back pressure helping to keep the pipe full.
- Figure 2 is not ideal: The downward flow, after the meter, allows air pockets to form. A fully pressurized pipe is OK.

FULL PIPE cont.

Figure 1

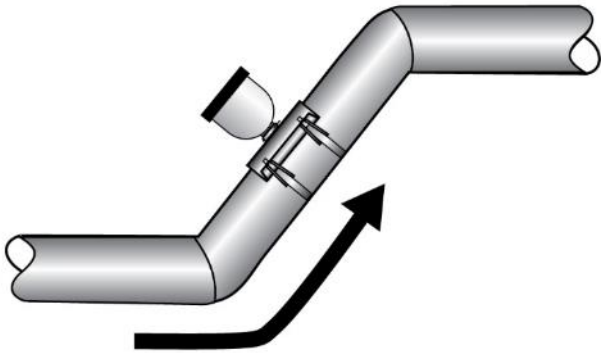
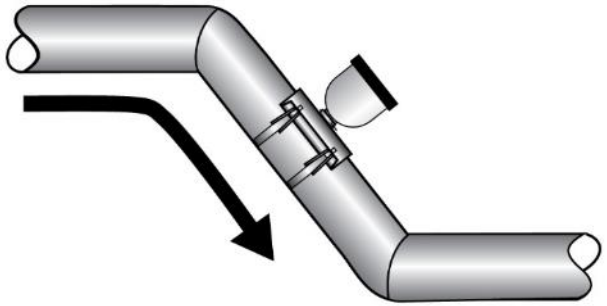


Figure 2



- Figure 1 recommended: Upward flow creates back pressure allowing air to bleed off helping to keep the pipe full.
- Figure 2 is not ideal: Downward flow allows air pockets to form and be trapped. A fully pressurized pipe is OK.

FULL PIPE cont.

Figure 1

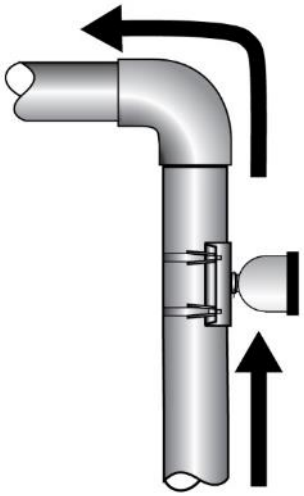
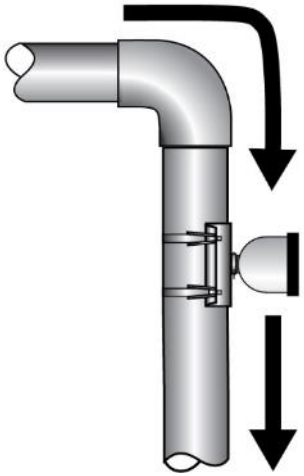


Figure 2



- Figure 1 is recommended: The upwards flow creates back pressure helping to keep the pipe full.
- Figure 2 is not ideal: The downward flow allows air pockets to form. A fully pressurized pipe is OK.

FULL PIPE cont.

Figure 1

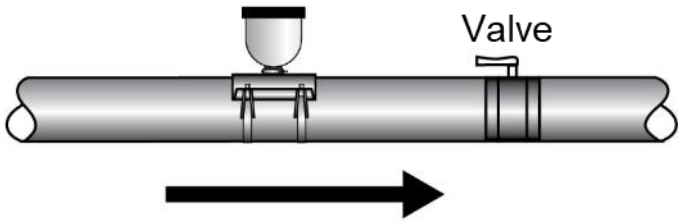
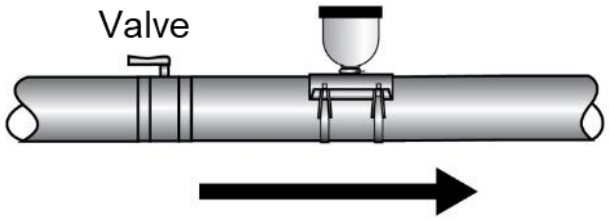


Figure 2



- **Figure 1 recommended: A valve located after the meter helps keep the pipe full.**
- **Figure 2 is not ideal: Post-valve cavitation can create a disturbance and air pockets.**

ACCURACY

- **Are there accuracy requirements?**
  - Can the expected accuracy be a percent of reading, or is a percent of full scale acceptable?

