



Level



Pressure



Flow



Temperature



Liquid Analysis



Registration



Systems Components



Services



Solutions

# Deltatop

## 节流装置分类与选型

Classification:  
INTERNAL

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**Endress+Hauser**   
People for Process Automation



# Content 内容

- Product Family ‘Deltatop’ Introduction 概述
- Orifices 孔板
- Pitot Tubes 毕托管
- Accessories 附件
- Engineered Solutions 工程方案
- Summary – Flowmeter selection? 总结 – 流量计的选择
- Logistics & Produce 物流与生产
- Installation 安装
- Calculation 计算

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Pressure



Level



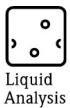
Pressure



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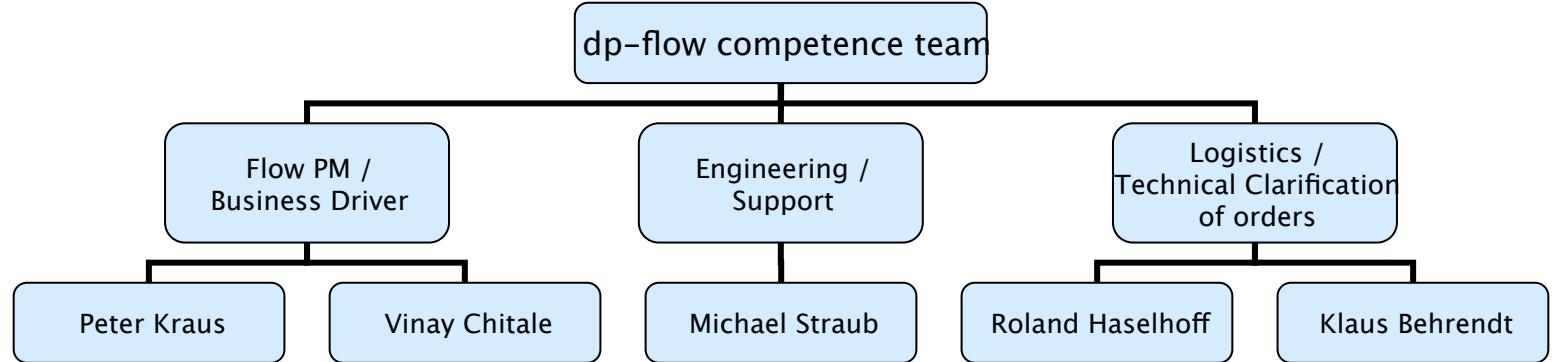
# Introduction

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# Dp-Flow Competence Team



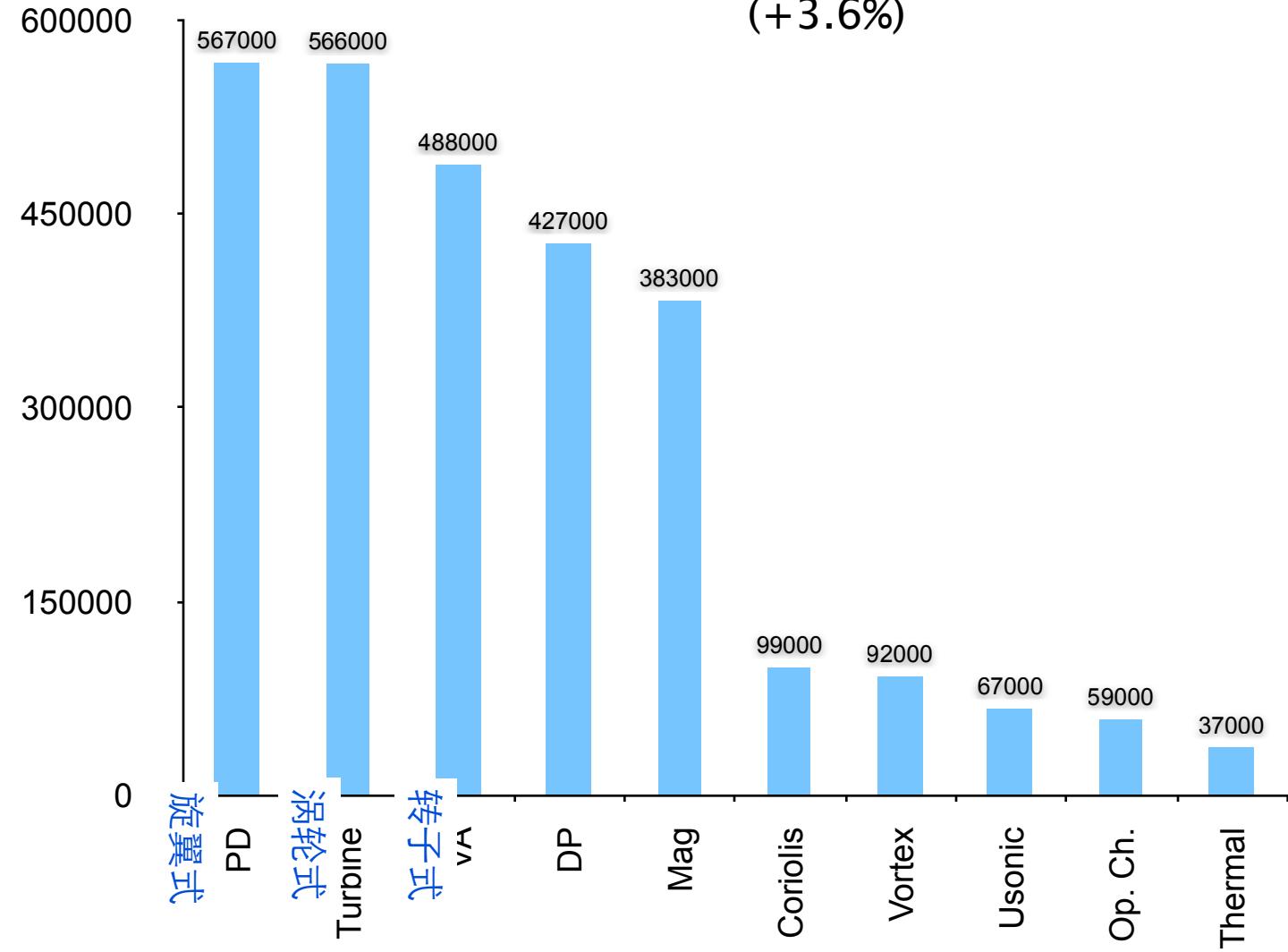
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# World flow meter market 2005 (Units)

Total Units = 2785000  
(+3.6%)

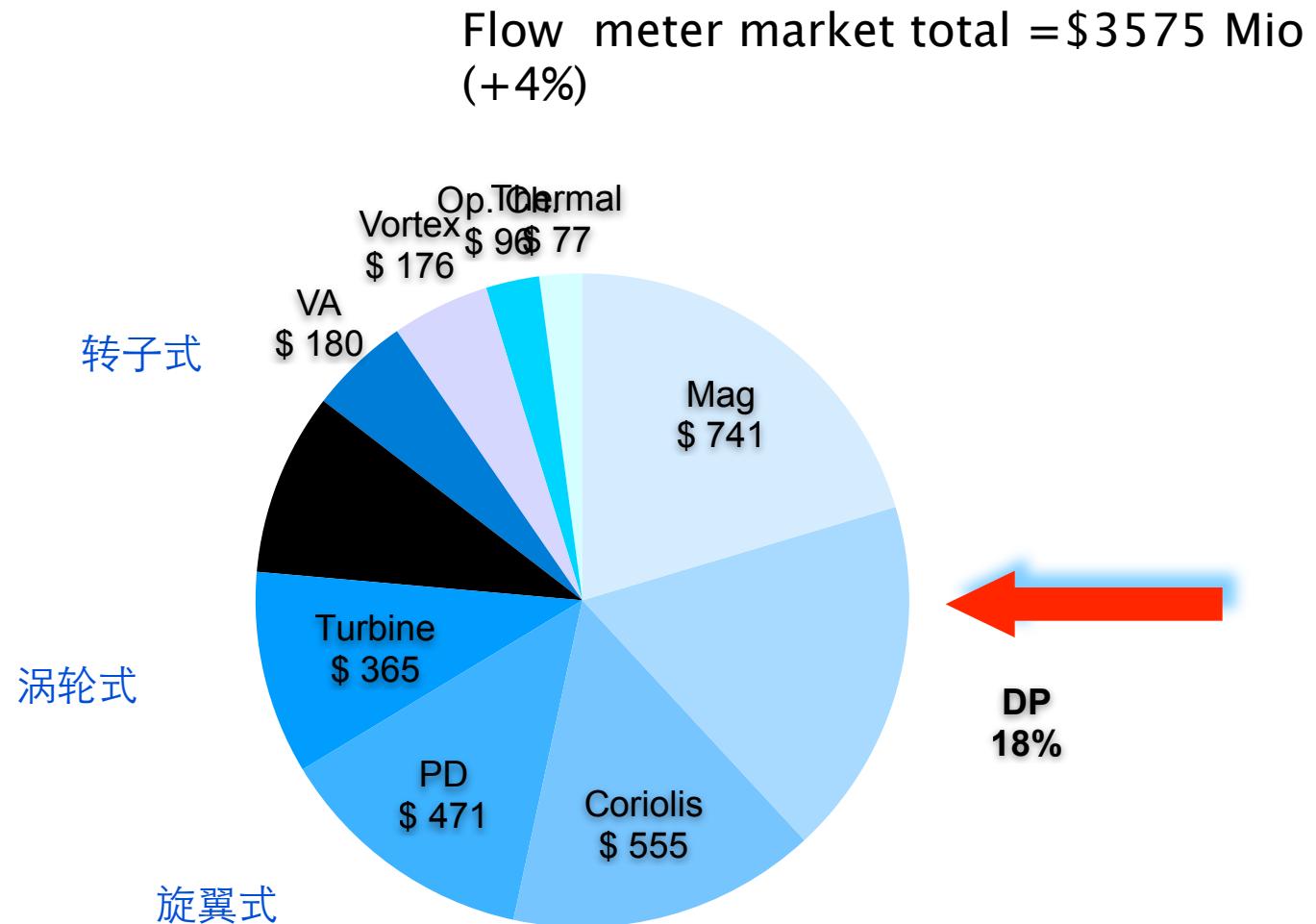


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# World flow meter market 2005



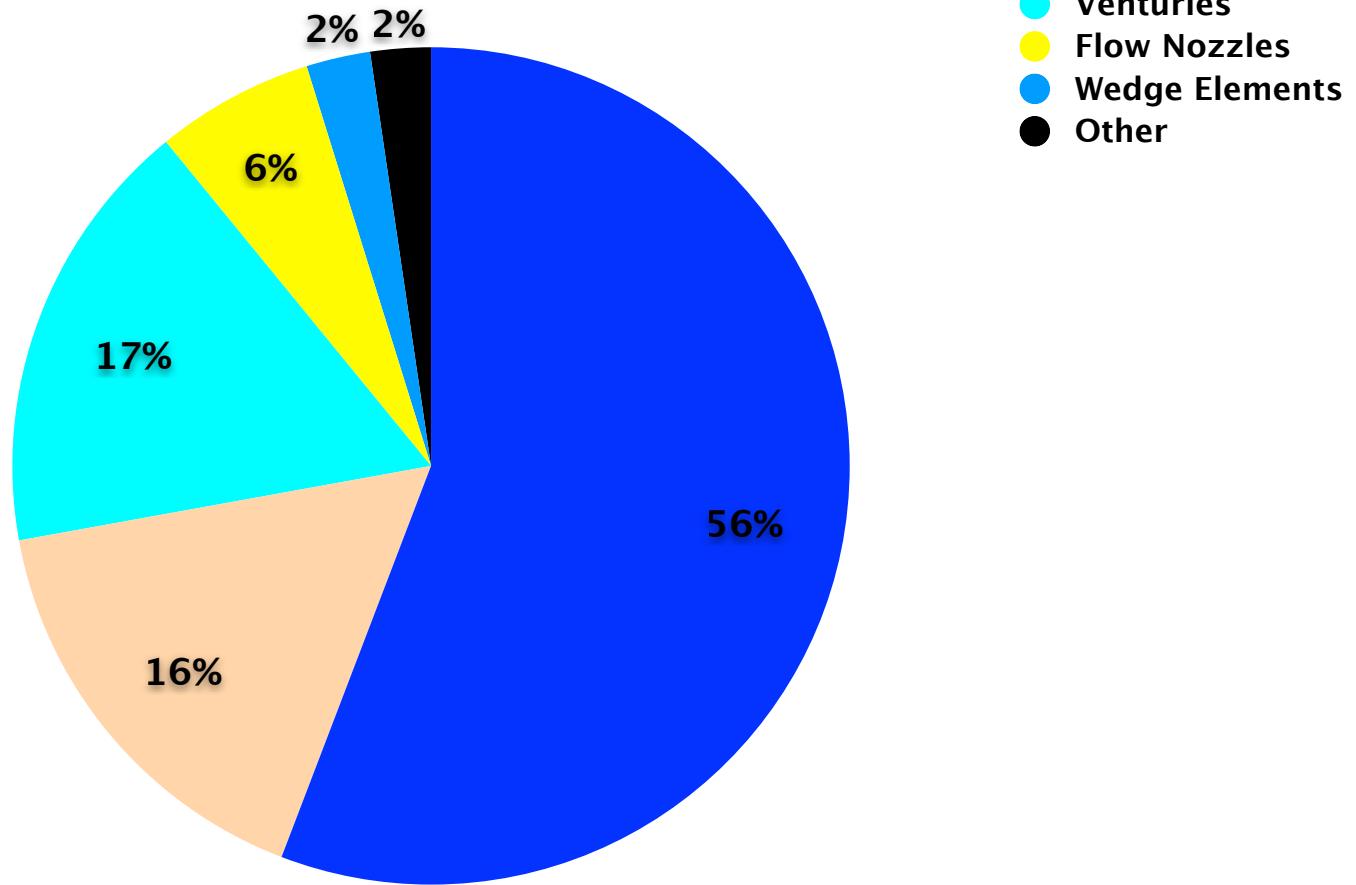
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Source:  
Flow Research Inc.  
Wakefield,  
Massachusetts

# Primary Elements Worldwide Sales -2006

Value = 351,9 Mio \$



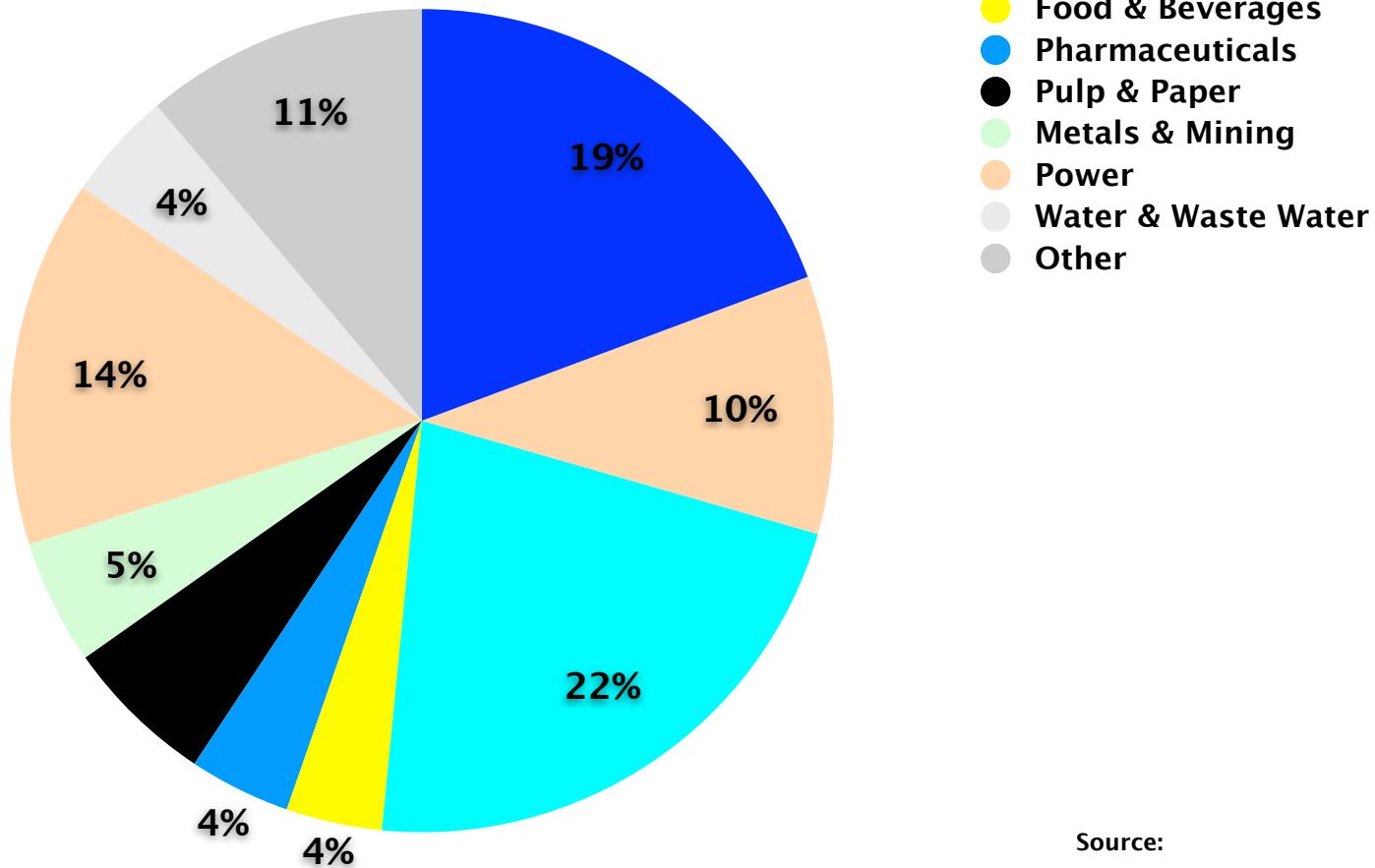
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Source:  
Flow Research Inc.  
Wakefield,  
Massachusetts

# Industry Split of DP Flow Transmitters Worldwide - 2006

Value = 644 Mio  
\$

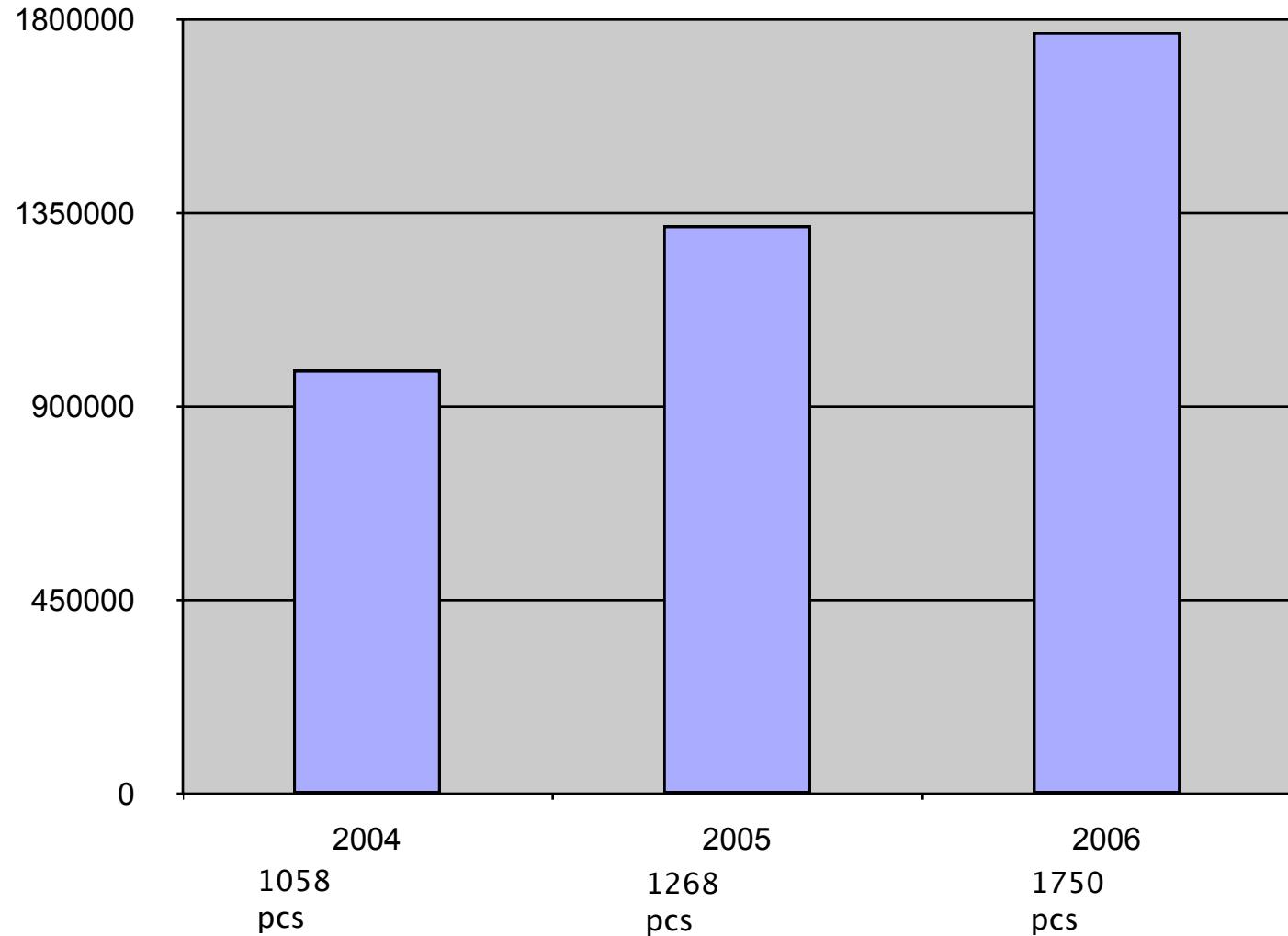


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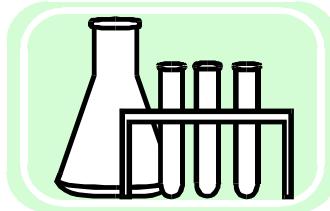
Source:  
Flow Research Inc.  
Wakefield,  
Massachusetts

# E+H dp flow yearly turnover €



# Typical applications

## Chemical industry



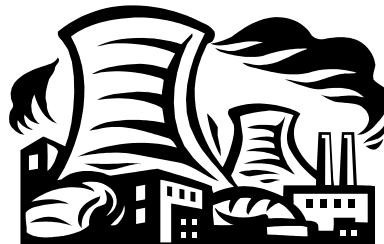
- process gases 过程气体
- compressed Air 压缩空气
- Steam 蒸汽
- cooling water 冷却水
- turbine meter (inlet)



## Petrochemical

- flare gas 燃烧废气
- crude oil 原油
- natural gas 天然气

## Energy



- cooling water 冷却水
- emission 排放测量
- energy 热能测量
- flare gas 燃烧废气
- Steam 蒸汽



# Key Arguments

- Well known and accepted measuring principle
  - 人人皆知和认可的测量原理
- Perfect for all fluid types
  - 适合所有的流体
- Robust primary element
  - 稳定坚固的测量元件
- High pressure and temperature versions
  - 能胜任高温高压
- Special materials are possible
  - 能够满足特殊材料要求
- Enlarged product range including the accessories
  - 包括附件使可销售的产品增加

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Pressure

# Key Arguments

- CER, Serial Number, all the W@M tools  
产品数据库、系列号和所有W@M工具
- With Applicator we do have the best tool to do all calculations  
有一个很好的计算软件Applicator
- We are the application sellers  
我们擅长于应用式销售
- Out of our product basket we select the instrument which fits best to your process  
我们多了一个选择以适合用户的要求
- Dp flow, just an opportunity more to make business  
Dp flow 是我们扩大市场的机会

