Instrument Sizing and Selection

Flow, Level, Temperature and Valve sizing updates you would like to know!

From an end-user and tool developer perspective

Tuesday 26 Jan 2016 3:15 – 4:30 pm     Workshop 1      MSC2401

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Andreas Vogt, FIRST GmbH
Intro Henk

• Instrument Engineering tools are my passion!
• I am 40 years in petrochemical industry as instrumentation engineering associate, call me an experienced instrumentation end-user
• Even after all those years I came across some surprises I was not aware off
• This is my 6th time at Texas A&M, 5th time presenting and running workshops. Almost an Aggie. HOWDY!
Intro Andreas

- Software engineer with passion for instrumentation & process design solutions
- 30 year of software development experience on effective engineering software
- Still excited in learning from and sharing ideas and knowledge with the community
- This is my 5th time giving workshops at A&M.
- Not an Aggie yet, but working on it. HOWDY!
Sizing and Selection Workshop Outline

• 3:15 Introduction
• 3:25 **Thermowell wake frequency calc** – do you know that there is more than the latest 2010 ASME PTC 19.3 standard?
• 3:40 **Flow** – what tools do the process designer use, and what challenges that may pose the IE?
• 3:55 **Level** – do we realize the effect of ambient temperature on our dp measurements?
• 4:10 **Control Valves** : do we really know how to derive at max, norm and min operating points?
• 4:25 **Take-away**
TEMPERATURE
SIZING & SELECTION
TEMPERATURE: background

- My prior company is using a German based, vendor independent sizing & selection tool since 1989
- Since my retirement I am soliciting my ex – colleges what they would like to add to this tool. I am trying to influence that tool development.
- In 2012 we attended a workshop at Texas A&M addressing the ASME PTC 19.3 2010 edition covering thermowell wake frequency calculation
- In 2012 the Thermowell module was introduced in CONVAL
- Since them the module has been used significantly and expanded continuously
  - Dimension checker, to replace the “boring” activity of trying to get a TW in compliance with the ASME bending modelling
  - TW optimizer or solver to find the most effective TW solution
  - TW CAT to automate the process of finding TW solutions for a batch of TW, say 1000 out of a project, or an existing installation where velocities have been changed
THERMOWELL wake frequency calculation discussion topics?

• What do you do when your TW is not in compliance with ASME PTC 19.3 2010 edition?

• What do you do when your TW dimensions are not in compliance with the ASME PTC19.3 2010 edition?

• Any of you using the DIN 43773 German standard? When and why? Any learnings?

• Any of you using a company specific standard or guideline? Why? Willing to share?
TW – what to do when not in compliance with PTC19.3?

- How do you know you are not in compliance?
- For what?
- How to resolve?
TW – what to do when **dimensions** not in compliance with PTC19.3?

- How do you know you are not in compliance?
- For what?
- How to resolve?
TW – mounting type?

• How to (best) address the mounting type?
TW – stress = f(velocity or mass flow)

- In-line resonance
- Transverse resonance
TW – natural frequency – effect of wall thickness (schedule)

- actual thermowell system natural frequency

(D=12" & L=225mm)

Calculated by ASME PTC 19.3

Actual

Thermowell System Frequency (kHz)

Pipe Wall Thickness (inch)
TW – velocity collars
TW – putting them in elbows
DP FLOW
SIZING & SELECTION
DP FLOW: background

• I was asked to advice the process design community on improving their flow meter sizing tool
  – Original tool based on the Miller handbook, a very detailed recognized standard specifically for the instrumentation community
DP FLOW : from a process designer viewpoint

• What tools are they using?
• To do what?
• What flow types should they address during FEED, during process design?
• How to align with the instrument folks?
• What about “universal mounting” issues?
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Legend:
- **X**: Applicable characteristic for this subtype
- **X**: Characteristic defining the subtype
- **X**: Characteristic defining the meter type
DP FLOW : Orifice plate stress / deflection calculation?

Is anyone calculating orifice plate stress & deflection?
DP LEVEL
SIZING & SELECTION
**DP LEVEL: background**

- My prior company is using a German based, vendor independent sizing & selection tool since 1989
- Since my retirement I am soliciting my ex-colleagues what they would like to add to this tool. I am trying to influence that tool development.
- In 2012 my Baytown folks asked me to get a dp level module, to address the poor management of our level sketches, often done on the back of cigarette paper during commissioning and startup
- An ex-colleague brought the following to my attention: the impact of winter/summer dp calibration on the level alarms
DP LEVEL with wet legs: ambient temperature impact on level alarms

- See examples on next pages
- Calibration span 0 – 100% level, 6.23 "H2O
- Summer calibration
- Alarm set @ 70%
- In winter due to glycol density changes, alarm will show @ 91.3% to the operator.
- Of course the opposite when calibrated in the winter
DP LEVEL: ambient temperature effect

In summer the transmitter is calibrated at ambient conditions say \(68^\circ\text{F}\) (Glycol 69.65 lb/ft\(^3\)). An alarm is set at 70\% corresponding to a -7.6 in H\(_2\)O DP.
DP LEVEL: ambient temperature effect

In winter, say 23°F (glycol 71.42 lb/ft³), the same level setting of 70% will generate a -6.4 "H₂O DP corresponding to a value of 91.3% to the operator!
CONTROL VALVE
SIZING & SELECTION
CONTROL VALVES: background

• We are consulting on a major project in Europe, performing reliability analysis using the CONVAL Ri KPI and the services CAT Consult to identify the application challenges during FEED and detailed engineering.

• The project is using SPI as the master to size & select the control valves.

• FEED process design is done by the client, using PFD and HMB
CONTROL VALVE – How to derive at Max – Norm – Min working points?

• Is there a golden rule?

• How to translate the multitude of process design cases into 3 working points?
CONTROL VALVE – The essential process data for flashing & outgassing?

• SPI process data sheet is not providing (for this project, but maybe in general?) the structured hooks to get process data for flashing and outgassing?
  – Mass vapor content or the vapor flowrate?
  – Vapor density,
  – ...