Example of full-scale versus reading accuracy

- **Reading: Assume a flow range is 10 GPM to 1,000 GPM and quoted accuracy is +/- 1% of reading. At 1,000 GPM accuracy would be +/- 10 GPM. At 10 GPM accuracy would be +/- .1 GPM.**
- **Full-scale: Assume a meter with the same flow range and accuracy is +/- 1% of full-scale. At 1,000 GPM accuracy would be +/- 10 GPM, same as above, but at 10 GPM, accuracy would be +/- 10 GPM.**

POWER

- Is power available?
- Is the available power AC or DC?
- Is a power supply needed?
- Do we offer a battery powered unit that will work?
- Will a solar panel work if we do not offer a battery powered unit.

DISPLAY/ELECTRONICS

- **Is a display needed?**
  - Are they just totalizing or will they need flow rate as well?
  - Will they be going directly into a PLC or other type of controller or device?
  - Do they need a meter, wall or panel mounted display.
- **Are they sending a signal to another device? What type of output will they need?**
  - Dry contact Reed-Switch pulse like an MJ or WJ, Hall Effect pulse, 4-20 mA, Modbus, High-Speed Digital or HART
- **Will they need to record data over a long period for reference and need a Data Logger.**

INSTALLATION TYPE

- Is the application better suited for an in-line or insertion meter?
- What type of fitting is needed or required? (Tee, saddle or weld.)

BILLING

- **Is the meter going to be used for billing purposes?**
  - A full bore meter is more accurate and better for billing purposes.
  - Other meters can be used a good “water management tool”, but not recommended for billing purposes.