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# Key Arguments

- One Inquiry, one offer, one order and one delivery  
同一个询价、同一个供应商、同一个合同和同样的交货时间
- A dedicated team which supports you in all dp flow questions  
以专业队伍支持你解决Dp flow 的所有问题
  - Application know how 应用知识
  - Applicator让选型和计算更简单
  - Full basket 齐全的产品
  - Easy selectable standard products 标准产品选型更容易
  - Engineered solutions 工程解决方案
- You don't have to convince your customer, just sell it  
你不必劝用户使用它，只需卖它就行了

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# Intruments

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# DO = Orifice as primary element

Deltatop

DO  
Orfices  
孔板

DO62C



DO63C



DO61W



DO64P



DO65F



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**“DO”** Means all products related to **“ORIFICE”** as a primary element

# Deltatop DO order structure

**root orifice primary type generation tapping mounting**

**D dp-flow**

**O orifice**

**6 generation**



- 1 flange tap 法兰取压
- 2 corner tap single bore 角接取压单孔型
- 3 corner tap annular chamber 角接取压环室型
- 4 plate tapping defined via rucksack 管道取压
- 5 meter run corner tap / annular chamber 带直管段角接取压环室型
- 8 orifice solution
- 9 meter run solution

|          |                   |
|----------|-------------------|
| <b>F</b> | flanged 法兰型       |
| <b>C</b> | carrier rings 夹持型 |
| <b>W</b> | weld neck 焊接型     |
| <b>P</b> | plate 单个孔板        |
| <b>S</b> | solutions         |

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# DP = Pitot Tube as primary element

Deltatop

**DP**  
Pitot Tubes  
毕托管

**DP61D**  
Small  
12mm

**DP62D**  
Middle  
25mm

**DP63D**  
Large  
42mm



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**“DP”** Means all products related to **“PITOT TUBE”** as a primary element

# Deltatop DP order structure

root pitot primary type generation profile strengthprofil shape

D dp-flow

P pitot tube

6 generation

- 1 small (12mm)
- 2 middle (25,4mm - standard)
- 3 large (42mm)

D diamond



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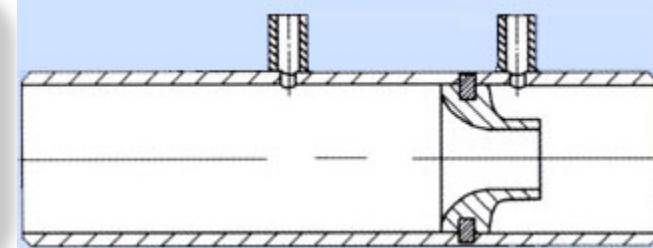
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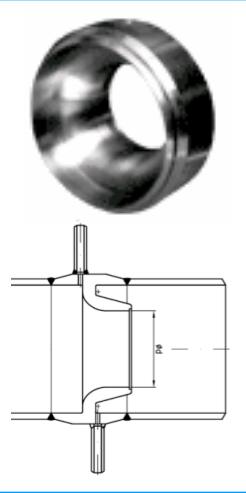
# DN = Nozzle as primary element

Deltatop

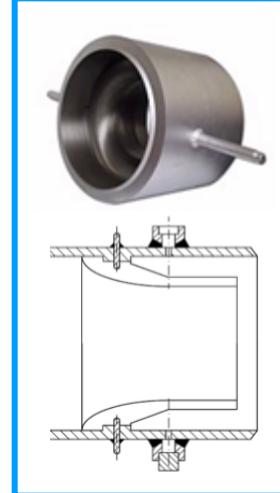
**DN  
Nozzles**  
喷嘴



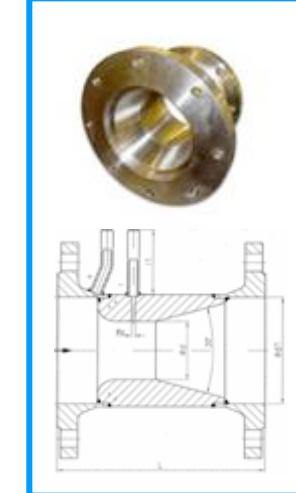
**DN61S**  
ISA 1932  
标准喷嘴



**DN62S**  
Long Radius  
长径喷嘴



**DN63S**  
Venturi Nozzle  
文丘里喷嘴



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**“DN”** Means all products related to **“Nozzle”** as a primary element

# DV = Venturi as primary element

Deltatop

DV  
Venturi Tubes  
文丘里管

DV61S

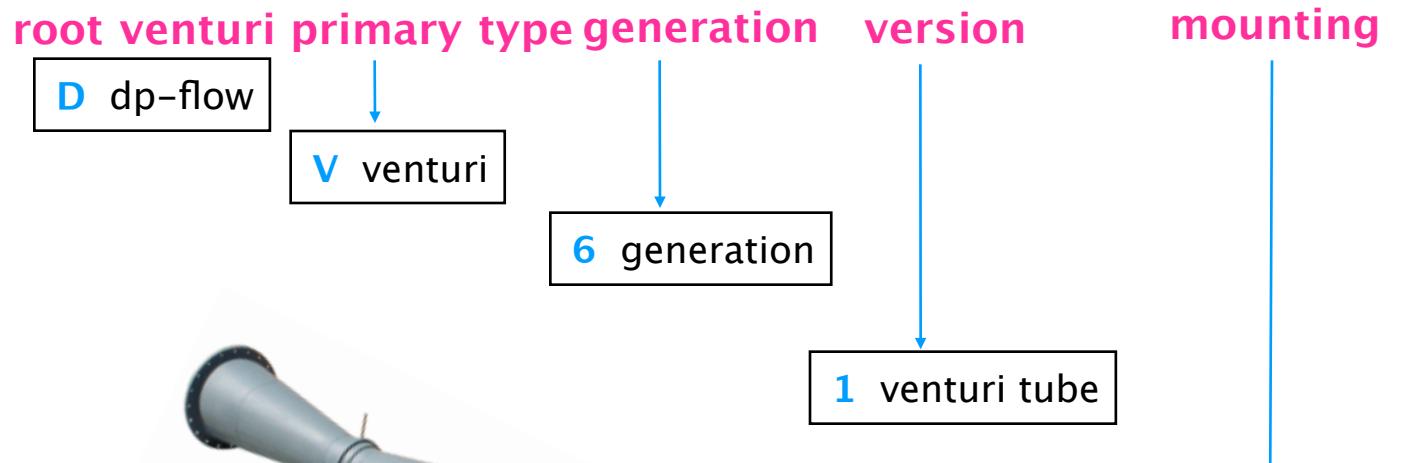


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“DV” Means all products related to “Venturi” as a primary element

# Deltatop DV order structure



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# DA = Accessories

Deltatop

DA  
Accessories  
附件

DA6xC



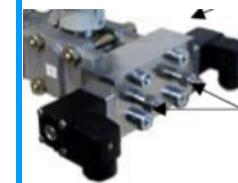
DA6xV



DA63M



DA62P



DA63R



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“DA” means all products related to “Accessories”



# Family Tree – Deltatop

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# Family Tree – Deltatop

## Orifices

DO61W  
DO62C  
DO63C  
DO64P  
DO65F

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# Family Tree – Deltatop

## Orifices

DO61W  
DO62C  
DO63C  
DO64P  
DO65F

## Pitot Tubes

DP61D  
DP62D  
DP63D  
DP61B  
DP62B  
DP63B

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# Family Tree – Deltatop

## Orifices

DO61W  
DO62C  
DO63C  
DO64P  
DO65F

## Solutions

DN61S  
DN62S  
DN63S  
DV61S  
DO68S  
DO69S

## Pitot Tubes

DP61D  
DP62D  
DP63D  
DP61B  
DP62B  
DP63B

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# Family Tree – Deltatop

## Orifices

DO61W  
DO62C  
DO63C  
DO64P  
DO65F

## Solutions

DN61S  
DN62S  
DN63S  
DV61S  
DO68S  
DO69S

## Pitot Tubes

DP61D  
DP62D  
DP63D  
DP61B  
DP62B  
DP63B

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## Accessories



# Family Tree – Deltatop

## Orifices

DO61W  
DO62C  
DO63C  
DO64P  
DO65F

## Solutions

DN61S  
DN62S  
DN63S  
DV61S  
DO68S  
DO69S

## Pitot Tubes

DP61D  
DP62D  
DP63D  
DP61B  
DP62B  
DP63B

DA61C  
DA61V

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## Accessories

# Family Tree – Deltatop

## Orifices

DO61W  
DO62C  
DO63C  
DO64P  
DO65F

## Solutions

DN61S  
DN62S  
DN63S  
DV61S  
DO68S  
DO69S

## Pitot Tubes

DP61D  
DP62D  
DP63D  
DP61B  
DP62B  
DP63B

DA61C  
DA61V

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## Accessories

# Family Tree – Deltatop

## Orifices

DO61W  
DO62C  
DO63C  
DO64P  
DO65F

## Solutions

DN61S  
DN62S  
DN63S  
DV61S  
DO68S  
DO69S

## Pitot Tubes

DP61D  
DP62D  
DP63D  
DP61B  
DP62B  
DP63B

DA61C  
DA61V

Classification:  
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## Accessories

# Family Tree – Deltatop

## Orifices

DO61W  
DO62C  
DO63C  
DO64P  
DO65F

## Solutions

DN61S  
DN62S  
DN63S  
DV61S  
DO68S  
DO69S

## Pitot Tubes

DP61D  
DP62D  
DP63D  
DP61B  
DP62B  
DP63B

DA61C  
DA61V

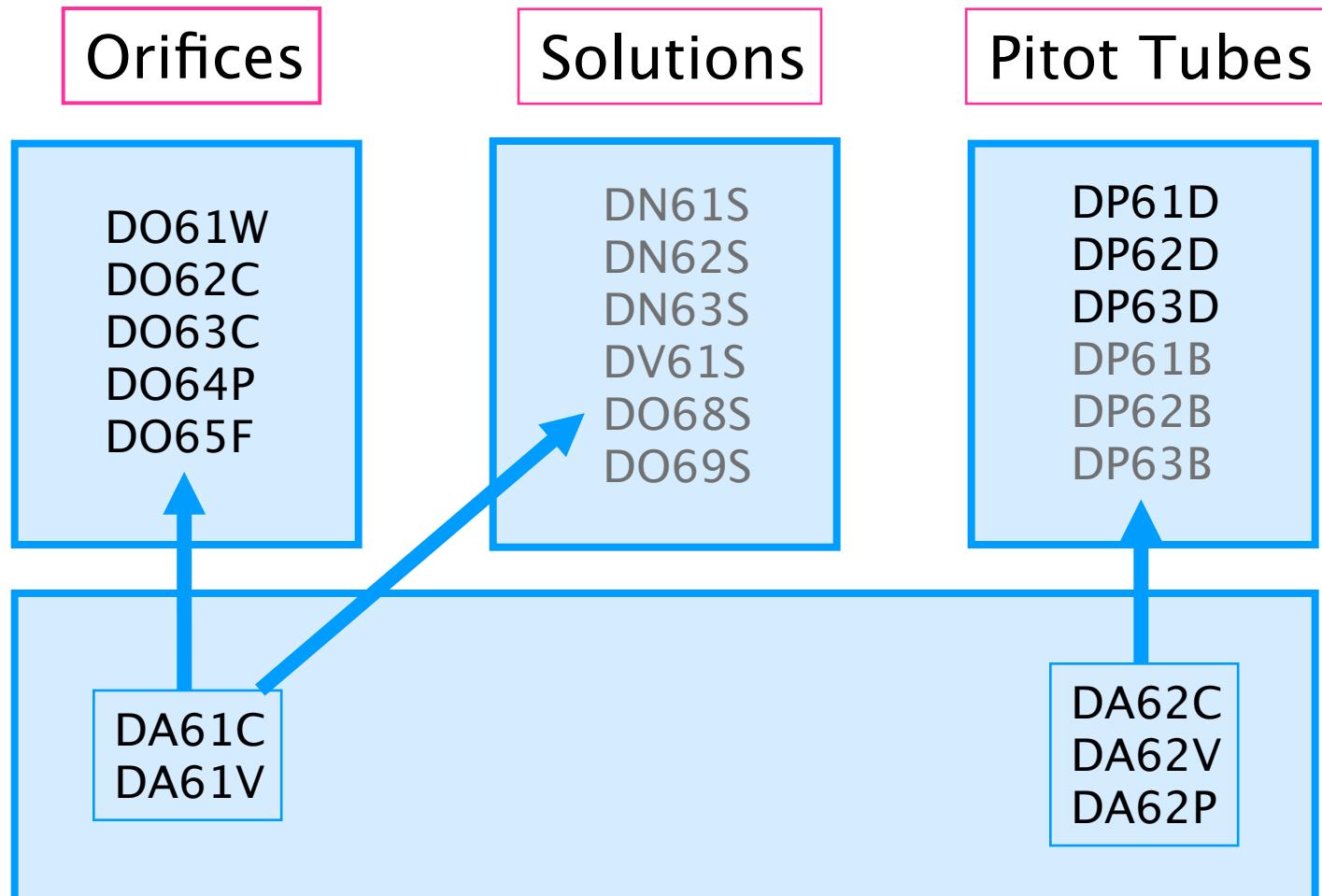
DA62C  
DA62V  
DA62P

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## Accessories

# Family Tree – Deltatop

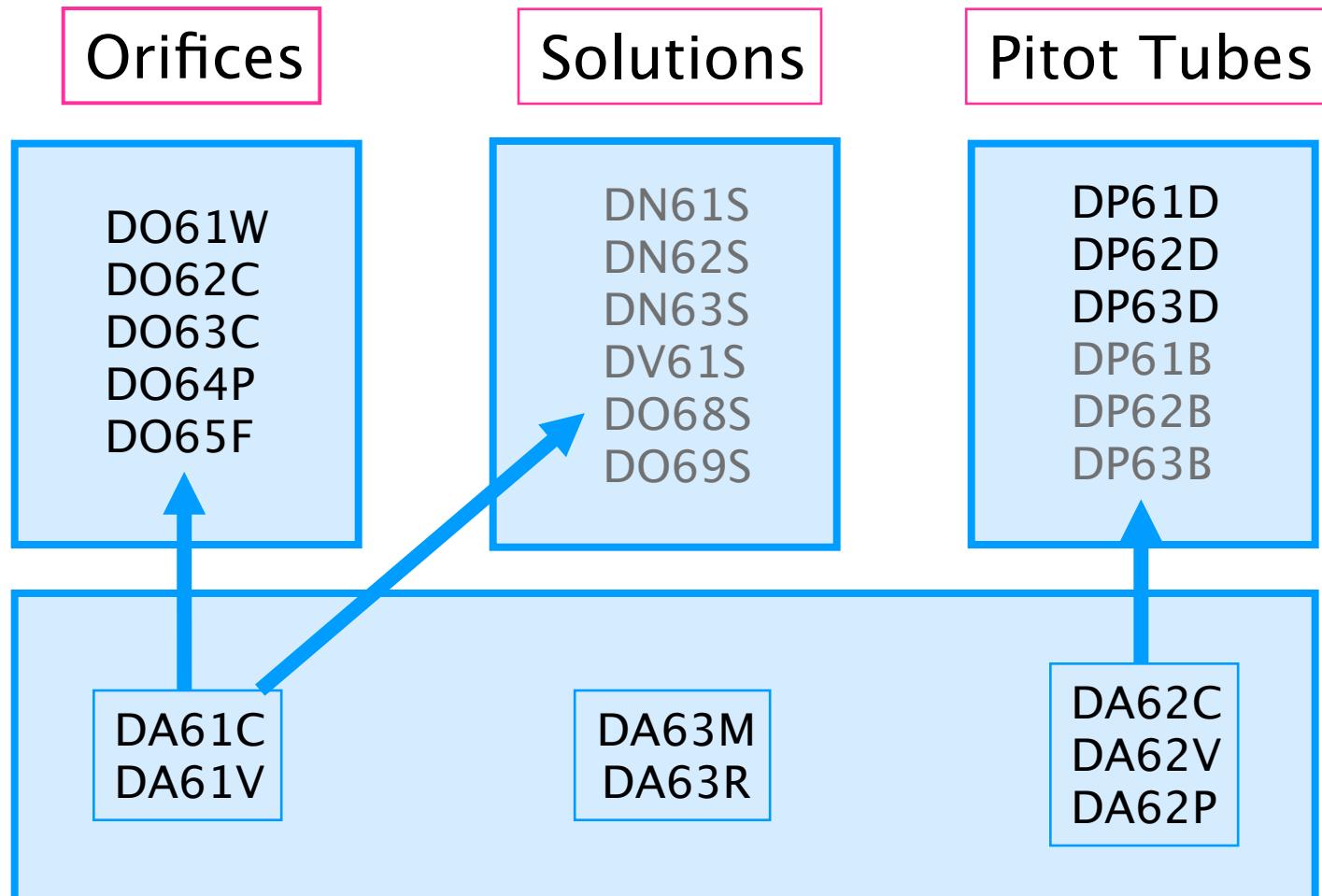


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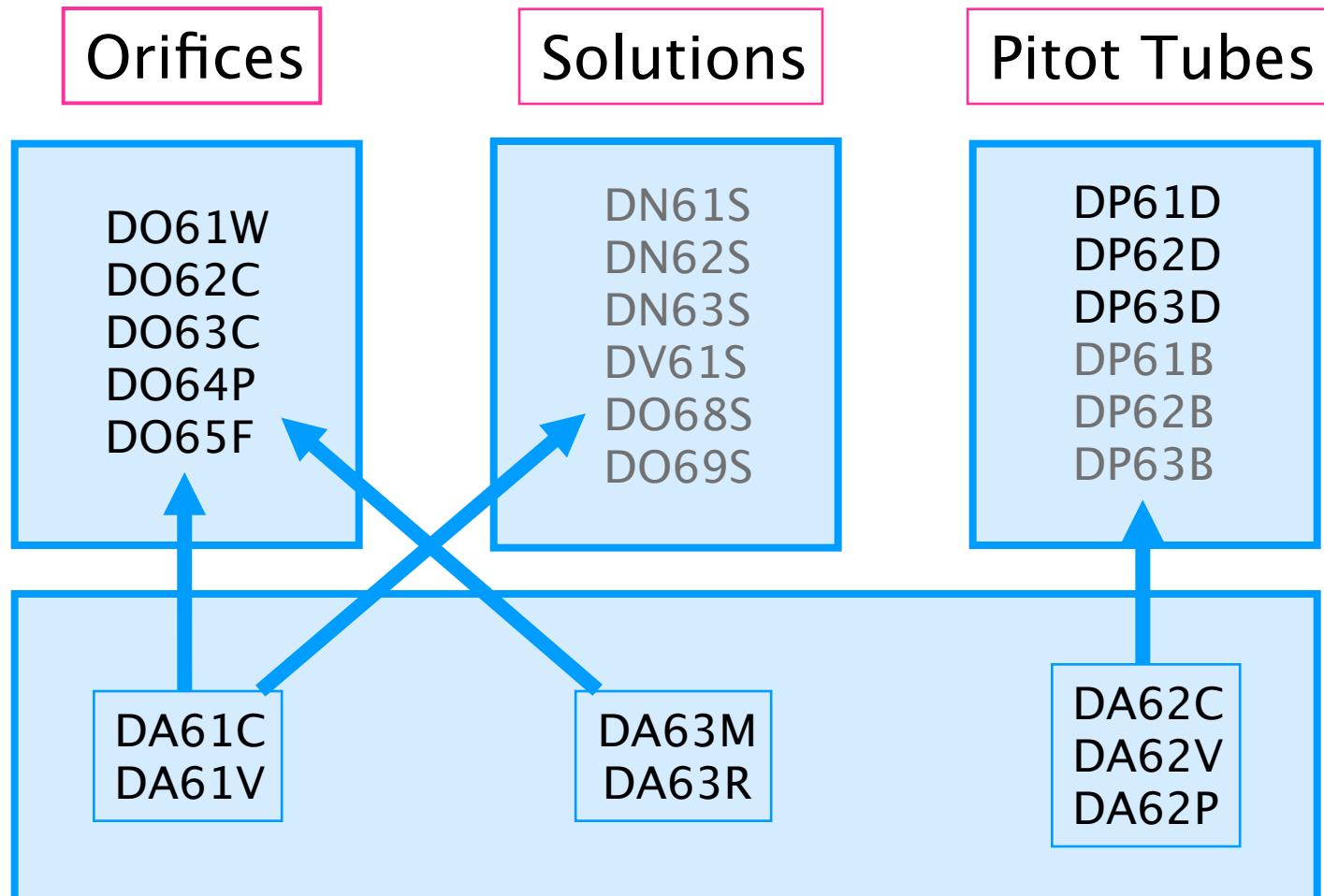
Accessories

