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 PROCESS & CONTROL ENGINEERING



PRINT PROFILE

Every month, PACE magazine features meticulously researched stories covering topics such as control, automation, sensing, instrumentation, fluid handling, test and measurement, safety control systems and network and communications.

With the highest circulation out of all publications in the process control industry, PACE magazine is a great way for you to build brand awareness and educate the market on your product/service.

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ONLINE PROFILE

With an average of over 13,000 page impressions per month, pacetoday.com.au is Australia's leading process and control industry website.

Specifically designed to be the community hub for process control, automation and instrumentation engineers, visitors are presented with essential news, new products and features as well as content from the print magazine. In addition, industry professionals are encouraged to register and submit product news, event listings and relevant company news.



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- OVER 5,700 UNIQUE VISITORS PER MONTH

Source: Google Analytics June – Aug 2011

FEATURES

Please send all editorial content to: editor@pacetoday.com.au | Features may change at editor's discretion

FEBRUARY 2012	MARCH 2012	APRIL 2012	MAY 2012	JUNE 2012	JULY 2012
<ul style="list-style-type: none"> • Sensors & Analysers • Process Control in Power Generation • SCADA & MES • Water & Wastewater 	<ul style="list-style-type: none"> • Instrumentation • PLCs & Soft Control • Energy Management • Process Control in Mining 	<ul style="list-style-type: none"> • Motors, Drives & Motion Control • Information Integration • Wireless Technology • Process Control in Food & Pharmaceuticals 	<ul style="list-style-type: none"> • Safety Systems • Connectivity and Networking • National Manufacturing Week: Preview • PACE Zenith Awards 2012: Finalists Issue 	<ul style="list-style-type: none"> • Test & Measurement • SCADA & MES • Water & Wastewater • Instrumentation 	<ul style="list-style-type: none"> • Energy Management • Process Control in Mining (QME issue) • PACE Zenith Awards 2012: Winners Issue
BOOKING: MON 09 JAN MATERIAL: TUE 17 JAN	BOOKING: FRI 03 FEB MATERIAL: TUE 14 FEB	BOOKING: FRI 02 MAR MATERIAL: FRI 09 MAR	BOOKING: TUE 03 APR MATERIAL: FRI 13 APR	BOOKING: WED 02 MAY MATERIAL: FRI 11 MAY	BOOKING: THU 07 JUN MATERIAL: TUE 19 JUN
AUGUST 2012	SEPTEMBER 2012	OCTOBER 2012	NOVEMBER 2012	DECEMBER 2012	
<ul style="list-style-type: none"> • Motors, Drives & Motion Control • Wireless Technology • Process Control in Oil & Gas (QGCE + M&E issue) • PLCs & Soft Control 	<ul style="list-style-type: none"> • Water & Wastewater • Information Integration • Sensors & Analysers • Process Control in Power Generation 	<ul style="list-style-type: none"> • Instrumentation • Discrete Control • Process Control in Mining (GME issue) • Process Control in Building Automation 	<ul style="list-style-type: none"> • Test & Measurement • SCADA & MES • Motors, Drives & Motion Control • Asset Management & Maintenance 	<ul style="list-style-type: none"> • Fluid Handling • Sensors & Analysers • Process Control in Food & Pharmaceuticals • Wireless Technology 	
BOOKING: FRI 29 JUN MATERIAL: TUE 10 JUL	BOOKING: THU 02 AUG MATERIAL: FRI 10 AUG	BOOKING: WED 05 SEP MATERIAL: FRI 14 SEP	BOOKING: WED 03 OCT MATERIAL: FRI 12 OCT	BOOKING: FRI 02 NOV MATERIAL: FRI 09 NOV	



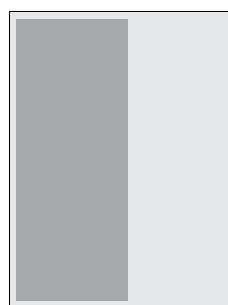
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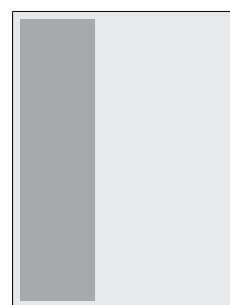
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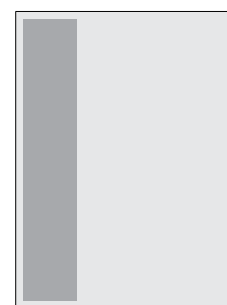
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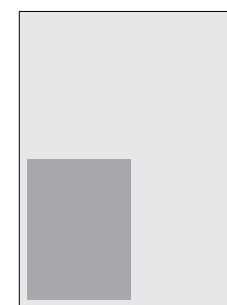
1/3 V



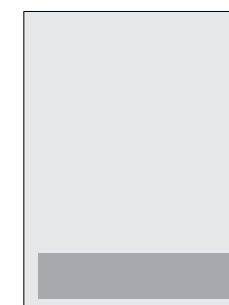
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How to deal effectively with complex unpredictable flow profiles

Well-designed flow conditioners can present a consistent and predictable outlet flow profile to the flow meter, write Mike Bess and Don Lundberg.