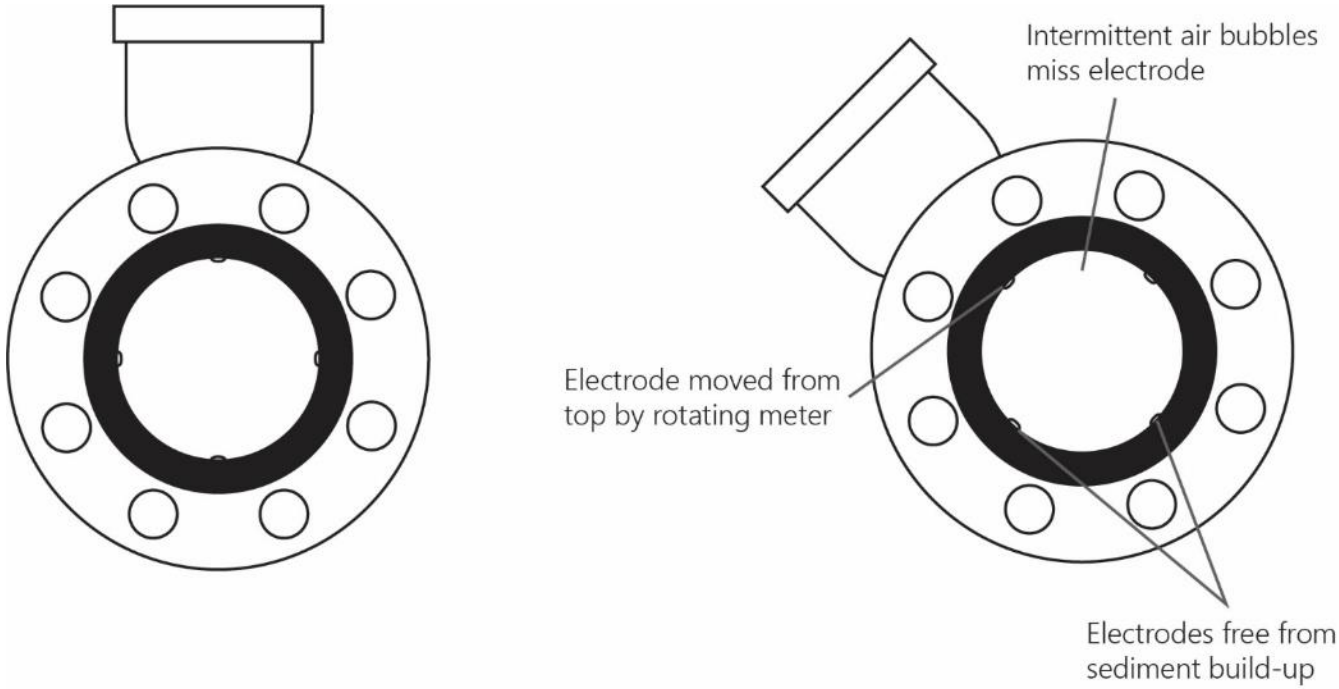
REGULATIONS

- **Are the meters going to be regulated?**
  - A meter with tampering features is required.
    - Electronics that can be password protected, with a passcode.
    - Housings that cannot be opened without cutting a security wire.
    - Meters that cannot be removed from the fitting, or pipe, without cutting a security wire of some sort.
- **Are there local installation requirements?**
  - Example 1: Although our spec for a flange mag and straight pipe are 2 diameters up and 1 diameter down, the state of Kansas requires 5 up and 2 down. If the installer installs to our 2/1 spec the state will make them reinstall the meter at another location to the 5/2 spec.
  - Example 2: Some locations in Colorado do not allow a user interface.

BUDGET

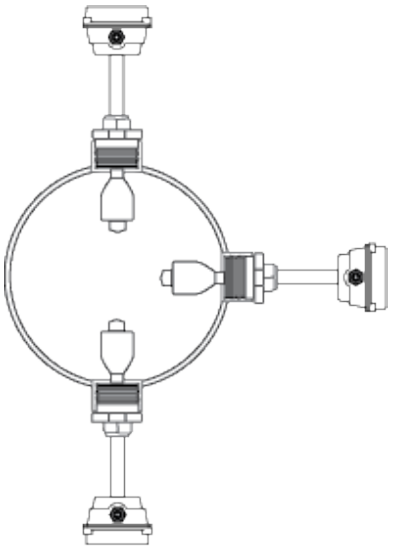
- **What is the general price point they are looking for.**
  - If they are looking for a cheap $50 meter, we have nothing to offer. Best to let them know and not spend a lot of time on the application.

FLANGED METER POSITIONING



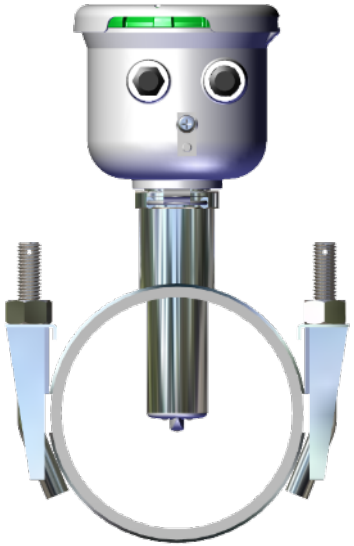
- **Rotating the meter one bolt hole helps prevents air, sediment or a less-than-full pipe condition from affecting the meter.**

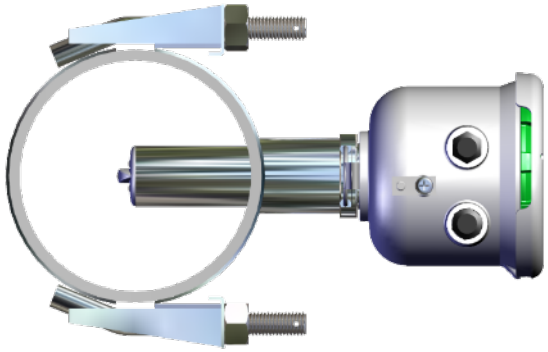
STANDARD INSERTION METER POSITIONING



- For standard insertion meters (where the tips are installed to approximately 12% the diameter of the pipe) the 12:00 and 6:00 positions are not ideal. At 12:00, air turbulence can affect reading and at 6:00 reading can be affected by sediment in the pipe. If either of these occur then the 3:00 or 9:00 positions are best

AG/EX90 INSERTION METER POSITIONING





- Because the AG/EX 90 electrodes are inserted to the middle of the pipe they are not easily affected by (1) air turbulence at the top of the pipe or (2) sediment at the bottom. 12:00, 9:00 or 3:00 positions are all acceptable.

CONCLUSION