# Family Tree – Deltatop



Accessories

# Family Tree – Deltatop

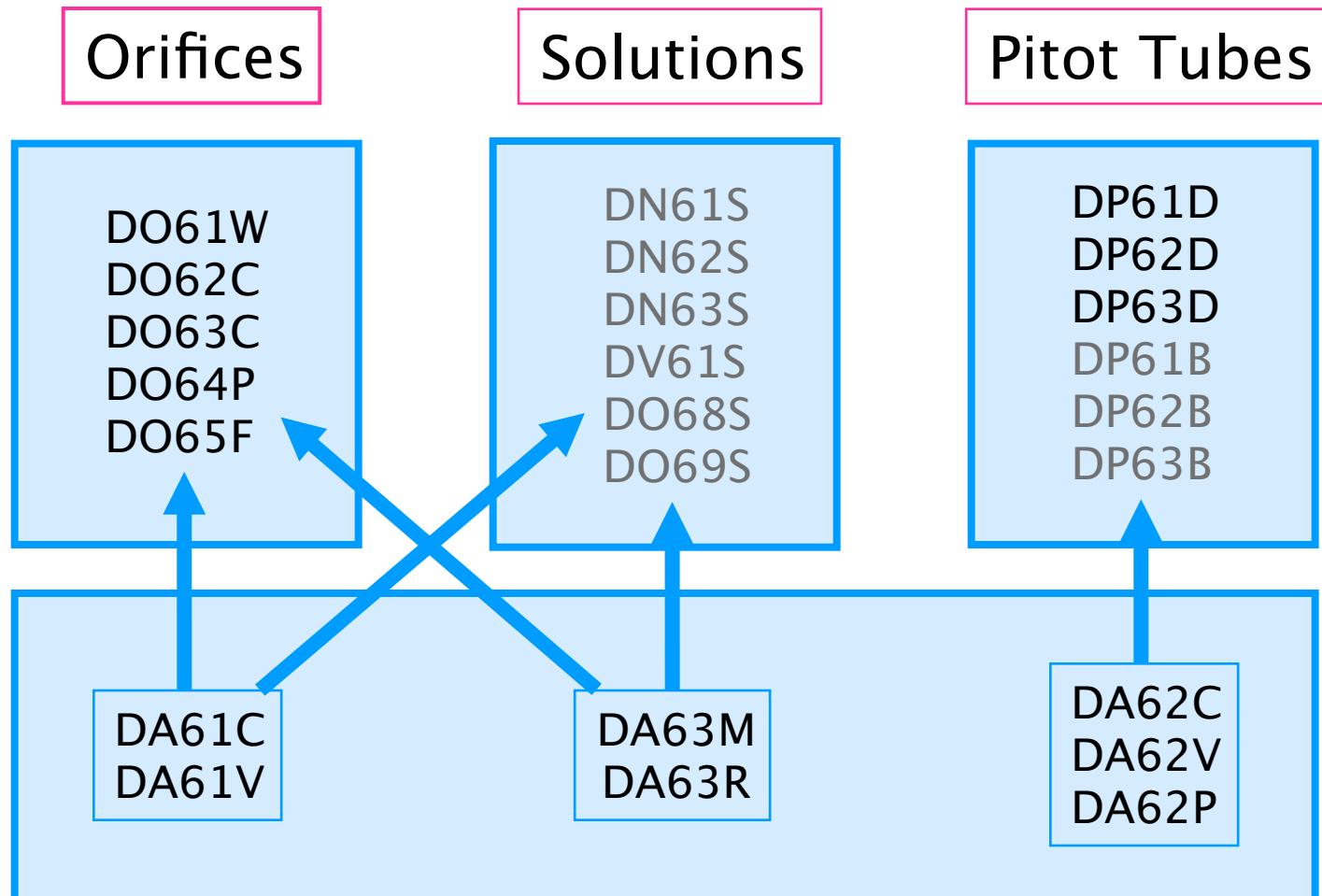


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# Family Tree – Deltatop

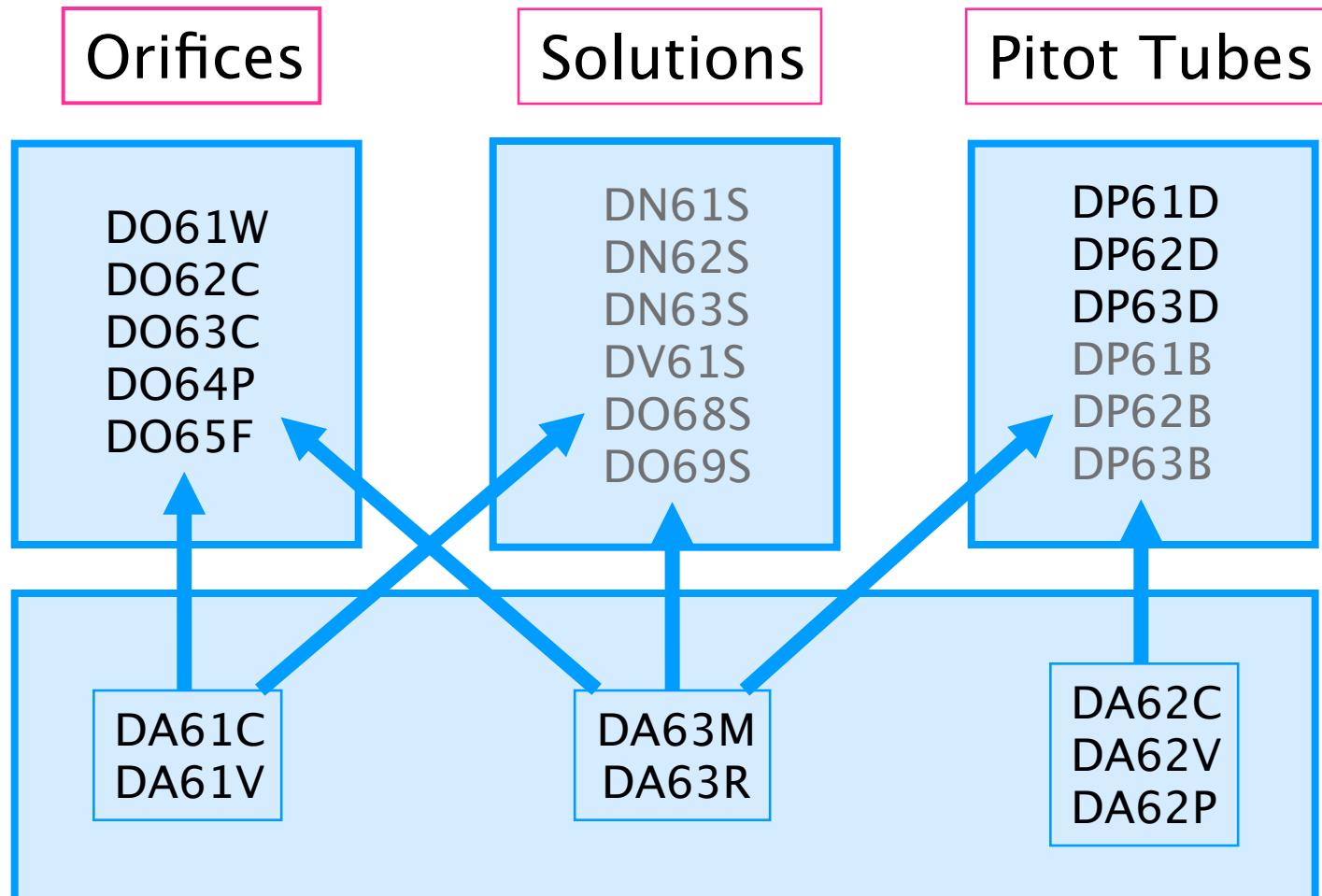


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Accessories

# Family Tree – Deltatop



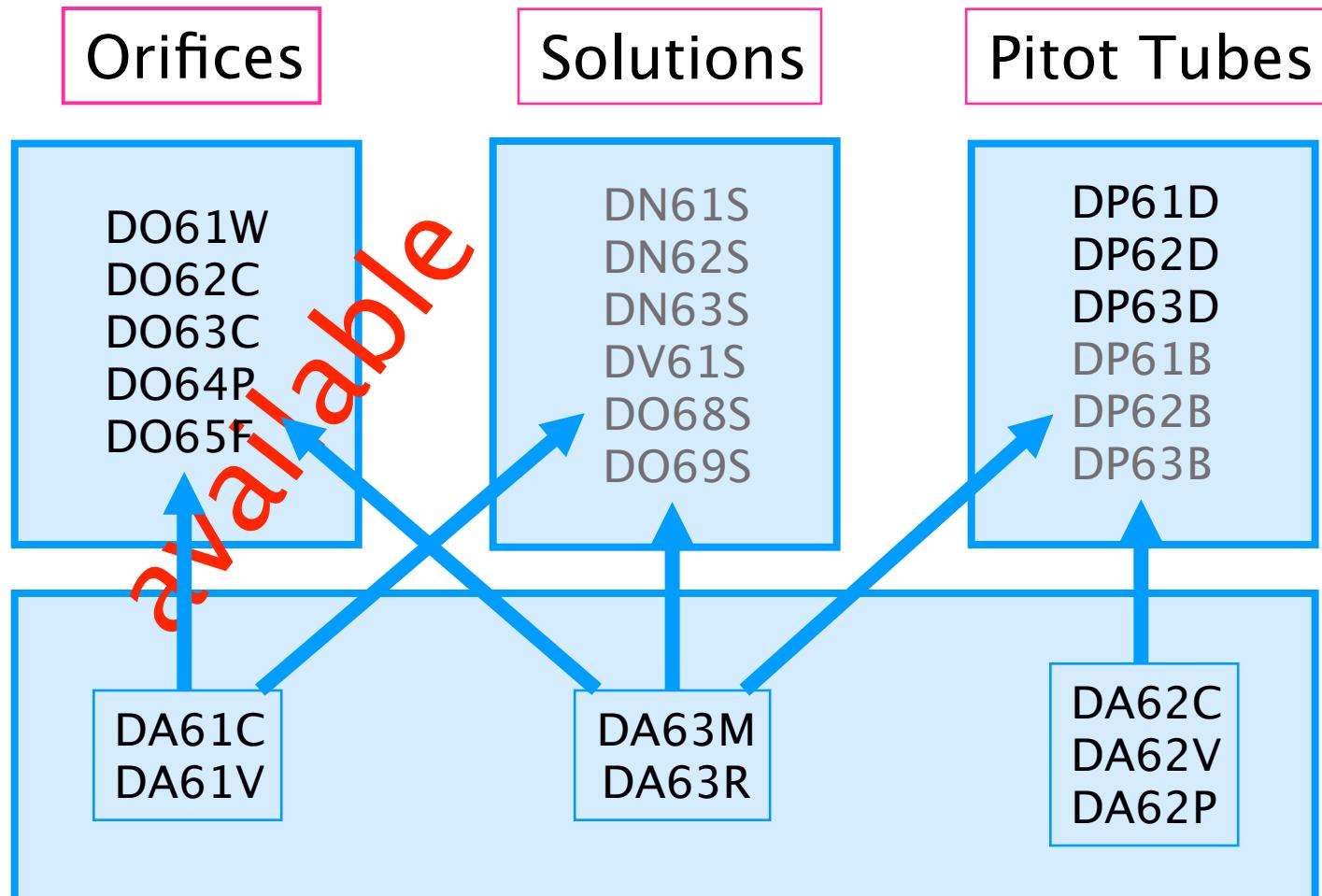
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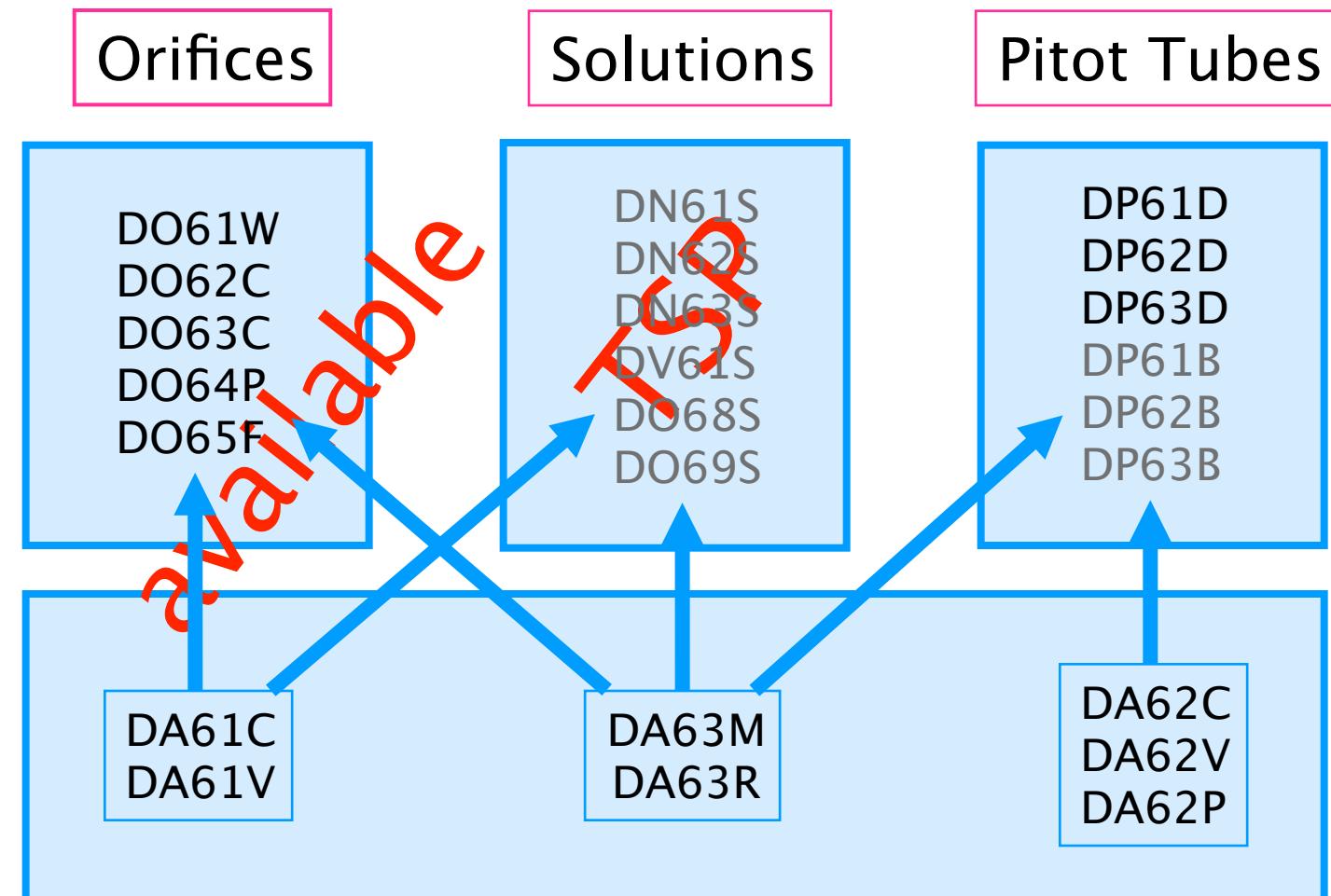


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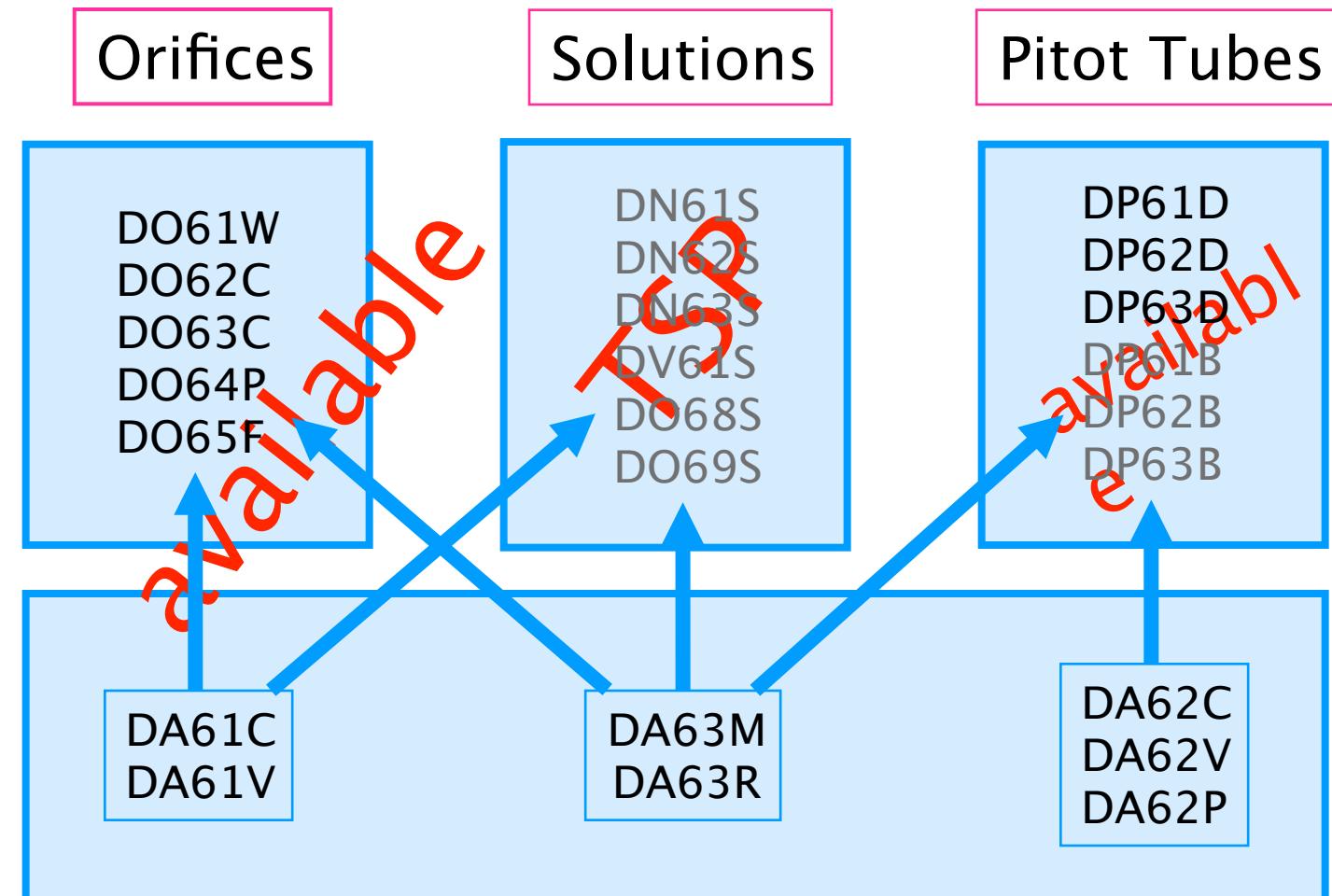
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# Family Tree – Deltatop



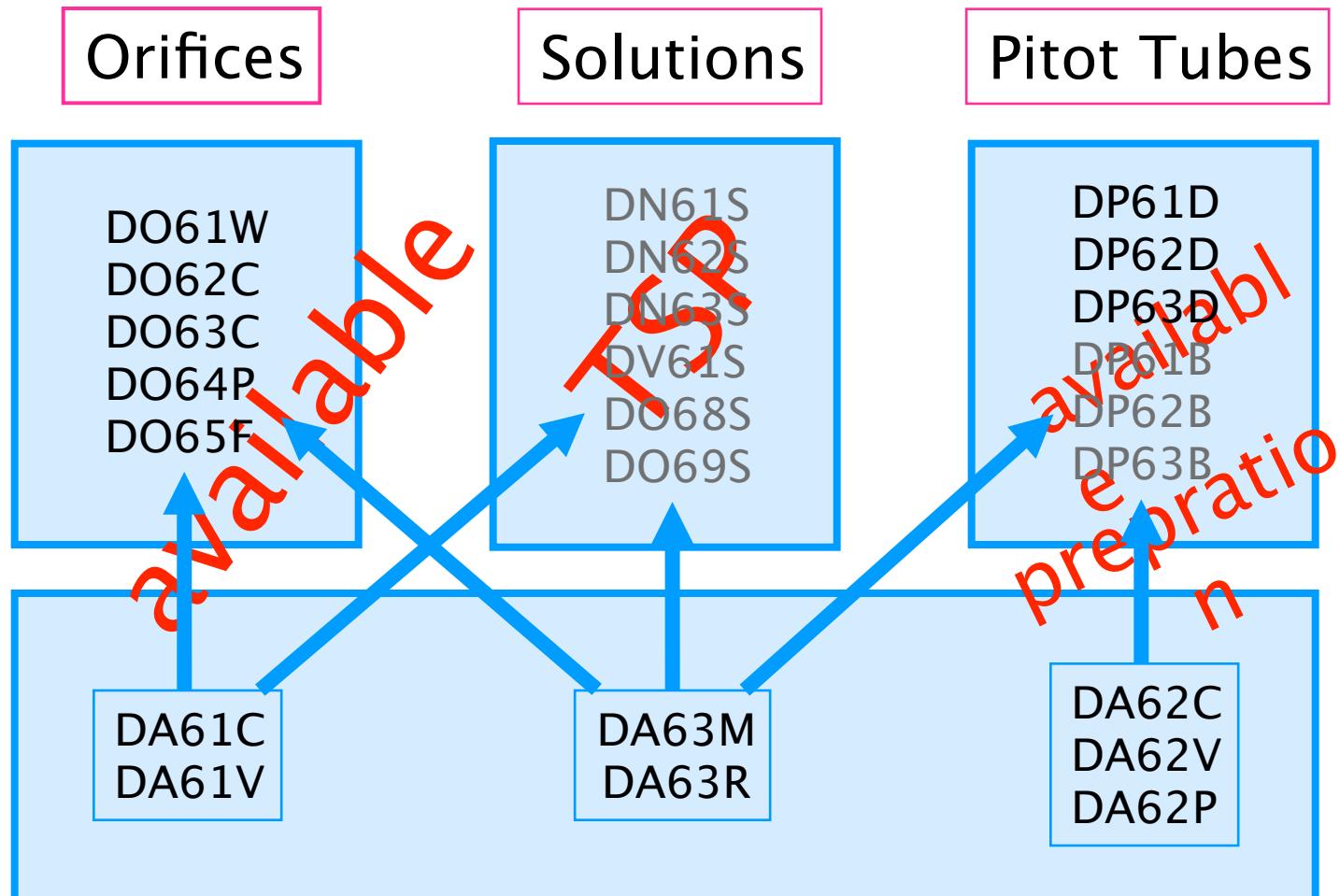
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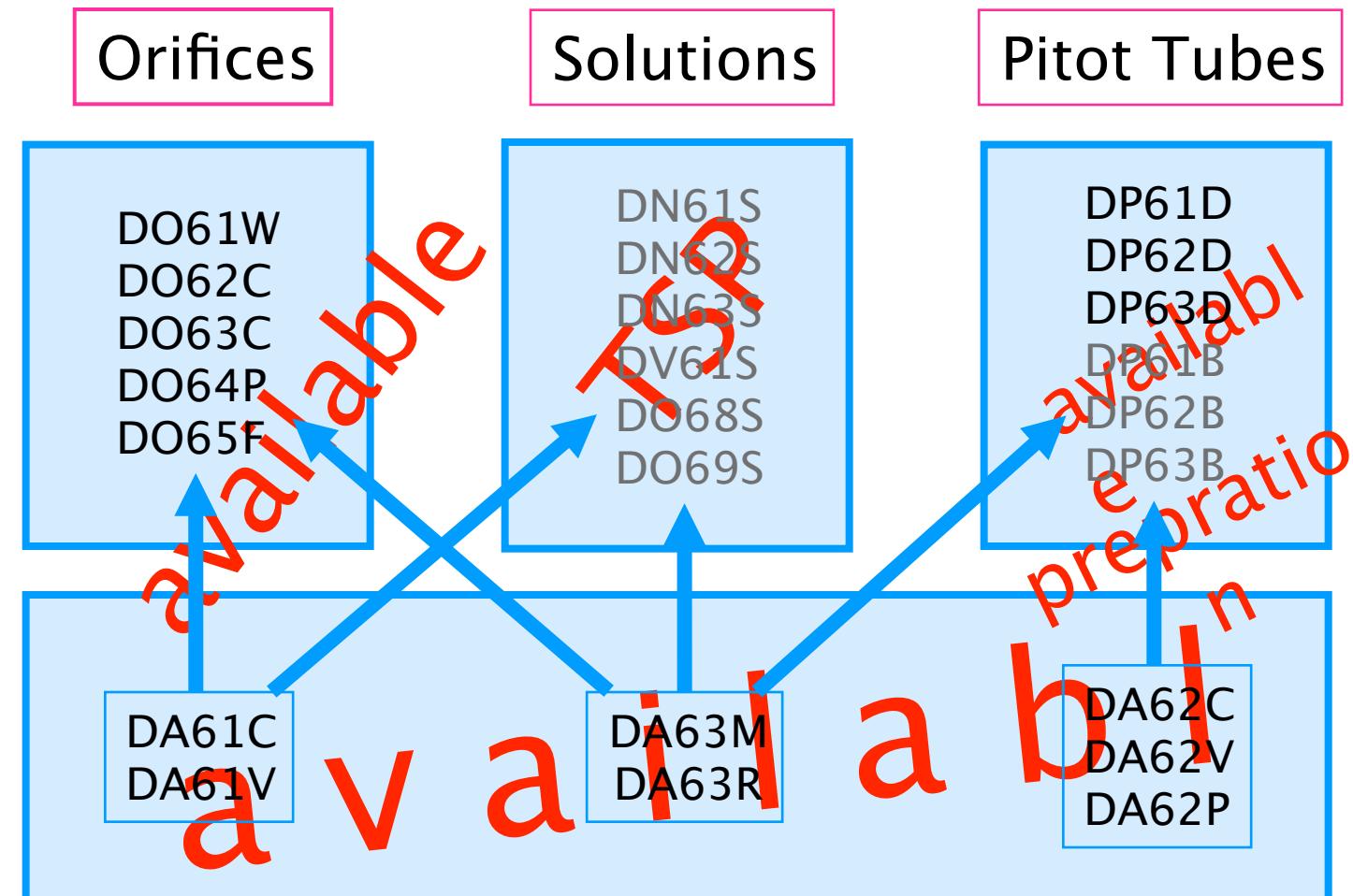
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# Family Tree – Deltatop



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Accessories



Pressure



Level



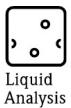
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Services



Solutions

# APS

## Advanced Product Structures

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# Deltatop Logistics – APS

- **APS (Advanced Product Structures)先进产品结构**
  - Describe products with more features than in the past  
产品的描述比以前更准确
  - Advanced order code up to 60 digits  
先进的型号系统最高可达到60位
  - Order code with must and can selection  
型号分为必选和可选二部分

Classification:  
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# Deltatop Logistics – APS

- **APS (Advanced Product Structures)先进产品结构**
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  - **Advanced order code up to 60 digits**  
先进的型号系统最高可达到60位
  - **Order code with must and can selection**  
型号分为必选和可选二部分

Order code (max. 60digits)