Flow conditioners are widely recognized and applied to solve complex flow profile distortions caused by upstream flow disturbances. These unpredictable flow profile variations can be controlled by a well-designed flow conditioner. Such flow conditioners are capable of presenting a consistent and predictable outlet flow profile to the flow meter, resulting in accurate and repeatable flow measurements.

However, when installed in wide-section flow measurement applications with Reynolds number ranges that go below 1000, are the effects of these normally repeating transitional flow profile phenomena.

These transitional flow flow distortions differ to the flow velocity profile that design flow meters assume and equalize. A well-designed flow conditioner can effectively neutralize transitional flow effects.

Flow conditioning

To optimize the value of flow conditioning in applications with normally repeating flow profile variations, it is flow accuracy or uniform flow flow profiles can change. Engineers specifying flow measuring technologies are quite aware that flow profile distortions will directly result in measurement inaccuracies. Engineers who understand that flow profiles are a function of pipe geometry, Reynolds number, their internal pipe roughness, and rate of change.

In many applications with low flow distortion and with turbulent, velocity flows are well understood. It is the flow profile also maintains diameter, and velocity variations can still be maintained. Flow measuring instruments are a function of a critical measuring range.

Consider the difference between laminar and turbulent flow conditions. Laminar flow occurs at the velocity where the Reynolds is below 2000. Turbulent flow occurs typically above Re of 4000. When flow occurs between the 2000-4000 Re region, it is commonly referred to as the transitional flow range. However, depending on the diameter, other measuring or measuring flow, and the rate of change, transitional flow can continue up to 7000 Re.

Figure 1 compares laminar or turbulent flow profiles. The laminar profile takes on a parabolic shape where the relationship between the average velocity and maximum velocity

FIGURE 1: The laminar profile takes on a parabolic shape where the relationship between the average velocity and maximum velocity is quite distinct, when compared to the turbulent flow profile. (Source: Richard Miles, Flow Measurement Engineering Handbook.)

to quite dramatic when compared to the turbulent flow profile.

As the Reynolds number and velocity increase from 2000 to up to 4000 Re, the relationship between the average velocity V_{avg} and the maximum velocity V_{max} (total) dramatically increases from 66 percent up to nearly 90 percent. Accordingly, the velocity profile from the transition to the pipe wall, a line changing as a function of Reynolds number, pipe flow measuring instruments will be susceptible to profile changes during the operational flow range or large varying ranges.

Typically, all pipe diameter applications are not perfectly repeatable, regardless of whether they are customer purchased or lower-cost, mass-produced. These types of profile effects are possible, even

The changing and unpredictable flow profiles in the transitional Reynolds number ranges.

Flow meters with turbulent capability and low-flow accuracy.

In a world, it is common for equipment that includes laminar-measured and turbulent profiles. Fortunately, a relatively new technology has both laminar flow rate and turbulent flow rate during the same measurement conditions, as these profile variations can be neutralized during flow conditioning.

Flow conditioning

However, whenever there are both laminar and turbulent profiles, there is always a transitional flow profile that contains considerable variation. Flow meters are typically measured to consistently within the relationship between maximum velocity V_{max} and average velocity V_{avg} to correlate flow on the meter. When flow meters are installed with flow conditioners, measured flow is uniform, which provides accurate accuracy through the same measuring range.

A well-designed flow conditioner provides stable flow by continuously changing the flow meter from constant diameter based to vary the pressure gain and decreasing the effects of normally transitional flow profile variations. The net result is more consistent flow ranges, more improved measurement high accuracy and repeatable performance across the same operating flow ranges. Because of application maintenance and installation, flow meters are critical to flow measuring accuracy. It is a systematic, recurring, target variation. The net result is more consistent flow ranges, more improved measurement high accuracy and repeatable performance across the same operating flow ranges.

Therefore, it is a more difficult to predict whether transitional flow effects will exist at the position of the direct measuring range. Figure 2 shows an unmeasured flow profile effect and a reversed flow profile.

When a flow meter is paired with a flow conditioner a stable and consistent

FIGURE 2: Ratio of the average to maximum (normalized) velocity for smooth and rough pipe. (Source: Richard Miles, Flow Measurement Engineering Handbook.)

The changing and unpredictable flow profiles in the transitional Reynolds number ranges.

Flow profile independent of diameter or rate of change, is produced upstream of the flow meter, resulting in highly accurate and repeatable measurement performance. In all wide-section applications, it can result in dimensional effects. Transformed flow will occur within a specified measuring range.

However, it is a more difficult to predict whether transitional flow effects will exist at the position of the direct measuring range. Figure 2 shows an unmeasured flow profile effect and a reversed flow profile.

When a flow meter is paired with a flow conditioner a stable and consistent

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