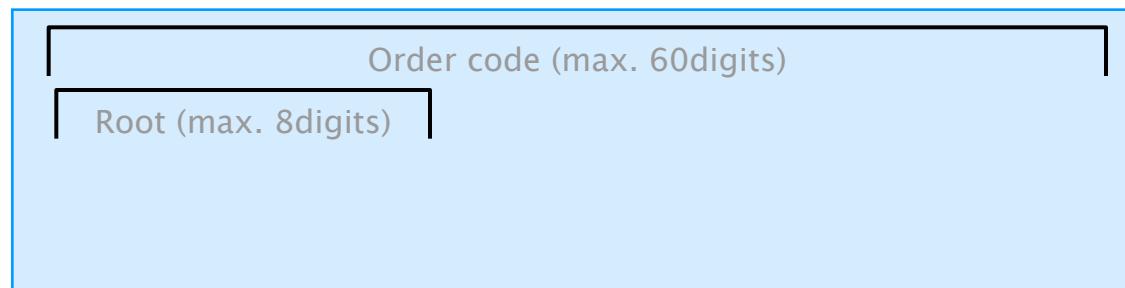
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型号分为必选和可选二部分



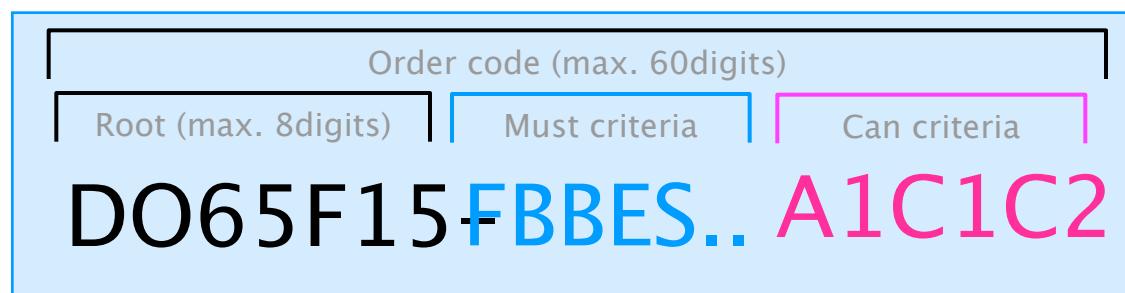
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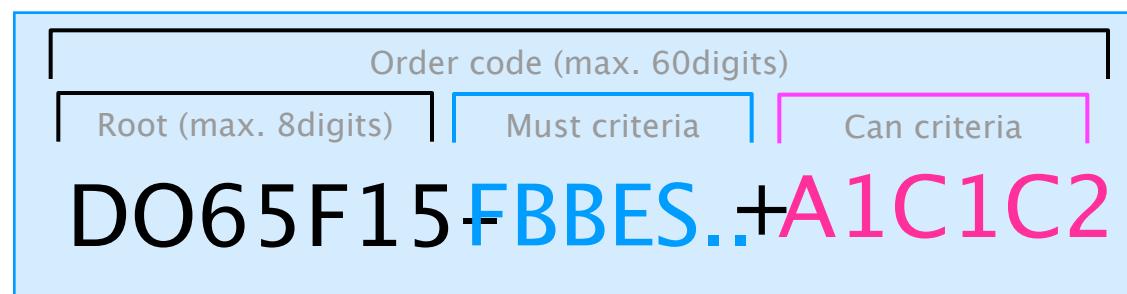
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# Deltatop Logistics – APS

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型号分为必选和可选二部分



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# Comparison old / new

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# Comparison old / new

Order code for a typical steam application (old)  
典型的蒸汽测量孔板的老型号

DPO50E-E1C2E4F + DPC50-A1B4 + DPV50-124 + DPM50-1F25

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# Comparison old / new

Order code for a typical steam application (old)

典型的蒸汽测量孔板的老型号

DPO50E-E1C2E4F + DPC50-A1B4 + DPV50-124 + DPM50-1F25

Order code for a typical steam application (new)

典型的蒸汽测量孔板的新型号

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# Comparison old / new

Order code for a typical steam application (old)

典型的蒸汽测量孔板的老型号

DPO50E-E1C2E4F + DPC50-A1B4 + DPV50-124 + DPM50-1F25

Order code for a typical steam application (new)

典型的蒸汽测量孔板的新型号

DO62C50-FBBESC2RAL3AEE2DEB**CA2BCDD**

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# Comparison old / new

Order code for a typical steam application (old)

典型的蒸汽测量孔板的老型号

DPO50E-E1C2E4F + DPC50-A1B4 + DPV50-124 + DPM50-1F25

Order code for a typical steam application (new)

典型的蒸汽测量孔板的新型号

DO62C50-FBBESC2RAL3AEE2DEB**CA2BCDD**

Order-Ident 型号在物流部门的传输

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# Comparison old / new

Order code for a typical steam application (old)

典型的蒸汽测量孔板的老型号

DPO50E-E1C2E4F + DPC50-A1B4 + DPV50-124 + DPM50-1F25

Order code for a typical steam application (new)

典型的蒸汽测量孔板的新型号

DO62C50-FBBESC2RAL3AEE2DEB**CA2BCDD**

Order-Ident 型号在物流部门的传输

DO62C50-1082/xxx includes all add. Info 😊 包含所有附加信息

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# Guidance by Exclusions 自动关联引导

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Pressure

# Guidance by Exclusions 自动关联引导

- Over 8000 exclusions implemented 超过8000种排除组合
- 8000 little helpers to avoid mistakes

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# Guidance by Exclusions 自动关联引导

- Over 8000 exclusions implemented 超过8000种排除组合
- 8000 little helpers to avoid mistakes  
避免至少8000个错误

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Pressure

# Guidance by Exclusions 自动关联引导

- Over 8000 exclusions implemented 超过8000种排除组合
- 8000 little helpers to avoid mistakes  
避免至少8000个错误
- Example: Accessory connections  
如：附件之间的连接

DO63C1F-FB###C1RAT2AVN3CVB.....

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# Guidance by Exclusions 自动关联引导

- Over 8000 exclusions implemented 超过8000种排除组合
- 8000 little helpers to avoid mistakes  
避免至少8000个错误
- Example: Accessory connections  
如：附件之间的连接

Only things come together which fit to each other  
只要能选在一起就是对的

DO63C1F-FB###C1RAT2AVN3CVB.....



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Pressure



Level



Pressure



Flow



Temperature



Liquid  
Analysis



Registration



Systems  
Components



Services



Solutions

# Orifices

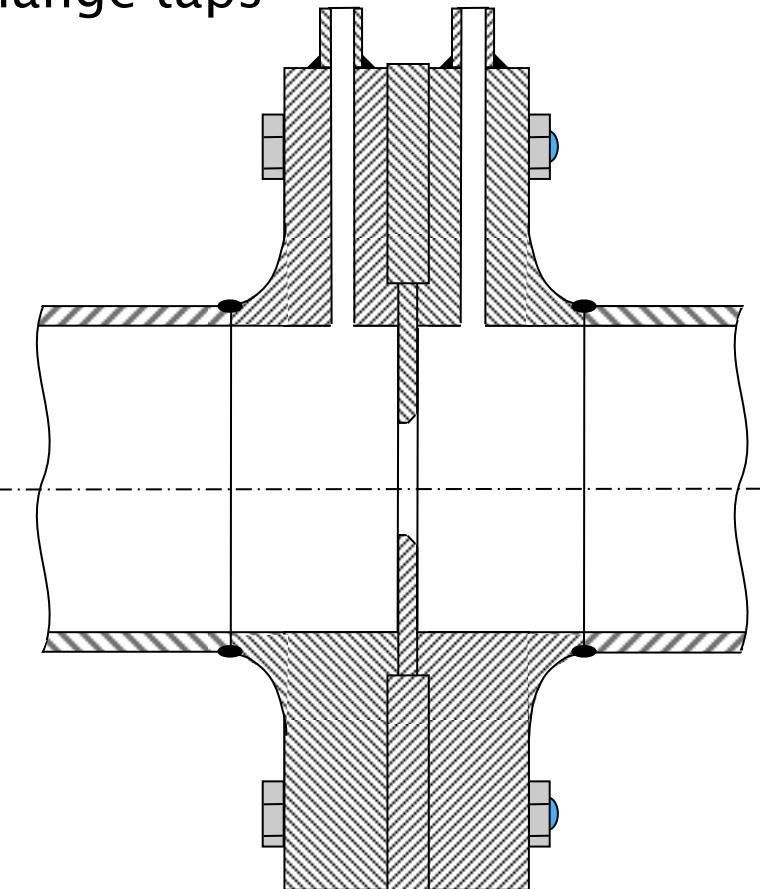
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# Deltatop DO61W

Orifice flanges 法兰取压孔板  
ASME B16.36  
DIN 19214  
flange taps



**Preferred in industries/  
regions where ANSI standards apply.**  
更倾向于采用ANSI标准的行业或地区

## Advantages:

- **Cost effective** 价格低  
(flanges included 含法兰)
- **orifice exchangeable** 可更换孔板  
(abrasive or changing media 磨损或改变介质)

## Limitations:

- **Will be disassembled for welding** 必须切开管道焊接
- **Welding on site required** 需要现场焊接

# Deltatop DO61W



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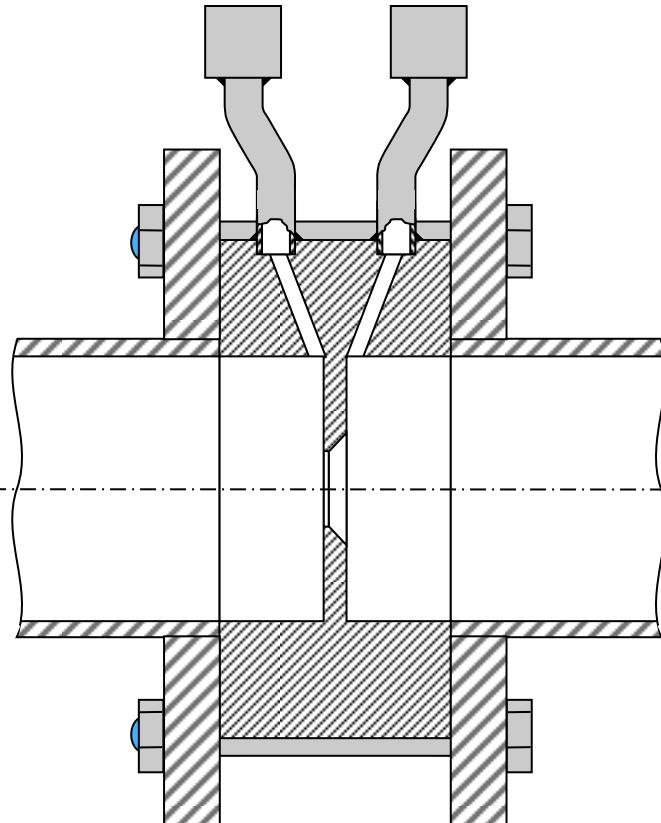
Slide

# Deltatop DO62C

Orifice with carrier ring  
Undivided  
Corner taps, single bore  
整体夹持型角接取压孔板

**Preferred in industries/  
regions  
where DIN/EN standards  
apply.**

更倾向于采用DIN/EN标准的行业或地区



## Advantages:

- Cost effective, easy manufacturing
- Rugged, only one piece, no internal sealing  
定位槽, 整体型, 无密封

## Limitations:

- Replacement requires complete new device  
只能整体更换

# Deltatop DO62C



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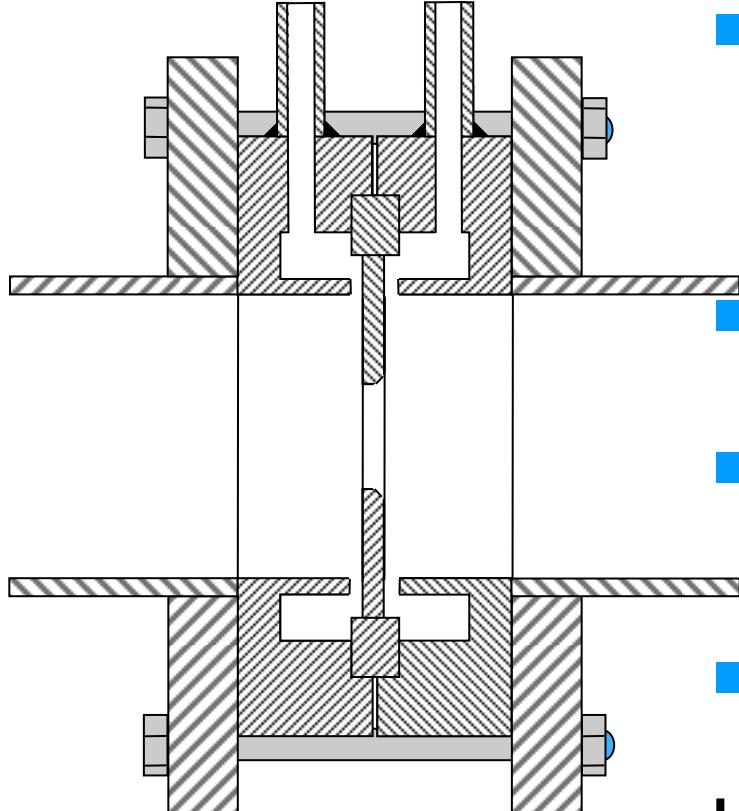
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# Deltatop DO63C

**Preferred in industries /  
Orifice with carrier rings regions  
Corner taps, annular chamber  
夹持式环室取压孔板**

**where DIN/EN standards apply  
更倾向于采用DIN/EN标准的行业或地区**

## Advantages:



- **Averaging of differential pressure over the hole circumference**  
通过环室可以得到平均差压
- **appropriate for verification for custody transfer**
- **orifice exchangeable** 可更换孔板 (abrasive or changing media)
- **PED compliant**  
适合做压力设备安全认证

## Limitations:

# Deltatop DO63C



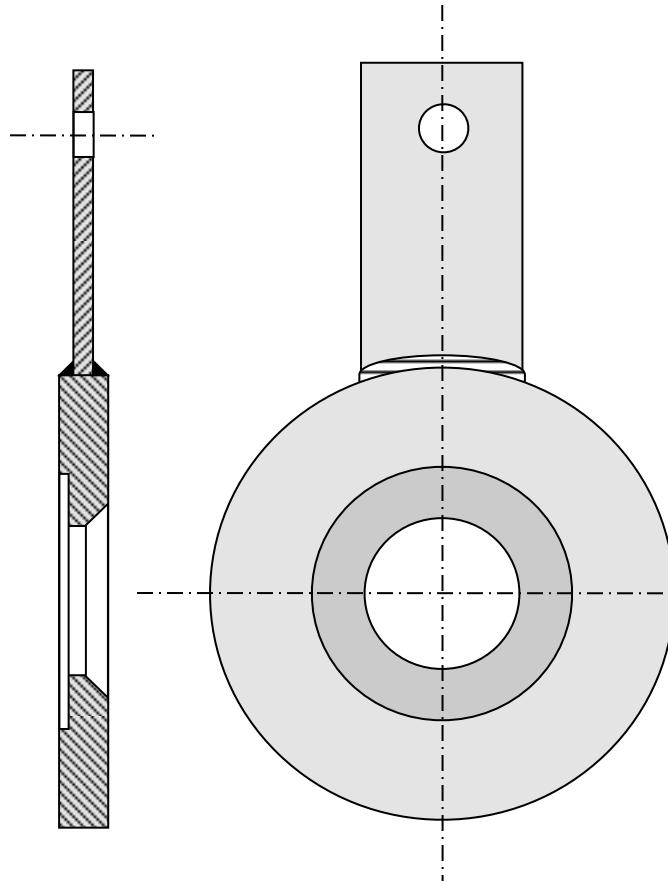
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# Deltatop DO64P

## Orifice plate 孔板元件



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**Preferred in industries/  
regions**  
**where ANSI standards apply.**  
更倾向于采用ANSI标准的行业或地区

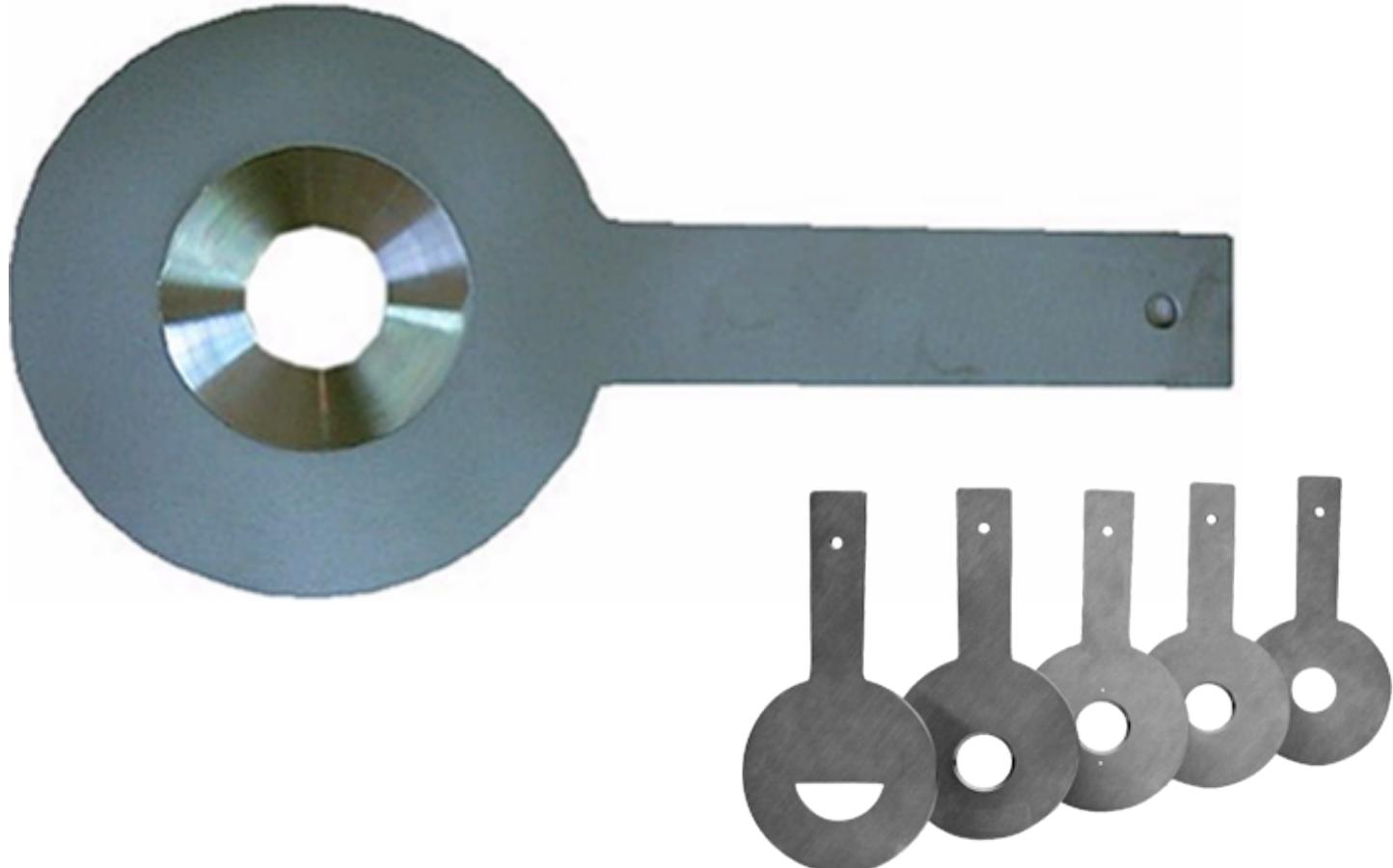
### Advantages:

- **Perfect for all tapping types** 适合各种取压方式
- **Replacement** 可更换 / **Spare part for DO61W的备件**
- **Easy to retrofit** 容易实现 (**between existing flanges**)
- **Not covered by PED**
- **Cost effective**
- **Short delivery time**

### Limitations:

- **Tapping to be arranged on site** 必须现场钻孔取压

# Deltatop DO64P

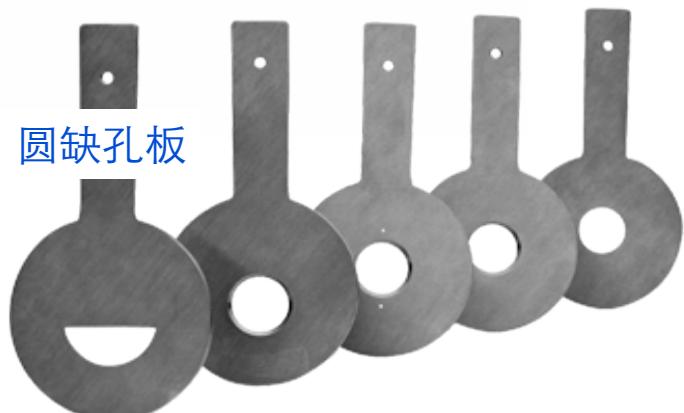


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# Deltatop DO64P



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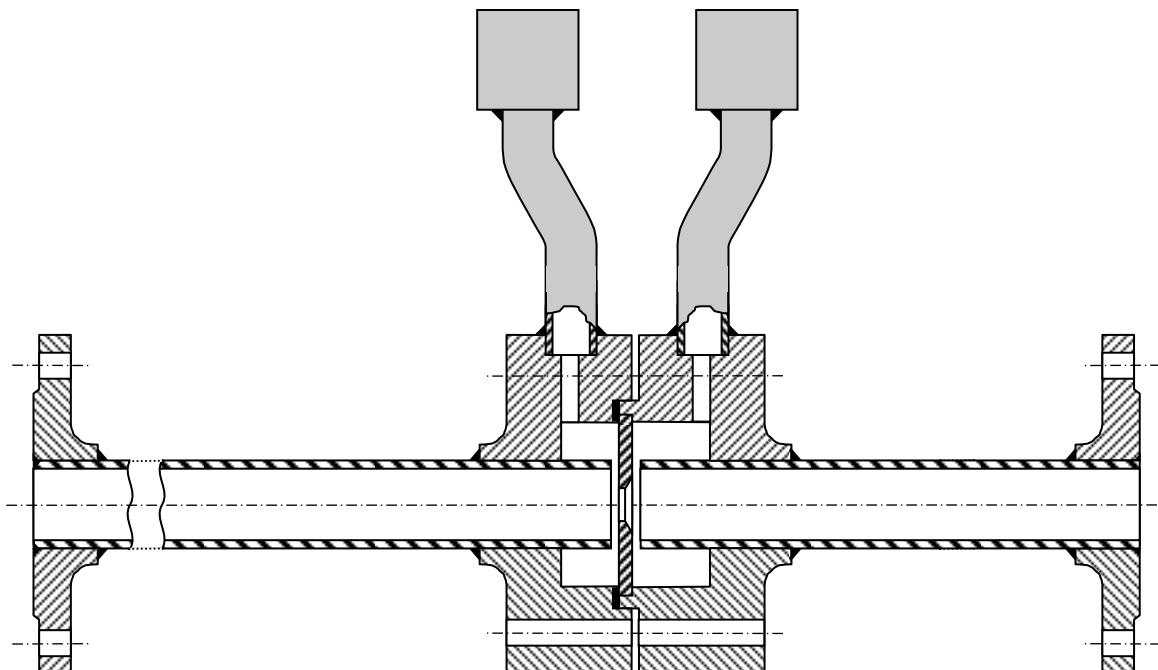
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# Deltatop DO65F

Meter run with end flanges

Corner taps, annular chamber

带前后直管段的环室取压法兰连接孔板



## Advantages:

- Same like DO63C
- Wet calibration possible 可能需要湿标
- Includes straight inlet and outlet run for small diameter step 小管径  
时带前后直管段
- Inlet/outlet pipe compliant to ISO5167
- For smallest diameters from DN10 最小可做到DN10

## Limitations:

- Relatively high cost 价

# Deltatop DO65F



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# Order Code - Family Products

- Deltatop Orifices DOxxx are family products
  - Like Flowtec products
  - Sales people are used to it
  - Nominal diameter is part of the root
  - Identical diameter coding as with Flowtec products

|     | Nominal Diameter: |
|-----|-------------------|
| 000 |                   |
| 25  | DN25 / 1"         |
| 40  | DN40 / 1-1/2"     |
| 50  | DN50 / 2"         |
| 65  | DN65 / 2-1/2"     |
| 80  | DN80 / 3"         |
| 1H  | DN100 / 4"        |
| 1Z  | DN125 / 5"        |
| 1F  | DN150 / 6"        |
| 2H  | DN200 / 8"        |
| 2F  | DN250 / 10"       |
| 3H  | DN300 / 12"       |
| 3F  | DN350 / 14"       |
| 4H  | DN400 / 16"       |
| 4F  | DN450 / 18"       |
| 5H  | DN500 / 20"       |
| 6H  | DN600 / 24"       |
| 7H  | DN700 / 28"       |
| 8H  | DN800 / 32"       |
| 9H  | DN900 / 36"       |
| 1T  | DN1000 / 40"      |

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# Order Code – Family Products

- Deltatop Orifices DOxxx are family products
  - Like Flowtec products
  - Sales people are used to it
  - Nominal diameter is part of the root
  - Identical diameter coding as with Flowtec products

**DO62C + DN400 = DO62C4H-**

|     |                          |
|-----|--------------------------|
| 000 | <b>Nominal Diameter:</b> |
| 25  | DN25 / 1"                |
| 40  | DN40 / 1-1/2"            |
| 50  | DN50 / 2"                |
| 65  | DN65 / 2-1/2"            |
| 80  | DN80 / 3"                |
| 1H  | DN100 / 4"               |
| 1Z  | DN125 / 5"               |
| 1F  | DN150 / 6"               |
| 2H  | DN200 / 8"               |
| 2F  | DN250 / 10"              |
| 3H  | DN300 / 12"              |
| 3F  | DN350 / 14"              |
| 4H  | DN400 / 16"              |
| 4F  | DN450 / 18"              |
| 5H  | DN500 / 20"              |
| 6H  | DN600 / 24"              |
| 7H  | DN700 / 28"              |
| 8H  | DN800 / 32"              |
| 9H  | DN900 / 36"              |
| 1T  | DN1000 / 40"             |



Pressure



Level



Pressure



Flow



Temperature



Liquid Analysis



Registration



Systems Components



Services



Solutions

# Pitot Tube

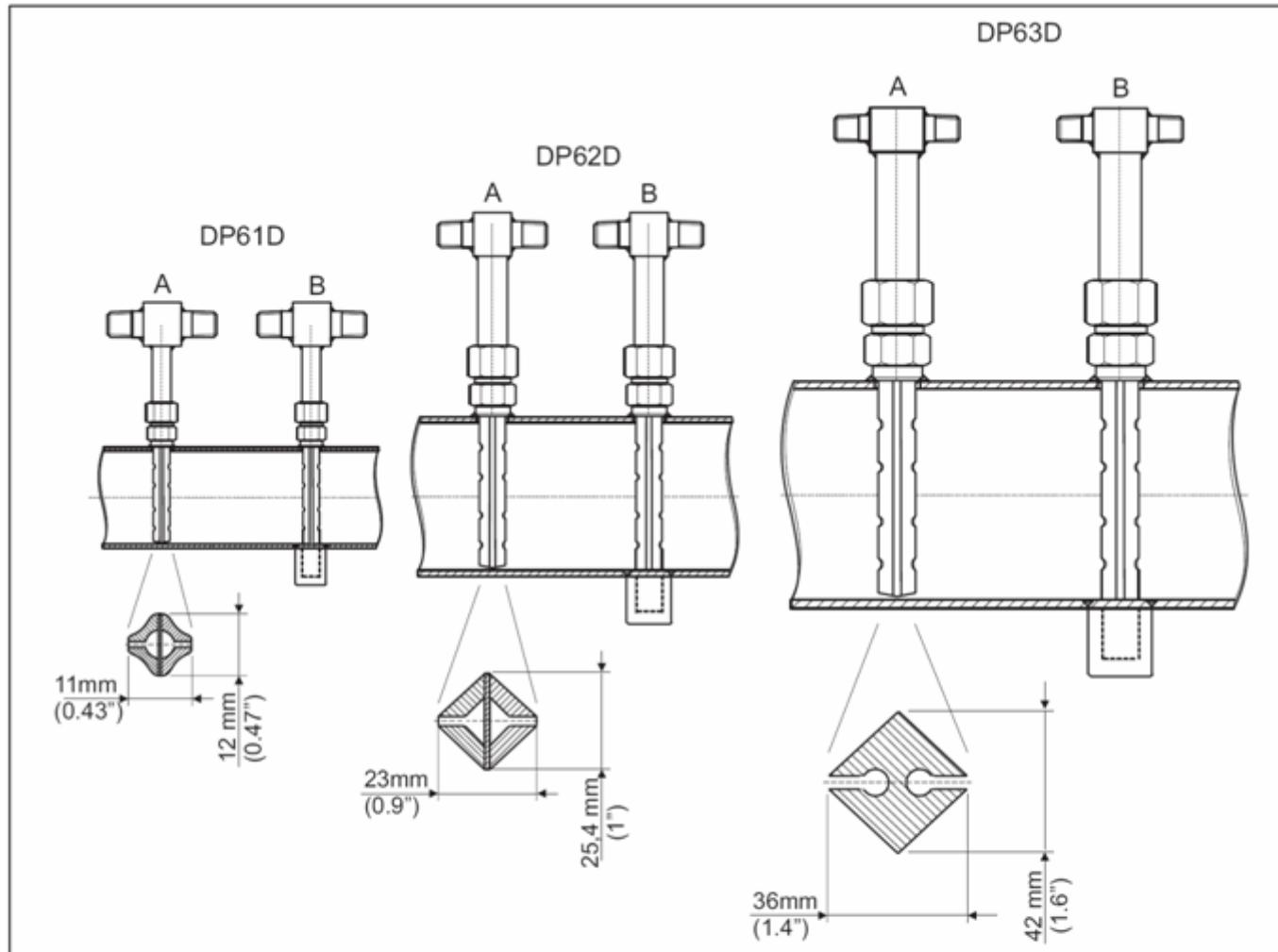
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# Deltatop DP61D, DP62D, DP63D

## Pitot Tube with diamond shaped sensor Profile



P01-D0xxxxxx-06-xx-00-xx-041

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**A:** without end support; **B:** with end support

# Deltatop DP61D, DP62D, DP63D

## Advantages:

- Very low pressure loss 很小的压力损失
- Low abrasion sensitivity 对磨损不敏感
- Easy to retrofit (just drill a hole) 容易制造
- Low cost for larger diameters 大管径时成本低
- Bidirectional due to absolutely symmetrical p 完全对称可实现双向测量
- Low influence of Re on k-factor 雷诺数Re对k系数影响较小



## Limitations:

- Relatively low dp, therefore limited TD  
因为获得的dp小，所以量程比TD有限
- Not standardized 没有统一的标准
- Relatively high cost for small diameters 小管道价格相对偏高

# Deltatop DP61D, DP62D, DP63D

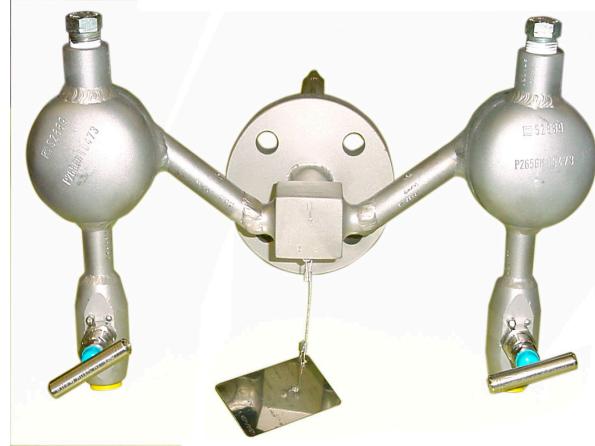
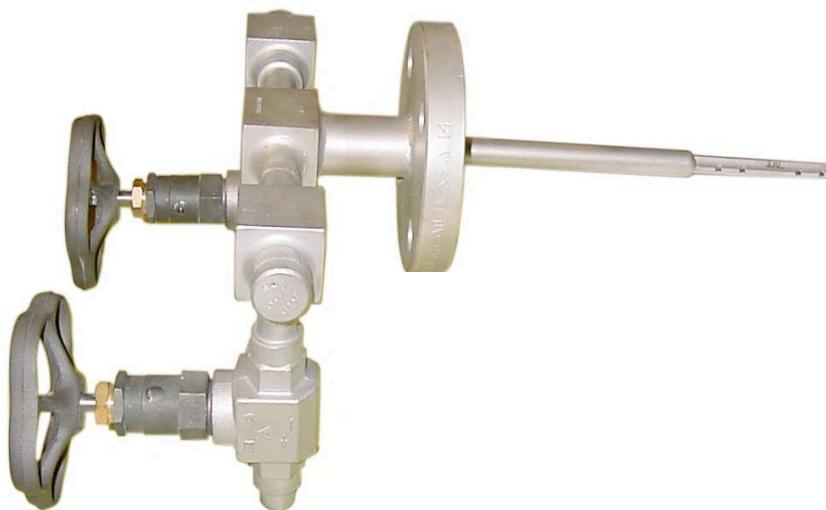


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# Deltatop DP61D, DP62D, DP63D



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# Feature Selection

- Process connection  
‘Flowtap’

‘Flowtap’ 在线插拔式过程连接



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# Feature Selection

## ■ Required space for 'Flowtap'

- Probe inserted:  $H1 = ID + WS + ISO + H4$
- Probe retracted, safety chain:  $H1 = 3 \times (ID + WS) + 4 \times ISO + H5$
- Probe retracted; spindle:  $H1 = 2 \times (ID + WS) + 3 \times ISO + H5$

with

- ID: inner pipe diameter
- WS: wall thickness
- ISO: mounting nozzle extension due to isolation (see page 27)
- H4, H5: lengths according to the following table

| Probe | End support | threaded connection with safety chain (A) |                | threaded connection with spindle (B) |                | flange connection with spindle (C) |                |
|-------|-------------|---|----------------|--------------------------------------|----------------|------------------------------------|----------------|
|       |             | H4 [mm (inch)]                            | H5 [mm (inch)] | H4 [mm (inch)]                       | H5 [mm (inch)] | H4 [mm (inch)]                     | H5 [mm (inch)] |
| DP61D | no          | 450 (18)                                  | 400 (15)       | 480 (19)                             | 430 (17)       | 760 (30)                           | 570 (22)       |
|       | yes         | 500 (20)                                  | 500 (20)       | 530 (21)                             | 530 (21)       | 810 (32)                           | 670 (26)       |
| DP62D | no          | 480 (19)                                  | 430 (17)       | 530 (21)                             | 460 (18)       | 820 (32)                           | 600 (24)       |
|       | yes         | 560 (22)                                  | 560 (22)       | 610 (24)                             | 620 (24)       | 900 (35)                           | 760 (30)       |



Note!

The values given here provide a basis for the estimation of the required space.

The exact values depend on the medium, material, pressure rating, application (gas, steam, liquid) and mounting position and can deviate from the given values by up to  $\pm 150$  mm (6").

# Feature Selection

- Integrated temperature sensor

集成温度传感器的毕托管



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Pressure



Level



Pressure



Flow



Temperature



Liquid Analysis



Registration



Systems Components



Services



Solutions

# Accessories

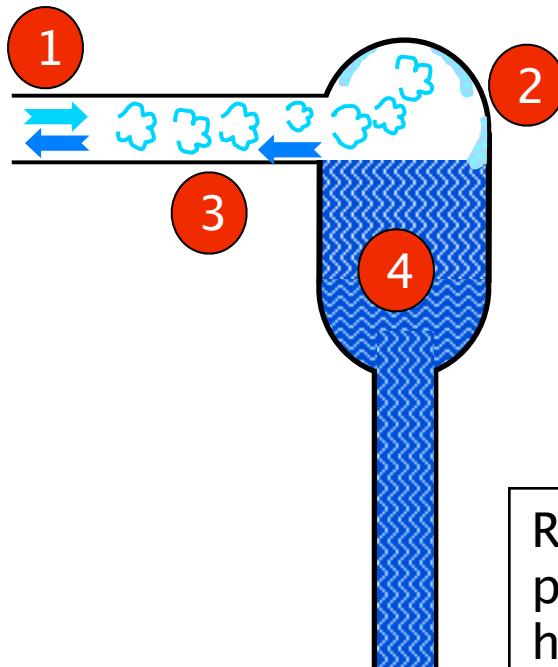
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# Condensate Pots

- E+H recommends strongly to use condensate pots in steam applications 测量蒸汽流量时，强烈推荐使用冷凝罐
- Condensate pots ensure a stable zero point  
冷凝罐可以保证零点稳定
- Condensate pots avoid signal fluctuations  
冷凝罐可以避免信号波动



- 1 ■ Steam enters from process
- 2 ■ Steam condensates on surface
- 3 ■ Condensate runs back

Requires proper installation with both pots at the same height. 要求正确的安装以获得相同的高度

# DA61C – Condensate pots for

## ■ Condensate pots for orifices DO6xx

- 300cm<sup>3</sup> carbon steel (HII) and stainless steel (316L/PN100)
- 250cm<sup>3</sup> high temperature version (16Mo3/PN250)
- Included in orifice structures as pairs  
包含在孔板订货号中是成对供应的
- Single pieces in accessory structure with identical feature codes  
作为附件拥有单独的型号，且是单个供应的



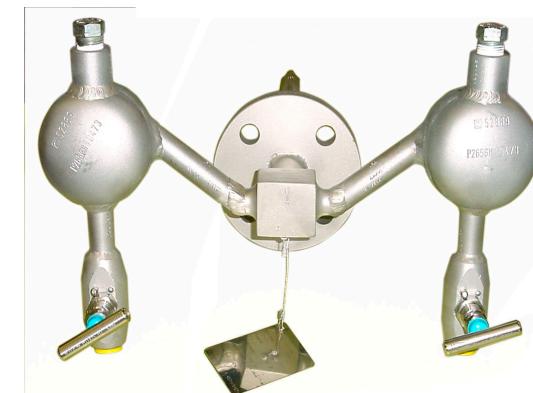
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# DA62C – Condensate pots for Pitot

- Condensate pots for pitot tubes DP6xD
  - 300cm<sup>3</sup> carbon steel (HII) and stainless steel (316L/PN100)
  - 300cm<sup>3</sup> high temperature version (16Mo3/PN100)
  - 20cm<sup>3</sup> high temperature / high pressure version (16Mo3/PN250)
- Included in orifice structures as pairs  
包含在孔板订货号中是成对供应的
- Single pieces in accessory structure with identical feature codes  
作为附件拥有单独的型号，且是单个供应的

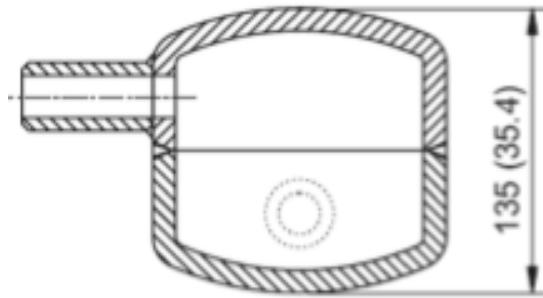


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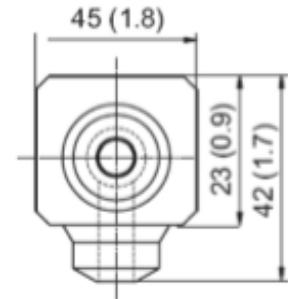
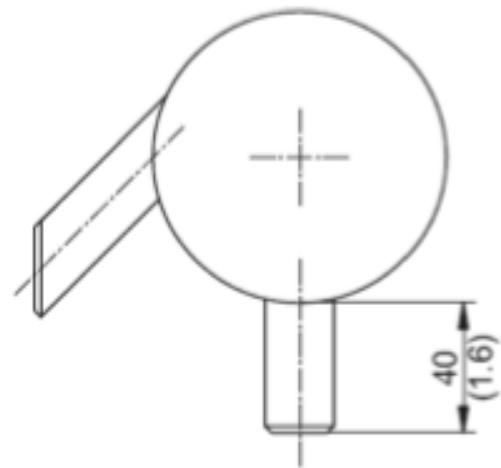
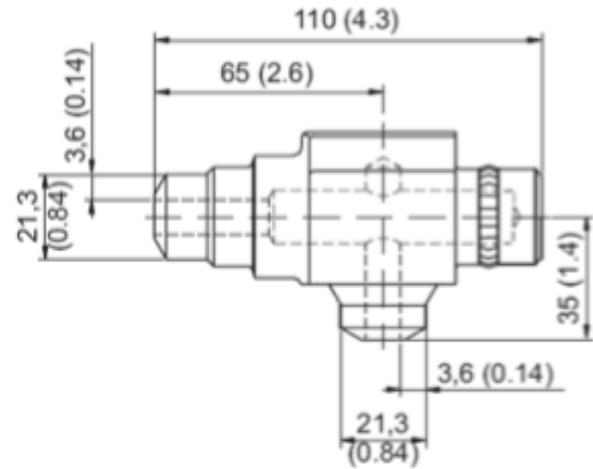
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# DA62C – Condensate pots for Pitot Tubes

## ■ Condensate pots for Pitot Tubes 300cm<sup>3</sup>



20cm<sup>3</sup>



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# DA62V - Shut-off Valves for Pitot Tubes

## ■ Shut-off valves for Pitot Tubes DP6xx

- Needle valves 针形阀
- Gate valves 闸阀
- Ball valves 球阀
- High temperature version 高温型
- Included in orifice structures as pairs  
包含在孔板订货号中是成对供应的
- Single pieces in accessory structures with identical feature codes  
作为附件拥有单独的型号，且是单个供应的



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# DA63M – Manifolds 阀组

- For all primary elements  
适合所有节流元件
- Included in primary element structure  
包含在主型号内
- 3-valve and 5-valve manifold
- For compact and remote versions  
有不同的型号分别适合一体化型和分离型节流装置
- For high temperature steam applications  
适合高温蒸汽



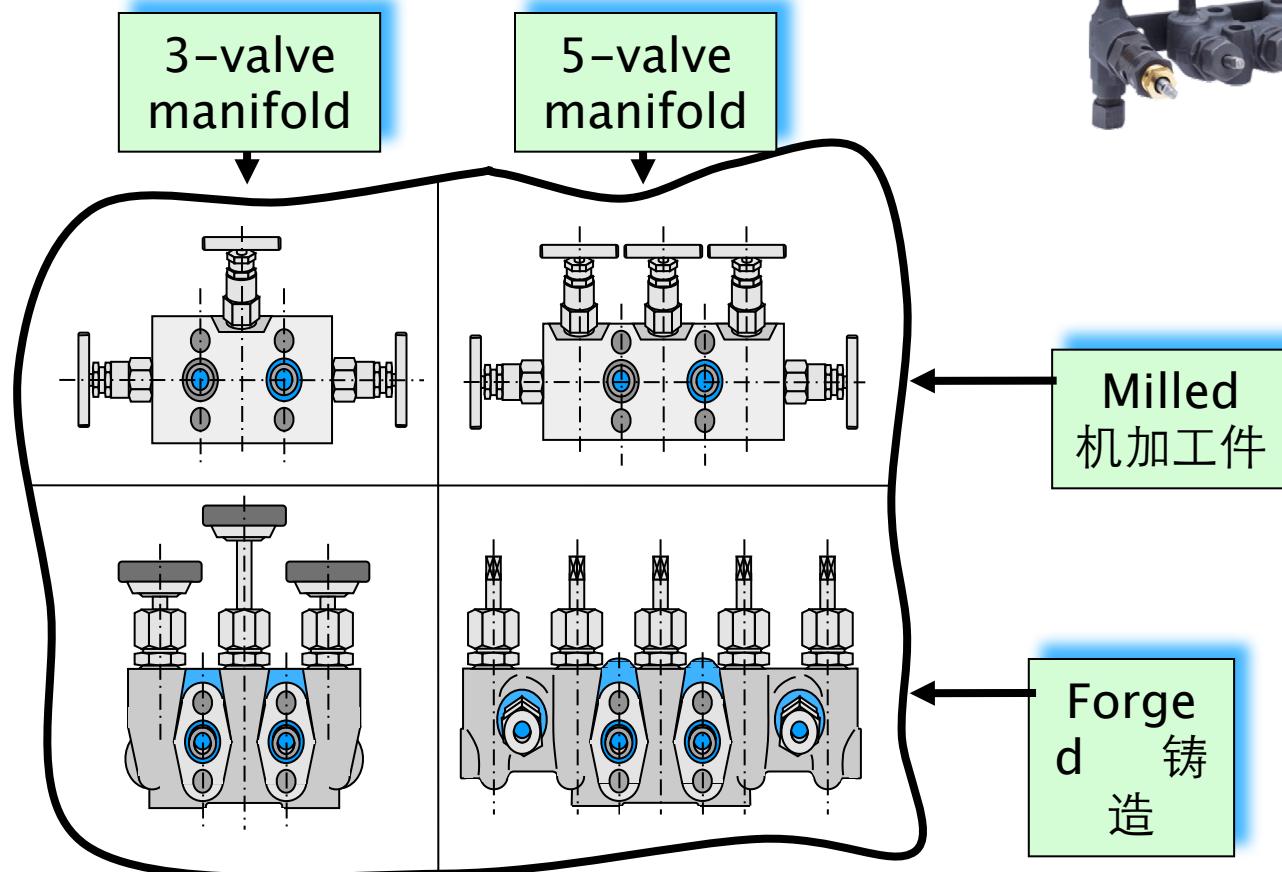
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# Manifolds

manifold combination

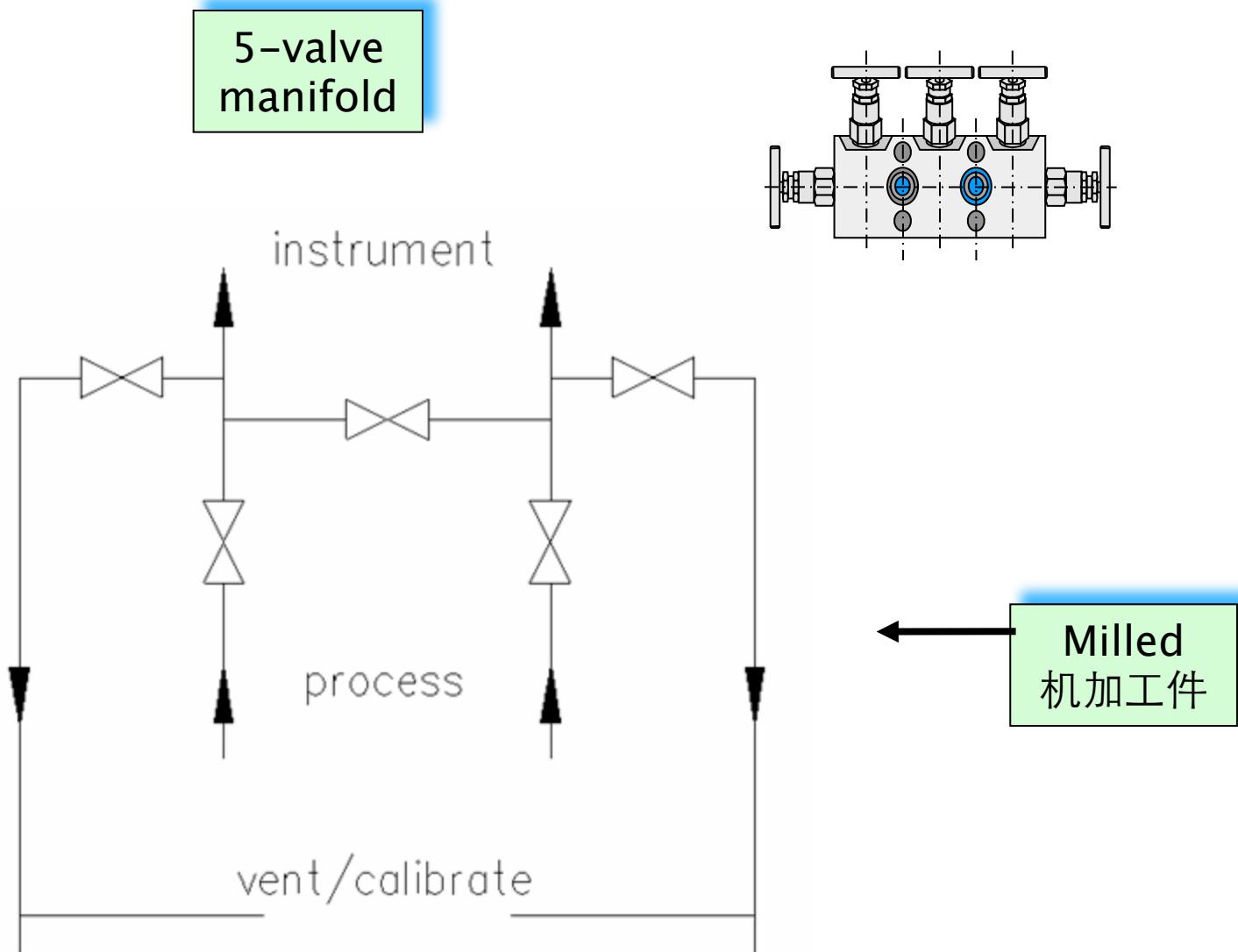


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# Manifolds



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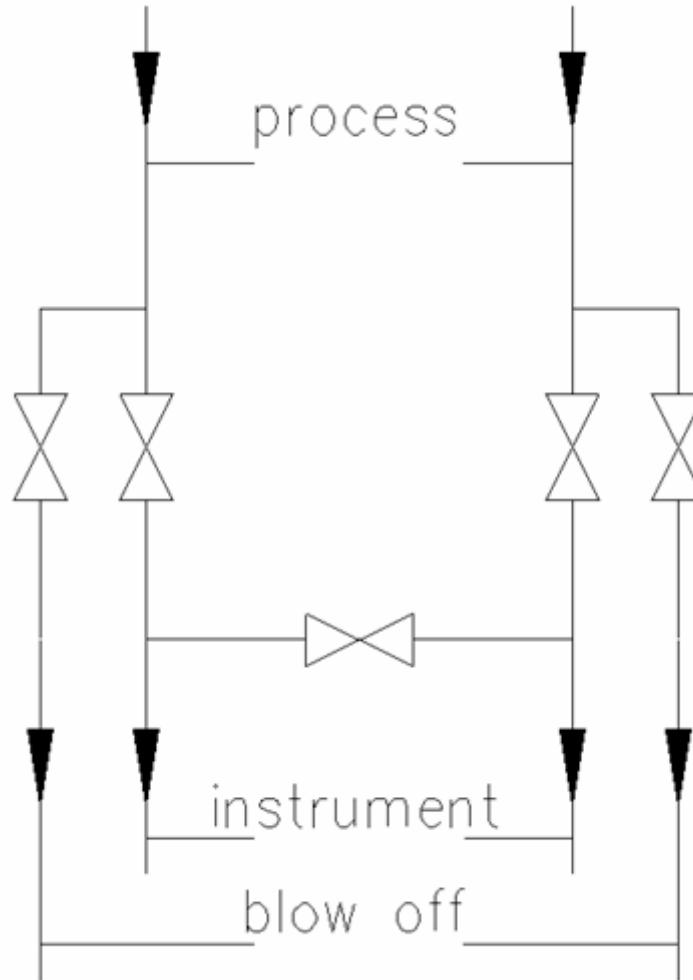


# Manifolds

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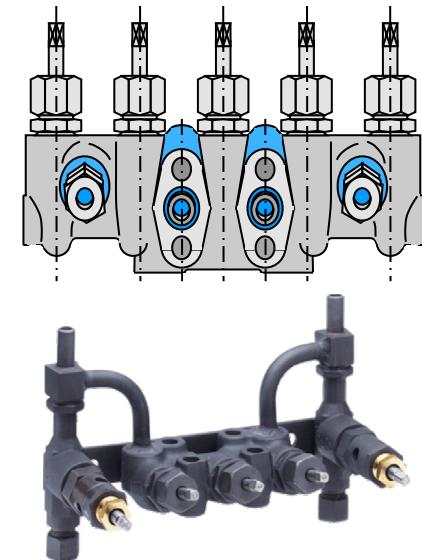
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Forge  
d铸造

5-valve  
manifold



# DA63R - Flow Conditioner 整流器

## ■ Zanker type flow conditioner

- Compliant with ISO5167
- Reduces straight runs requirements
- Family structure
- Stainless steel 316L



| Version | Mean Diameter |
|---------|---------------|
| DA63R25 | DN25 / 1"     |
| DA63R40 | DN40 / 1-1/2" |
| DA63R50 | DN50 / 2"     |
| DA63R65 | DN65 / 2-1/2" |
| DA63R80 | DN80 / 3"     |
| DA63R1H | DN100 / 4"    |
| DA63R1Z | DN125 / 5"    |
| DA63R1F | DN150 / 6"    |
| DA63R2H | DN200 / 8"    |
| DA63R2F | DN250 / 10"   |
| DA63R3H | DN300 / 12"   |
| DA63R3F | DN350 / 14"   |
| DA63R4H | DN400 / 16"   |

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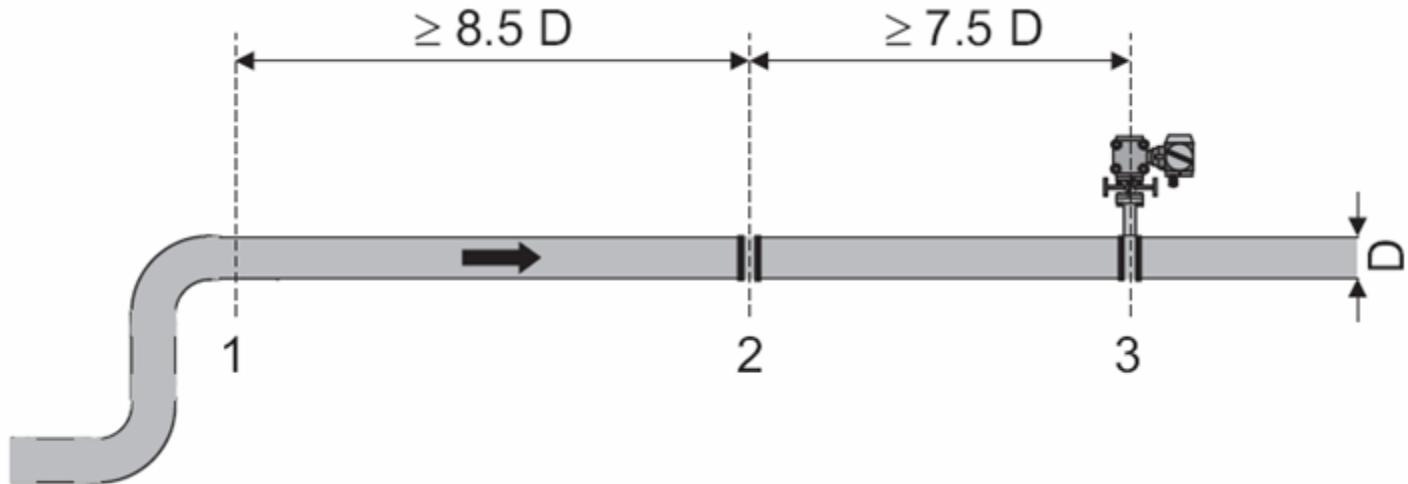
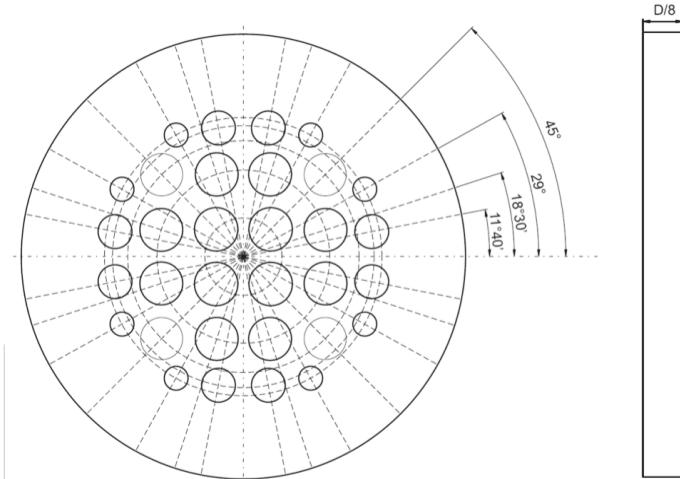
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# DA63R - Flow Conditioner

- Reduces straight inlet pipe requirements to 17D
- Thickness = D/8
- Additional pressure loss

$$\Delta p = 1,5 \rho v^2$$

- $\Delta p$ : Pressure loss across the rectifier [Pa]
- $\rho$ : Density of the fluid [ $\text{kg}/\text{m}^3$ ]
- $v$ : Flow velocity [ $\text{m}/\text{s}$ ]



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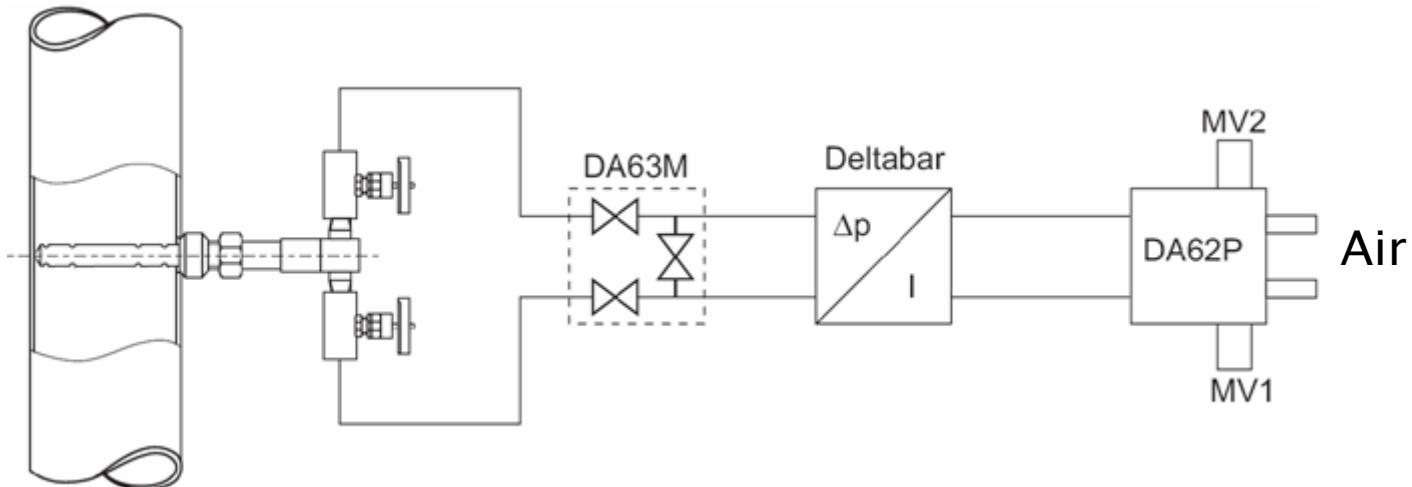
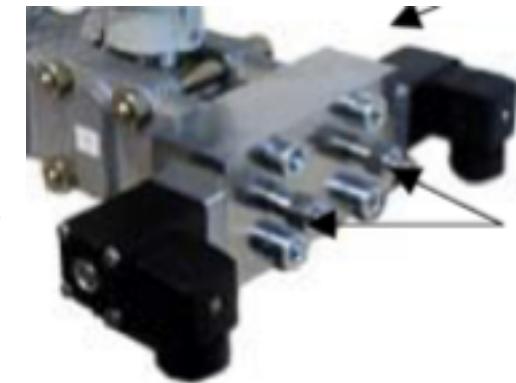
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# DA62P – Air Purge Unit

## ■ Purge unit for Pitot Tubes

毕托管吹扫装置

- To avoid blockage of tapping holes by particles
- For dry medium only
- Recommended for particle concentration > 100mg/m<sup>3</sup>
- dust concentration > 500mg/m<sup>3</sup> -> strong abrasion



Classification:  
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Pressure



Level



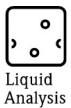
Pressure



Flow



Temperature



Liquid Analysis



Registration



Systems Components



Services



Solutions

# Engineered Solutions

Classification:  
INTERNAL

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# Classical Venturi Tubes acc. ISO5167-4

- Inlet cone rough (cast), throat drilled
  - DN100...800,  $\beta$  0,3..0,75
  - DN50...500,  $\beta$  0,3..0,8
  - $200000 < Re < 2000000$
- Inlet cone and throat drilled (machined)
  - DN50...250,  $\beta$  0,4...0,75
  - $200000 < Re < 1000000$
- Inlet cone rolled and welded, throat drilled
  - DN200...1200,  $\beta$  0,4...0,7
  - $200000 < Re < 2000000$
- 4 single bore taps at 0,5D and 0,5d
- shorter straight lengths as orifices and nozzles
- only available as engineered solution

ASK US !

# Classical Venturi Tubes acc. ISO5167-4

- Inlet cone rough (cast), throat drilled
  - DN100...800,  $\beta$  0,3..0,75
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DV61S

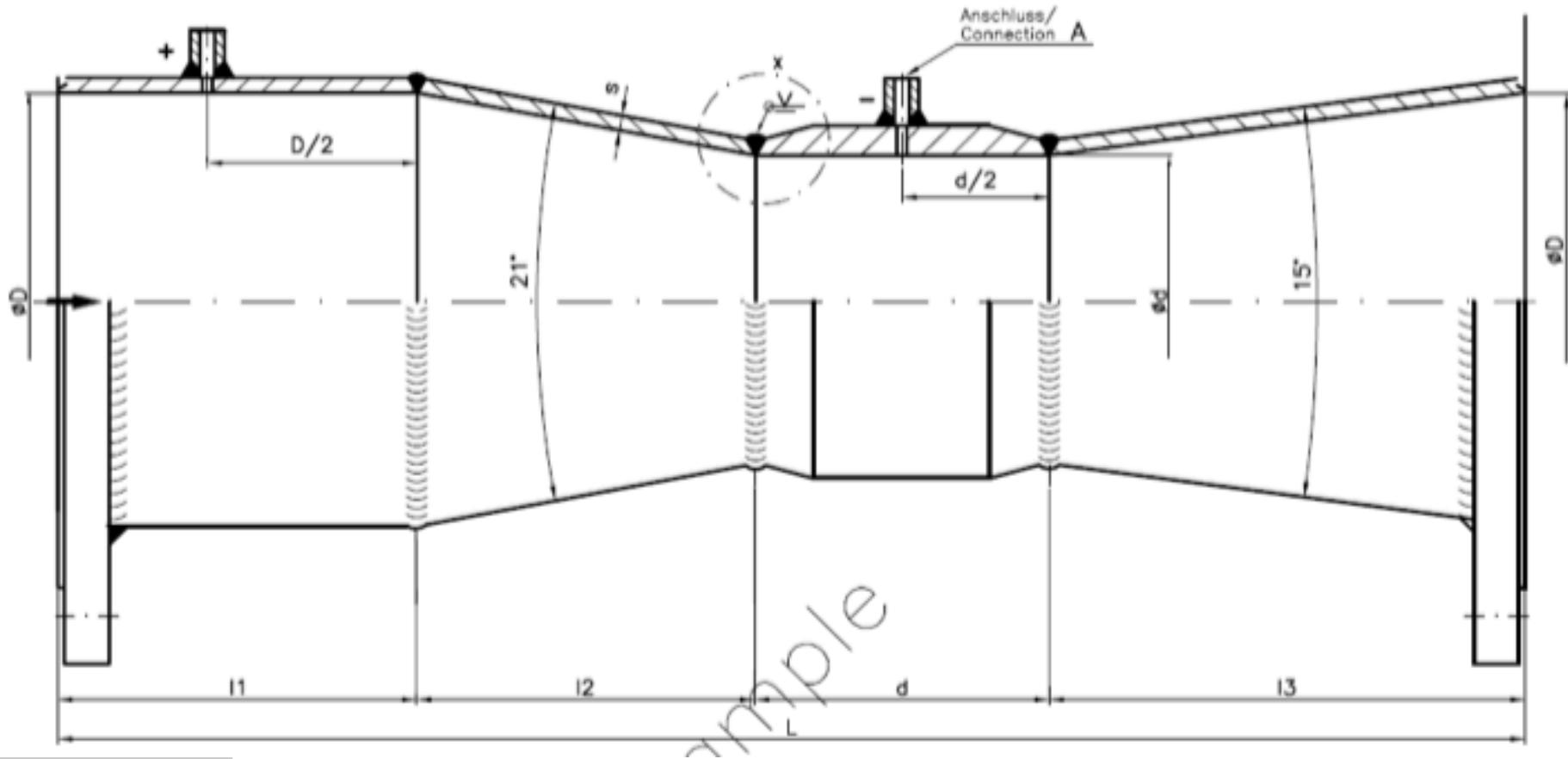
Classification:  
INTERNAL

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ASK US !

# Venturi Tubes





# Specials

- Split range arrangements 分成不同的流量段测量
- With P/T measurement included 同时测量压力和温度
- Restriction Orifices 限流孔板
- Wedge meters 楔型孔板
- Prandtl tubes 普朗特管 (毕托静态管)

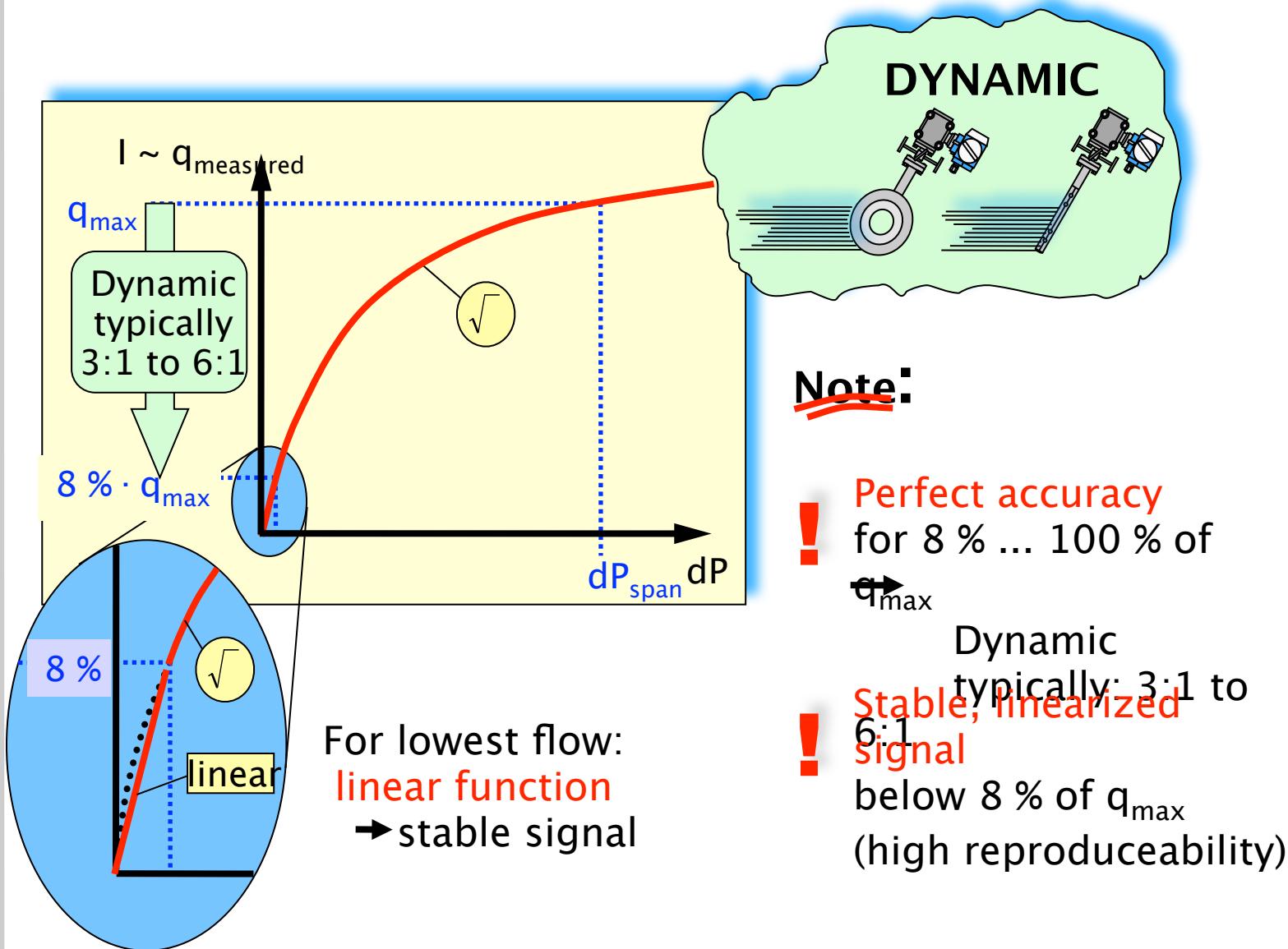
ASK US!

Classification:  
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# dP Flow dynamic

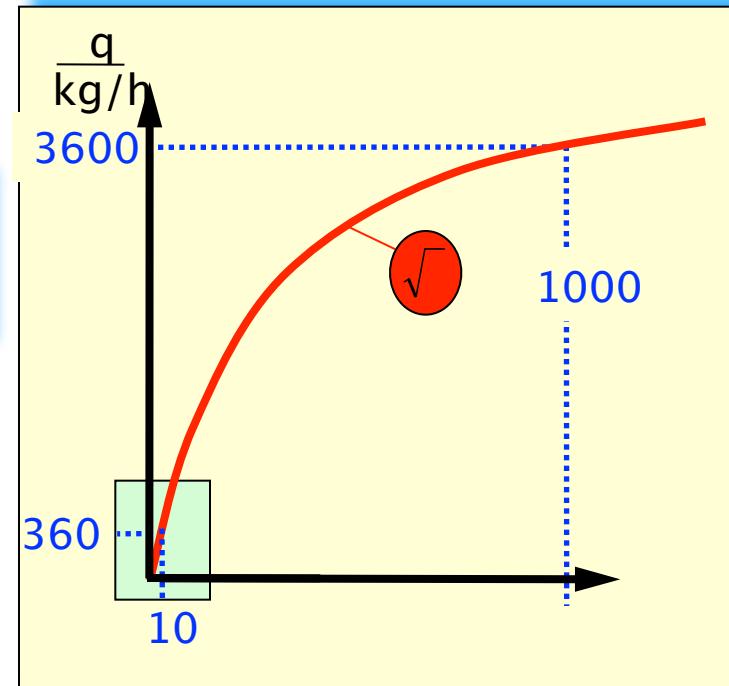
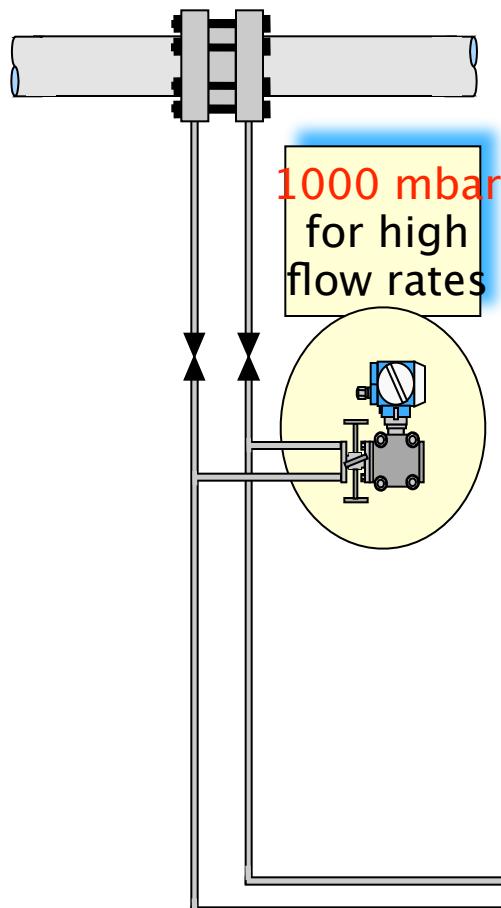


Classification:  
INTERNAL

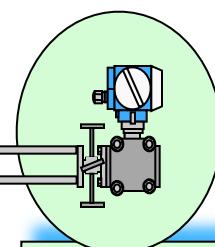
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# dP Flow solution for high dynamic needs



Dynamic range (typically: 3:1 to 6:1)



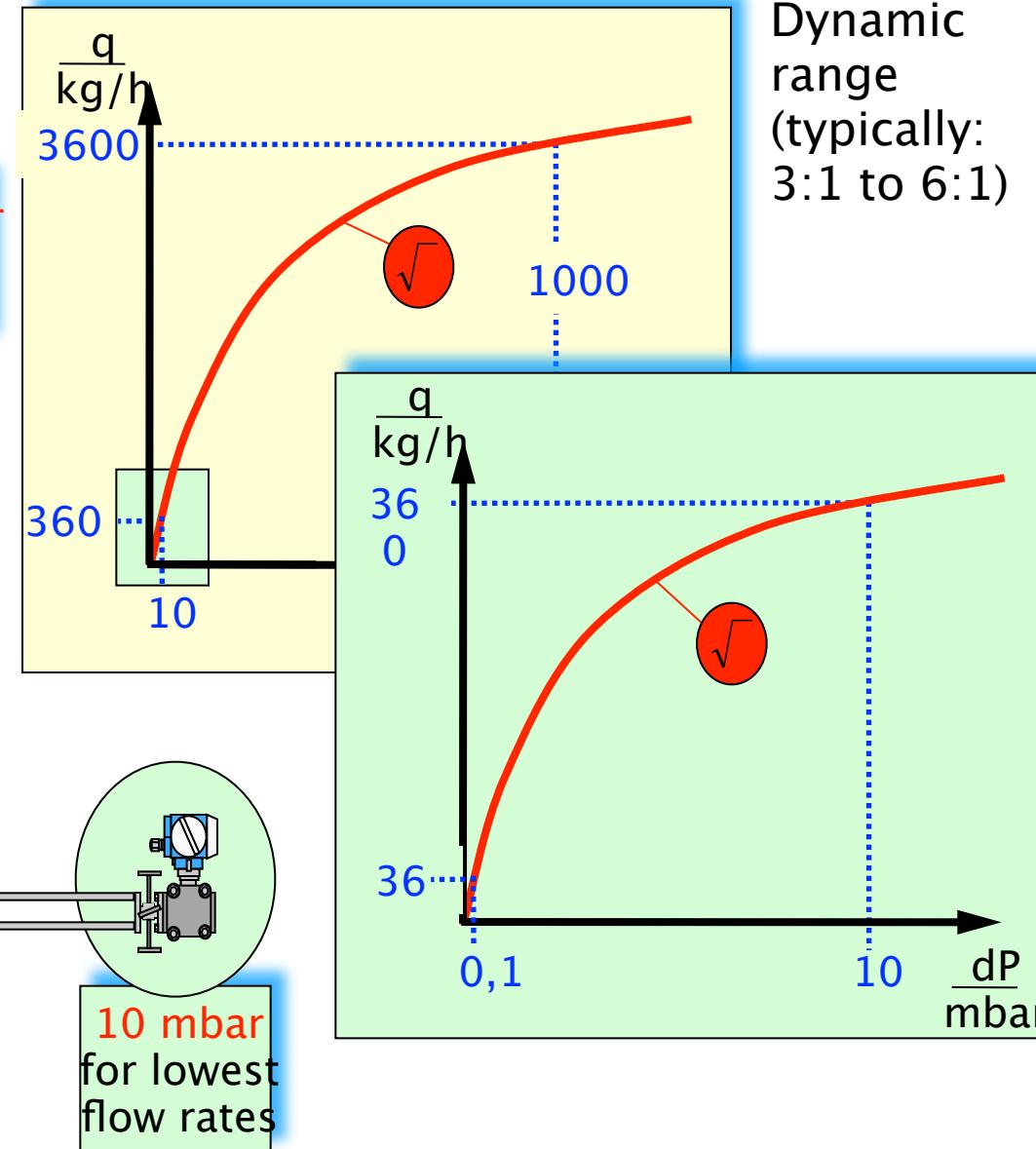
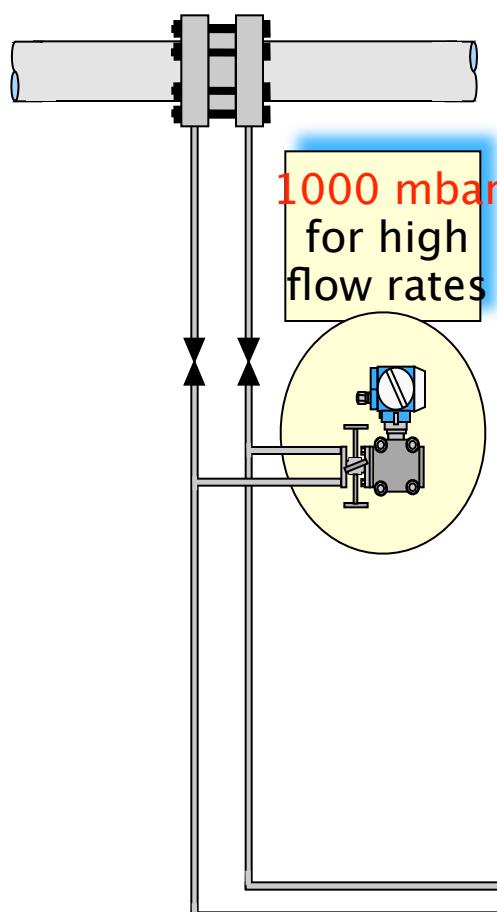
10 mbar  
for lowest flow rates

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# dP Flow solution for high dynamic needs

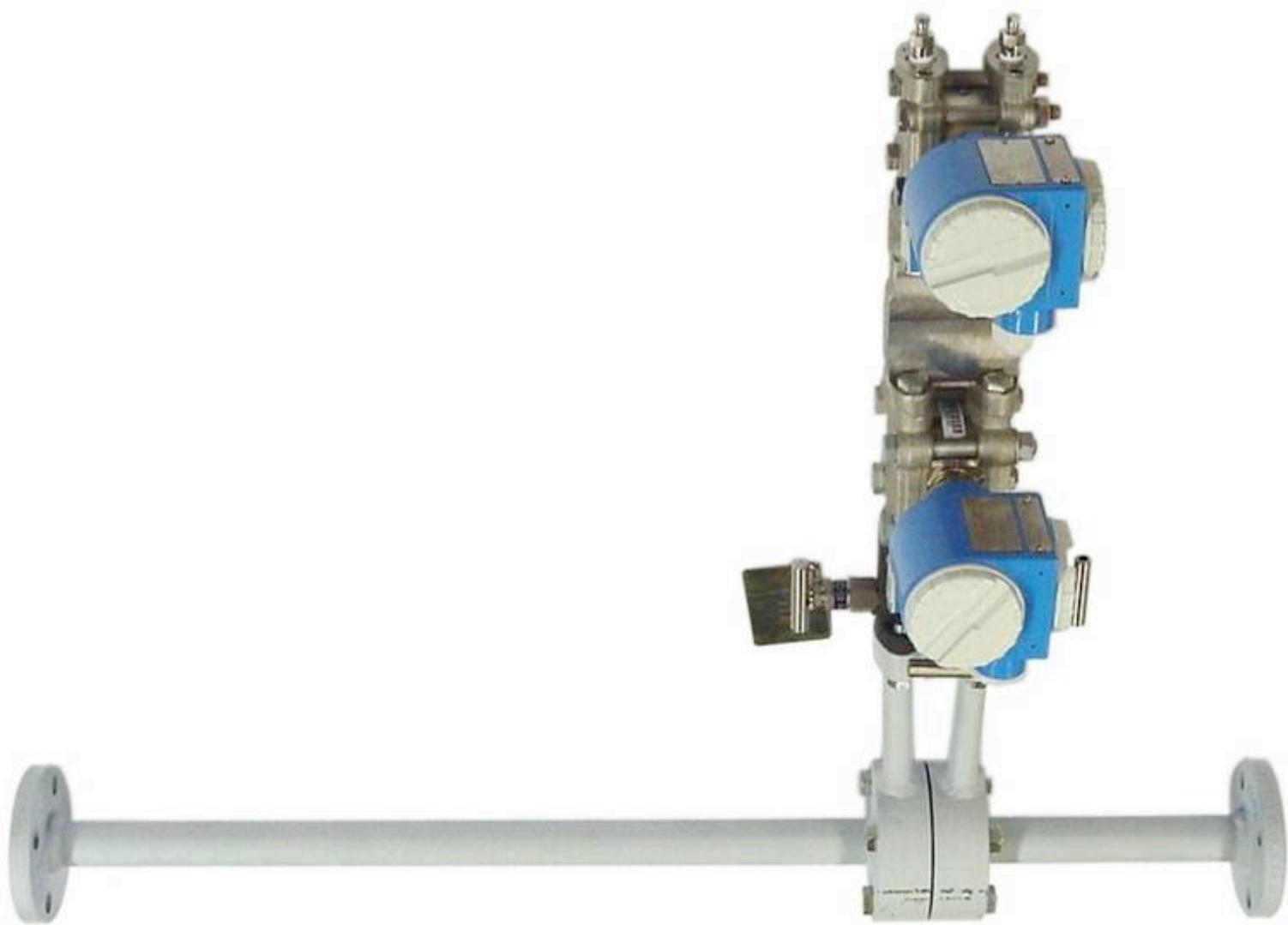


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# Split Range Application



Classification:  
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# Gas Flow with p + T Compensation

- Eight measuring points



Classification:  
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# XXL Pitot tubes

- Stack flow measurement 烟气管道流量测量
- In pipe sizes up to DN 12000
- Round and rectangular duct 圆形或矩形管道
- With access openings for easy cleaning from both sides  
带可打开式的安装结构能实现双向吹扫
- Air purging units available 可附带空气吹扫装置



Classification:  
INTERNAL

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Pressure



Level



Pressure



Flow



Temperature



Liquid  
Analysis



Registration



Systems  
Components



Services



Solutions

# Phase out

Classification:  
INTERNAL

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# Deltatop / Deltaset DPOxx and DPPxx

Classification:  
INTERNAL

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# Deltatop / Deltaset DPOxx and DPPxx

- Product name Deltaset will disappear but...不再有Deltaset
- Remote versions are integrated in the new family structures  
分离型在型号内定义
- Deltatop remains with new structure but...保留Deltatop,  
但是...
- Deltatop Deltatop DPOxx and DPPxx will be phased out  
as well Deltatop不再叫DPOxx 和 DPPxx
- All products are fully available以前有的产品依然存在，只是型号  
变了
- New Deltatop family is fully compatible (...and more)  
新的Deltatop系列产品完全与老的产品相对应，同时还增加了一些

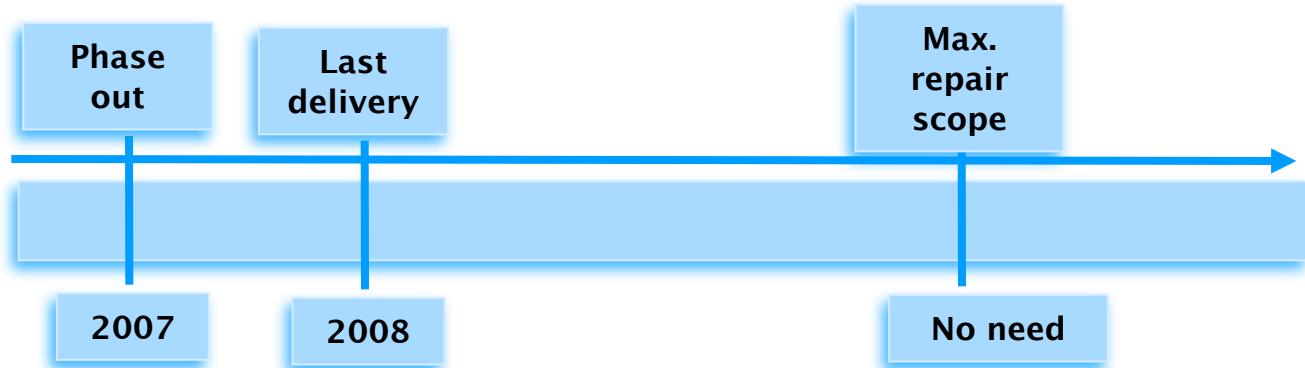
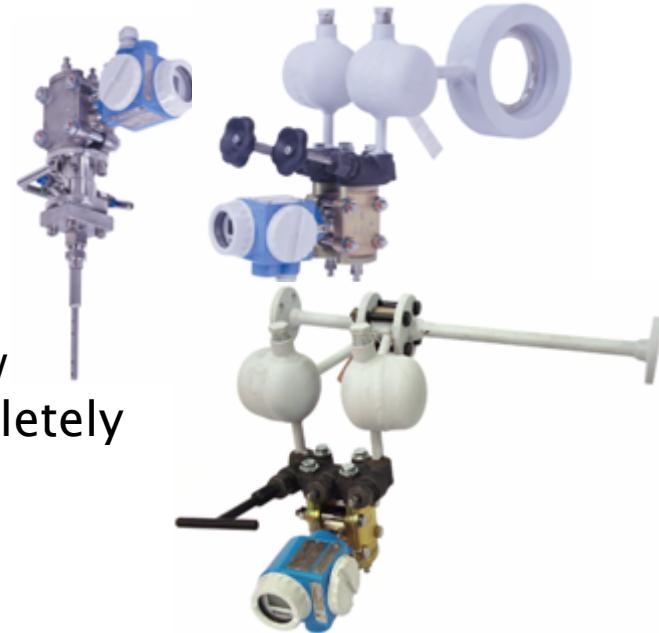
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INTERNAL

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# Phase out primary elements

- **Phase out** October 2007
- Call for last order June 2008
- Close SAP September 2008
- No repair scope needed, the new primary elements replaces completely the existing once



Classification:  
INTERNAL

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# Deltatop / Deltaset DPOxx and DPPxx

**Switch Over  
As Soon As Possible**

Classification:  
INTERNAL

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Slide



Pressure



Level



Pressure



Flow



Temperature



Liquid Analysis



Registration



Systems Components



Services



Solutions

# Applications

Classification:  
INTERNAL

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# Polypropylene Plant in China



**DPO15-C12C2F**

Classification:  
INTERNAL

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## Measuring technology:

- Orifice Meterrun,  
Differential pressure  
transmitter DELTABAR S

## Process:

- Air/Exhaust gas
- Flowrate 250kg/h
- Pressure 4–6barabd
- Temperature 35°C
- Viscosity 0,07mpa.s

## Features:

- Deltatop, the dp flow family of Endress + Hauser is usable up to 420 bar and 1000 deg C
- DELTABAR S is suited for static pressure up to 420 bar for high safety during operation.

# Flow measurement of air to aeration tanks

## Process:

Air supplying line Orifice flowmeter with our Differential pressure transmitter, temperature, pressure and RMC621 installed in Yongin Gugal WWTP .

## Project details:

- Cost: About 8,000 Euro each(3 sets installed)
- Air flow rate: 1400 ~ 1600 Nm<sup>3</sup>/h

## Key Success Factors:

Compensation for pressure and temp.

Use of Flow computer RMC621 which is added up the trust from normal states

24H full operation with constant value  
Company: Yongin Clean Water.

Location: Yongin City, Kyoungki-DO Republic of Korea



## Process Specifications:

Fluid: Compressed Air

Pressure: 3 bar

Temperature: 28 Deg C.

Flow Range: 0 ~ 2500 Nm<sup>3</sup>/h

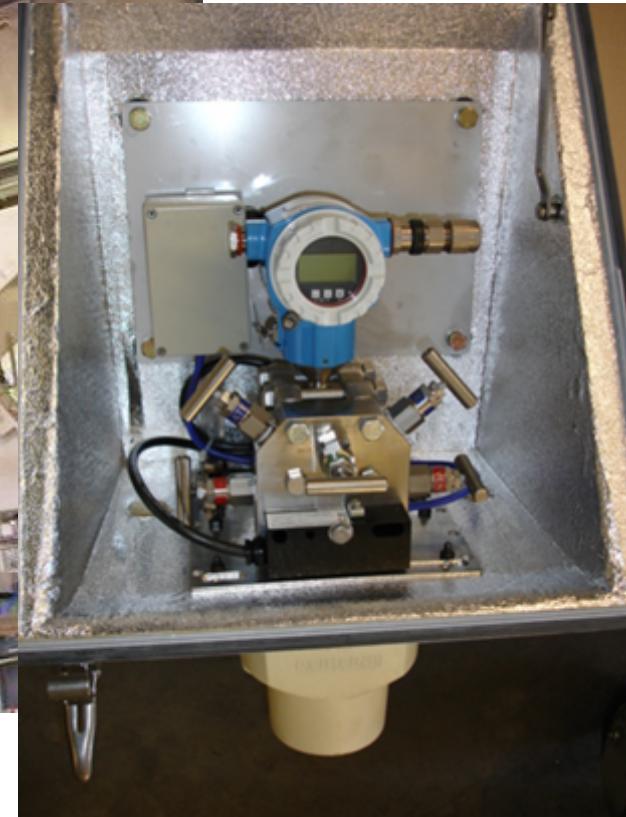
## Instrument detail:

Model: PMD230, RMC621

Size: 350A orifice flange local brand

Software/Bus: 4..20 mA/HART

# Gas flow application in NL



Classification:  
INTERNAL

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Gas flow Application  
Chemical Industry inNL

# Liquid flow



## Instrument:

PMD70-1BA7BBDAAA + DPP10-  
C1W1A12F

Size/Lining: 48"

## Process Specs:

Fluid: Water

Classification:  
INTERNAL

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Company: Nantong Carjill Company in  
Location: Jiangsu province of China

# Air flow measurement/ES



Pipe thickness: 0,8 – 1,5 mm → Rigidity problem

Flying flecks and condensation → Air purge system



Classification:  
INTERNAL

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Chimney:  
25 meter  
high  
DN 3000  
Polyester

# Air flow measurement/ES



Pipe thickness: 0,8 – 1,5 mm → Rigidity problem



Chimney:  
25 meter  
high  
DN 3000  
Polyester

Flying flecks and condensation → Air purge system



Classification:  
INTERNAL

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# Unknown



Classification:  
INTERNAL

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24-03-2005

# CO<sub>2</sub> in a soft drink production



Classification:  
INTERNAL

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## Process Specifications:

Fluid: CO<sub>2</sub>  
Pressure: 5,5 Bara  
Temperature: 50 degC.  
Flow Range: 500lbs/h

# Steam Measurement / Typical Installation



Classification:  
INTERNAL

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Pressure



Level



Pressure



Flow



Temperature



Liquid Analysis



Registration



Systems Components



Services



Solutions

# Summary

你选什么流量计？

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# Flowmeter selection?

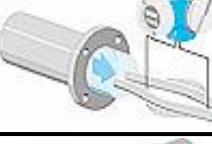
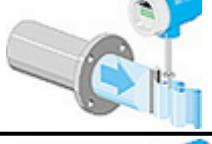
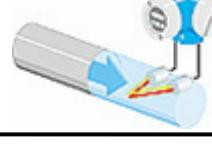
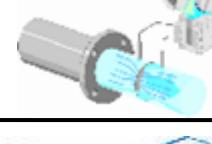
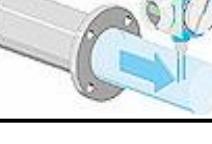
Flowmeter selection is also based on mainly three factors      流量计的选择基于三个因素：

- Economy      经济性
- Instrument      仪表（原理、结构、耐温耐压等自身因素）

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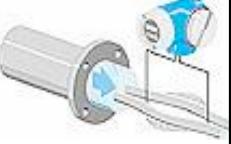
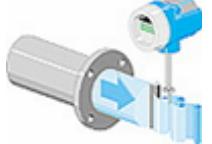
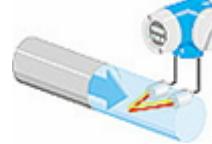
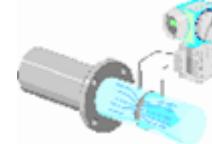
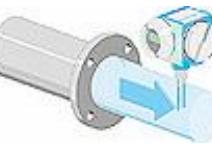
# Different flow measuring solution

|                                    | Conductive<br>Liquids<br>导电液体   | Non<br>conductive<br>Liquids<br>非导电液体 | Gas<br>气体 | Steam<br>蒸汽 |
|------------------------------------|---|---------------------------------------|-----------|-------------|
| Proline<br>电磁<br>(Magn. Inductive) |    |                                       |           |             |
| Proline<br>质量<br>(Coriolis)        |    |                                       |           |             |
| Proline<br>涡街<br>(Vortex)          |    |                                       |           |             |
| Proline<br>超声波<br>(Ultrasonic)     |   |                                       |           |             |
| Deltatop<br>节流装置                   |  |                                       |           |             |
| Proline<br>热式质量<br>(thermal)       |  |                                       |           |             |

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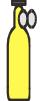
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| Proline<br>涡街<br>(Vortex)          |    |                                       |           |             |
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Classification:  
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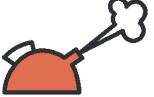
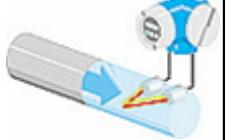
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| Proline<br>质量<br>(Coriolis)        |  |  |  |             |
| Proline<br>涡街<br>(Vortex)          |  |   |   |             |
| Proline<br>超声波<br>(Ultrasonic)     |  |   |   |             |
| Deltatop<br>节流装置                   |  |   |   |             |
| Proline<br>热式质量<br>(thermal)       |  |   |   |             |

Classification:  
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# Different flow measuring solution

|                                    | Conductive<br>Liquids<br>导电液体   | Non<br>conductive<br>Liquids<br>非导电液体   | Gas<br>气体   | Steam<br>蒸汽   |
|------------------------------------|---|---|---|---|
| Proline<br>电磁<br>(Magn. Inductive) |   |   |   |   |
| Proline<br>质量<br>(Coriolis)        |   |  |  |   |
| Proline<br>涡街<br>(Vortex)          |   |  |  |  |
| Proline<br>超声波<br>(Ultrasonic)     |   |   |   |   |
| Deltatop<br>节流装置                   |  |   |   |   |
| Proline<br>热式质量<br>(thermal)       |  |   |   |   |

Classification:  
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# Different flow measuring solution

|                                    | Conductive<br>Liquids<br>导电液体   | Non<br>conductive<br>Liquids<br>非导电液体  | Gas<br>气体   | Steam<br>蒸汽   |
|------------------------------------|---|--|---|---|
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| Proline<br>涡街<br>(Vortex)          |   |   |  |  |
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| Deltatop<br>节流装置                   |   |  |   |   |
| Proline<br>热式质量<br>(thermal)       |   |  |   |   |

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Classification:  
INTERNAL

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# Different flow measuring solution

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| Deltatop<br>节流装置                   |  |  |  |  |
| Proline<br>热式质量<br>(thermal)       |  |   |  |   |

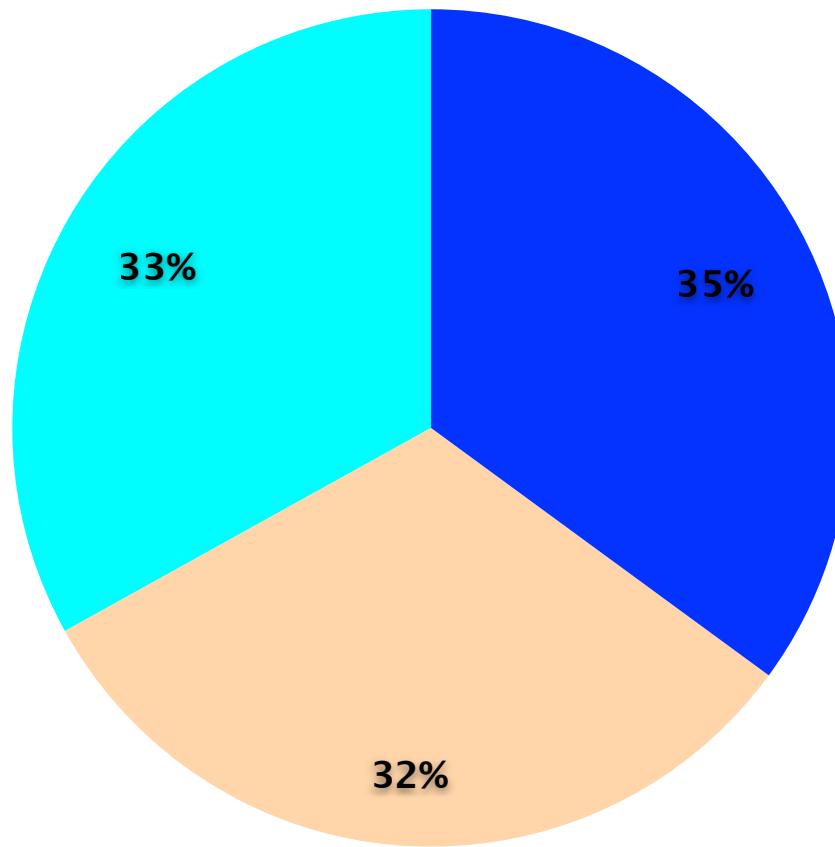
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INTERNAL

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# Application of DP Flow Transmitters Worldwide – 2006

Value = 644 Mio  
\$

● Liquid   ● Steam  
● Gas



Classification:  
INTERNAL

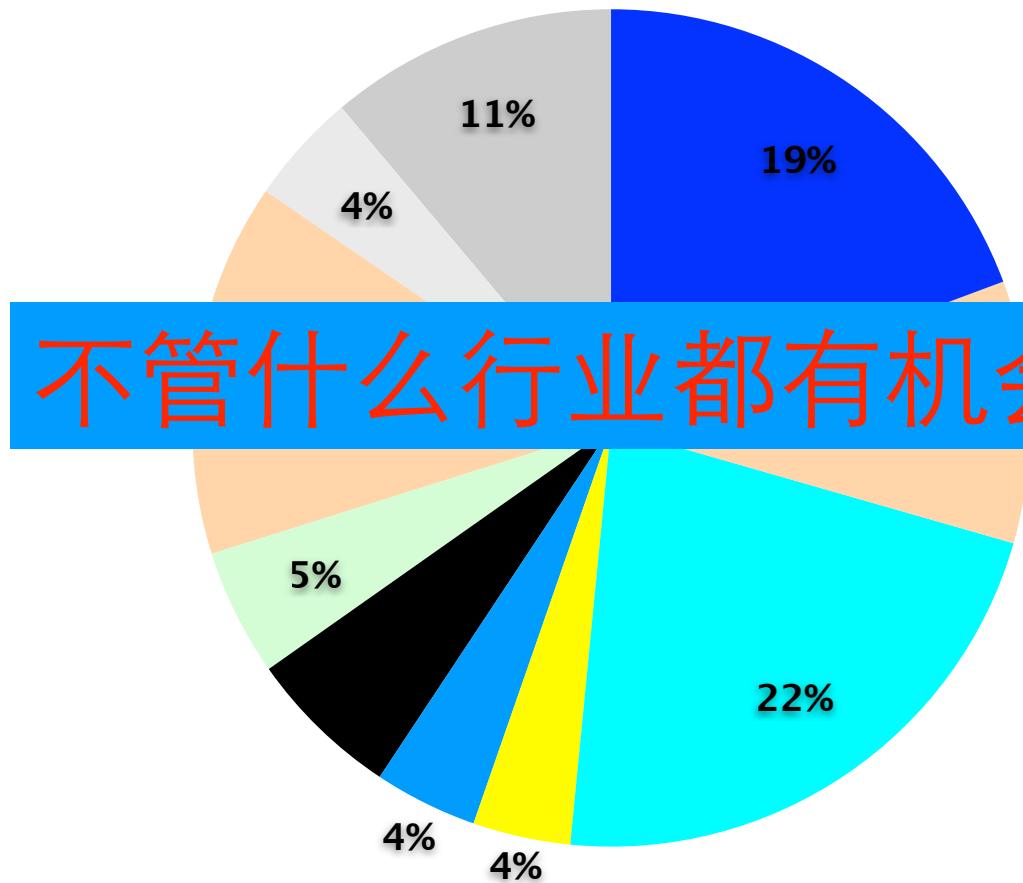
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# Industry Split of DP Flow Transmitters Worldwide - 2006

Value = 644 Mio  
\$

- Oil & Gas
- Refining
- Chemical
- Food & Beverages
- Pharmaceuticals
- Pulp & Paper
- Metals & Mining
- Power
- Water & Waste Water
- Other



不管什么行业都有机会卖！！！

Classification:  
INTERNAL

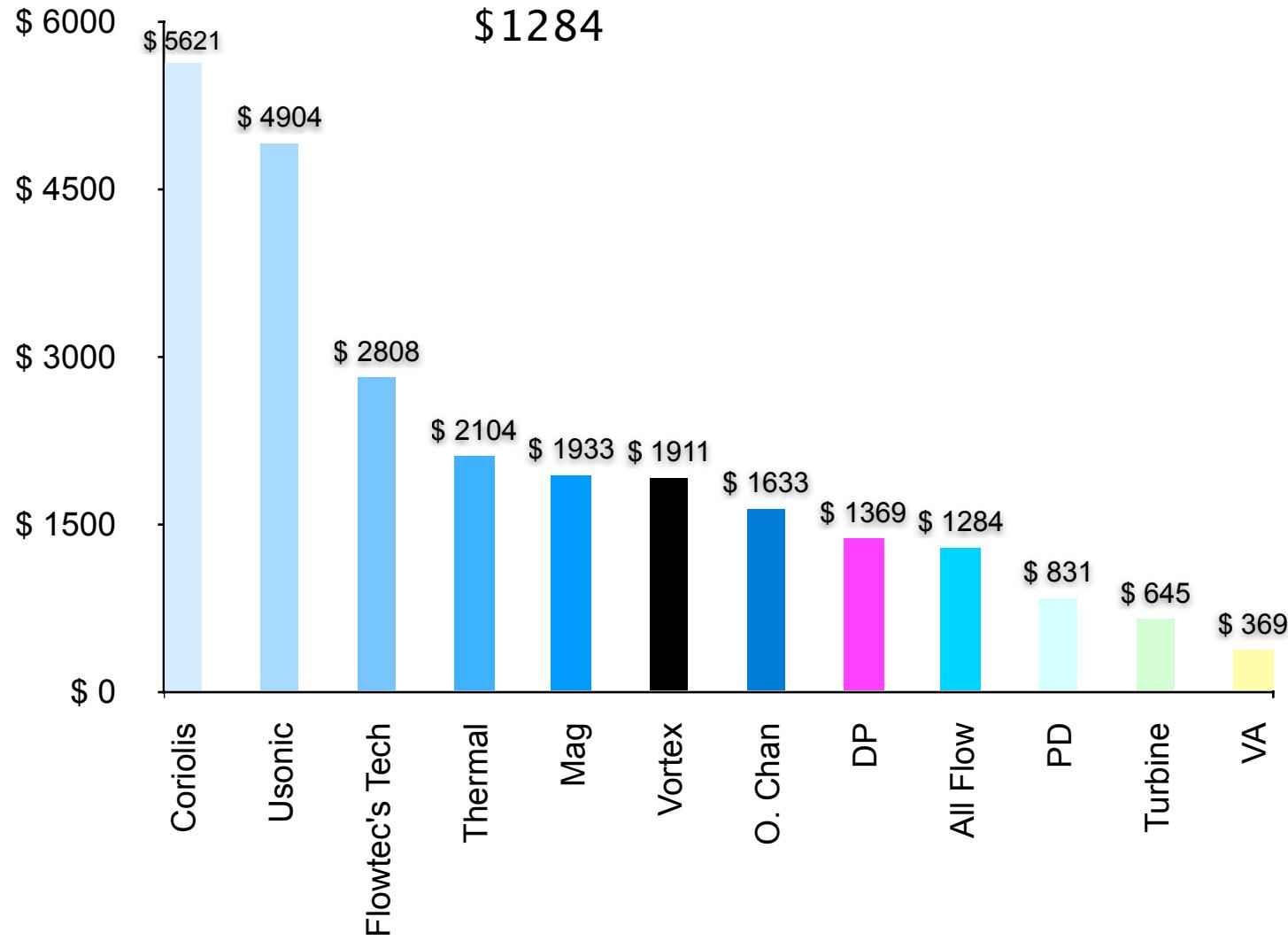
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Source:  
Flow Research Inc.  
Wakefield,  
Massachusetts

# Different flow technologies worldwide 2005( AUP in\$)

World average price for a flow meter =  
\$ 1284

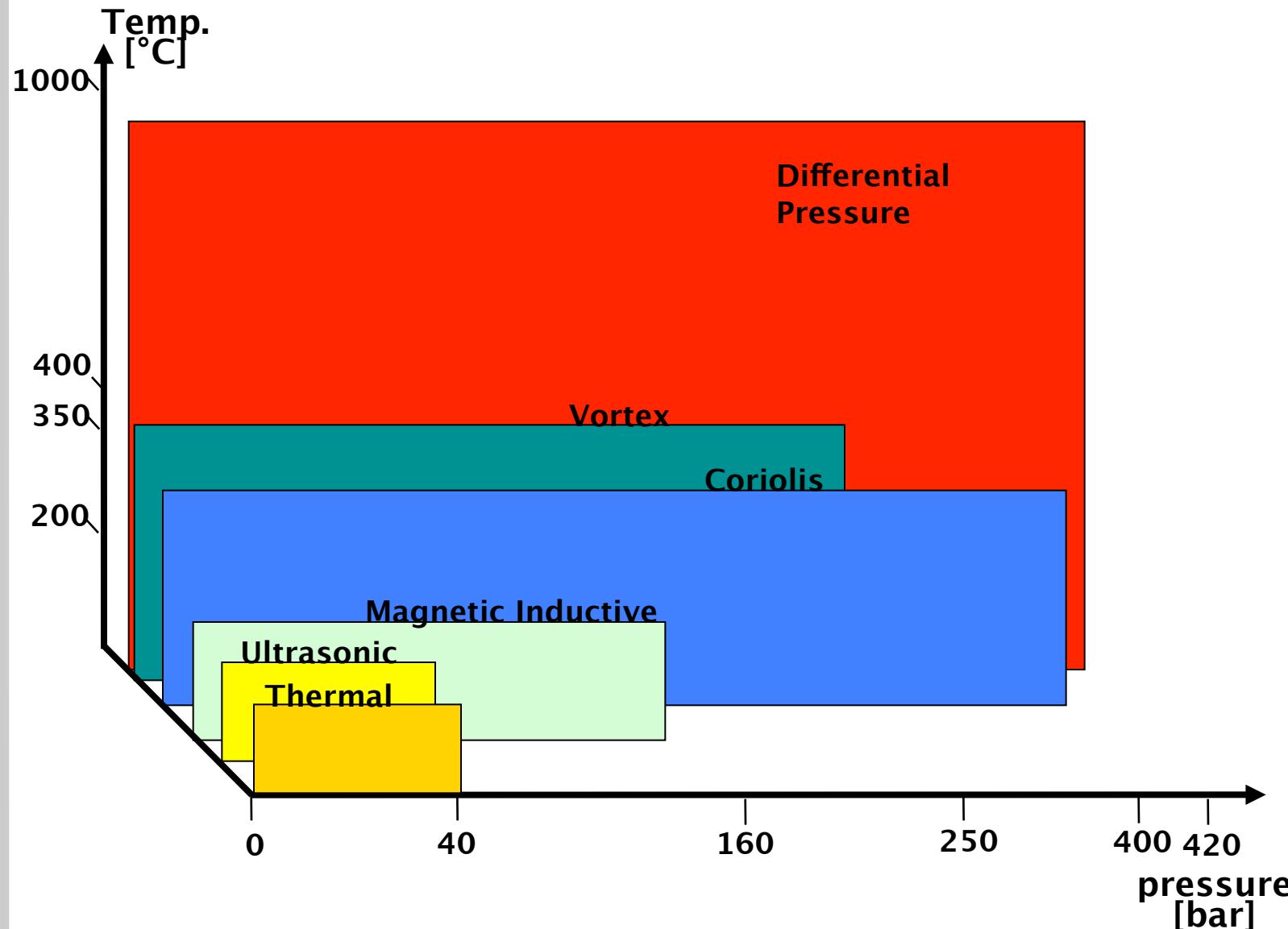


Classification:  
INTERNAL

2007-12-20  
Team dp-flow & QHY

Slide

# Application Range / Flowmeter selection





Pressure



Level



Pressure



Flow



Temperature



Liquid Analysis



Registration



Systems Components



Services



Solutions

# Logistic & Produce

Classification:  
INTERNAL

2007-12-20  
Team dp-flow & QHY

Slide



Pressure



Level



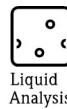
Pressure



Flow



Temperature



Liquid Analysis



Registration



Systems Components



Services



Solutions

# Logistic & Produce

- 订货时必须提供用户给的数据表
- 必须提供电子文档的计算书
- 少量的交货期按上限8周计算
- 数量大的和大口径的需事先确认交货期
- PCM目前主要靠外协供货
- APC苏州争取6月开始供货

Classification:  
INTERNAL

2007-12-20  
Team dp-flow & QHY

Slide



Pressure

Endress+Hauser 



Level



Pressure



Flow



Temperature



Liquid  
Analysis



Registration



Systems  
Components



Services



Solutions

# Installation

Classification:  
**INTERNAL**

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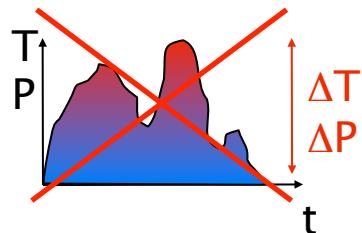
# Planning dP flow: General process requirements



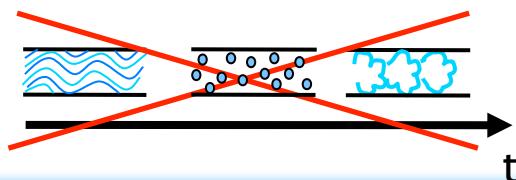
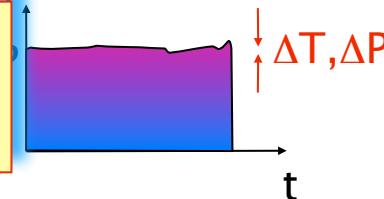
pipe running full



no marks and deposits



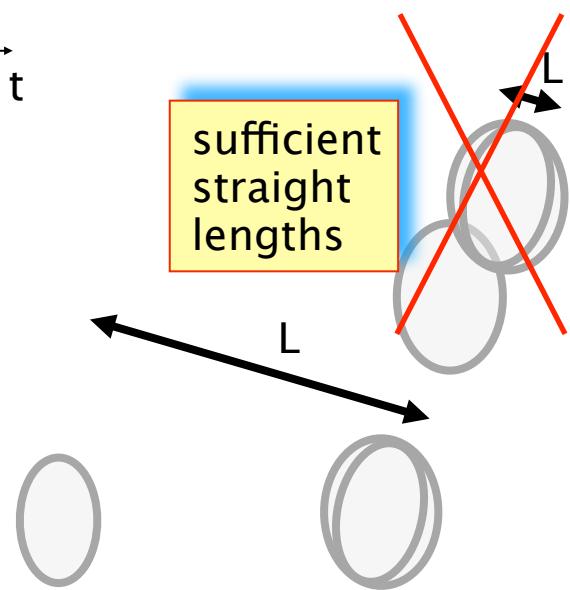
constant process conditions



homogenous media  
(composition constant over time)



sufficient straight lengths

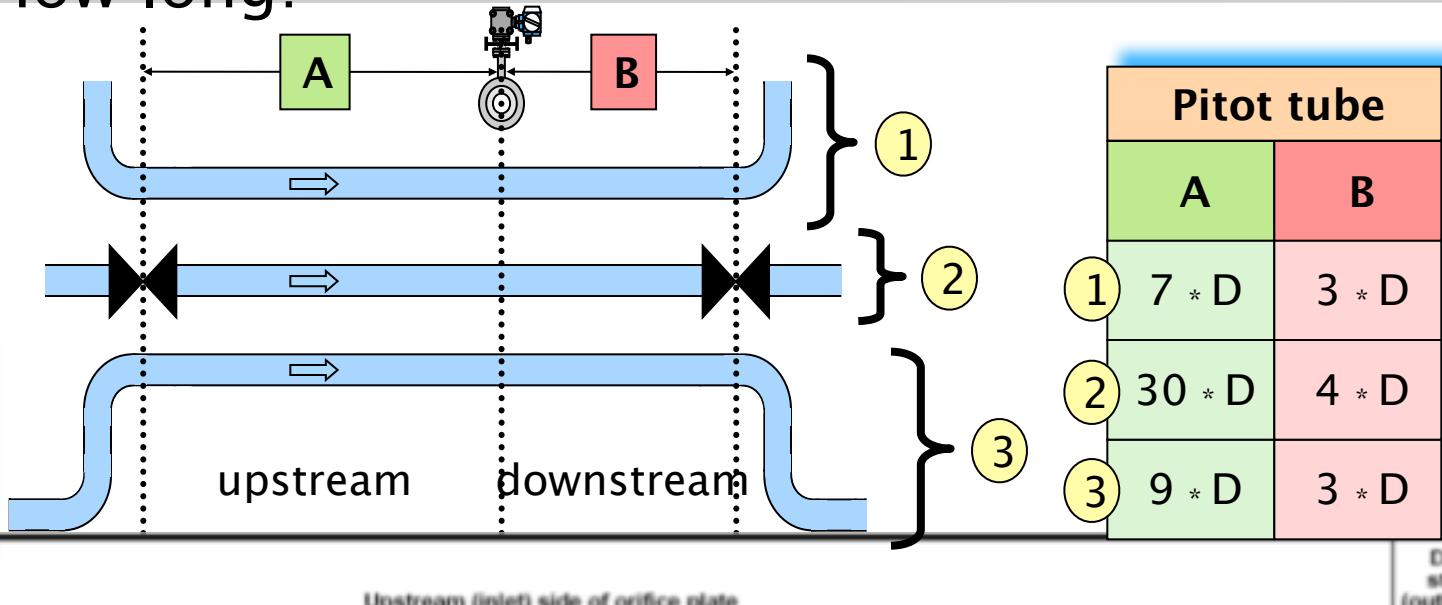


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# Planning dP flow: Straight lengths – How long?



Upstream (inlet) side of orifice plate

| Diameter ratio $\beta$ | Upstream (inlet) side of orifice plate |   |  |  |  |  |                 |   |  |  |   |                              |   | Downstream (outlet) side of the orifice plate          |                |   |    |    |    |    |    |    |   |   |   |     |
|------------------------|--|---|--|--|--|--|-----------------|---|--|--|---|------------------------------|---|--|----------------|---|----|----|----|----|----|----|---|---|---|-----|
|                        | Single 90° bend                        | Two 90° bends in any plane ( $S > 30D$ ) <sup>a</sup> | Two 90° bends in the same plane: S-configuration ( $30D \geq S > 10D$ ) <sup>a</sup> | Two 90° bends in the same plane: S-configuration ( $10D \geq S$ ) <sup>a</sup> | Two 90° bends in perpendicular planes ( $30D \geq S \geq 5D$ ) <sup>a, b</sup> | Two 90° tee with or without an extension | Single 90° bend | Two 45° bends in the same plane: S-configuration ( $S \geq 2D$ ) <sup>a</sup> | Concentric reducer 2D to D over a length of 1,5D to 3D | Concentric expander 0,5D to D over a length of D to 2D | Full bore ball valve or gate valve fully open | Abrupt symmetrical reduction | Thermometer pocket or well <sup>c</sup> of diameter $\leq 0,03D$ <sup>d</sup> | Fittings (columns 2 to 11) and the densitometer pocket |                |   |    |    |    |    |    |    |   |   |   |     |
| 1                      | 2                                      | 3   | 4  | 5  | 6  | 7  | 8               | 9   | 10   | 11   | 12  | 13                           | 14  |  |                |   |    |    |    |    |    |    |   |   |   |     |
| —                      | A <sup>e</sup>                         | B <sup>f</sup>  | A <sup>e</sup>   | B <sup>f</sup>   | A <sup>e</sup>   | B <sup>f</sup>                           | A <sup>e</sup>  | B <sup>f</sup>  | A <sup>e</sup>   | B <sup>f</sup>   | A <sup>e</sup>                                | B <sup>f</sup>               | A <sup>e</sup>  | B <sup>f</sup>   | A <sup>e</sup> |   |    |    |    |    |    |    |   |   |   |     |
| $\leq 0,20$            | 6                                      | 3   | 10   | 9  | 10   | 9  | 19              | 18  | 34   | 17   | 3   | 9                            | 7   | 9  | 5              | 9 | 6  | 9  | 12 | 6  | 30 | 15 | 5 | 3 | 4 | 2   |
| 0,40                   | 16                                     | 3   | 10   | 9  | 10   | 9  | 44              | 18  | 50   | 25   | 9   | 3                            | 30  | 9  | 5              | 9 | 12 | 8  | 12 | 6  | 30 | 15 | 5 | 3 | 6 | 3   |
| 0,50                   | 22                                     | 9   | 18   | 10   | 22   | 10                                       | 44              | 18  | 75   | 34   | 19  | 9                            | 30  | 18   | 8              | 5 | 20 | 9  | 12 | 6  | 30 | 15 | 5 | 3 | 6 | 3   |
| 0,60                   | 42                                     | 13  | 30   | 18   | 42   | 18                                       | 44              | 18  | 65 <sup>h</sup>  | 25   | 29  | 18                           | 30  | 18   | 9              | 5 | 26 | 11 | 14 | 7  | 30 | 15 | 5 | 3 | 7 | 3,5 |
| 0,67                   | 44                                     | 20  | 44   | 18   | 44   | 20                                       | 44              | 20  | 60   | 18   | 36  | 18                           | 44  | 18   | 12             | 6 | 28 | 14 | 18 | 9  | 30 | 15 | 5 | 3 | 7 | 3,5 |
| 0,75                   | 44                                     | 20  | 44   | 18   | 44   | 22                                       | 44              | 20  | 75   | 18   | 44  | 18                           | 44  | 18   | 13             | 8 | 36 | 18 | 24 | 12 | 30 | 15 | 5 | 3 | 8 | 4   |



Pressure

# Summary of dP flow installation layouts

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# Summary of dP flow installation layouts

VDE/VDI 3512 Sheet 1 or similar

| State of the fluid                 | liquid           |   |                       | gaseous (gases and vapour) |                      |              |
|------------------------------------|------------------|---|-----------------------|----------------------------|----------------------|--------------|
| State of impulse piping fill fluid | liquid           | partially degassing                       | completely vapourised | gaseous                    | partially condensing | fully liquid |
| Examples                           | condensate water | boiling water<br>gas-car. CH <sub>4</sub> | liquefied gas         | dry air                    | humid air            | steam        |
| a) Deltabar S above primary device |                  |   |                       |                            |                      |              |
| b) Deltabar S below primary device |                  |   |                       |                            |                      |              |

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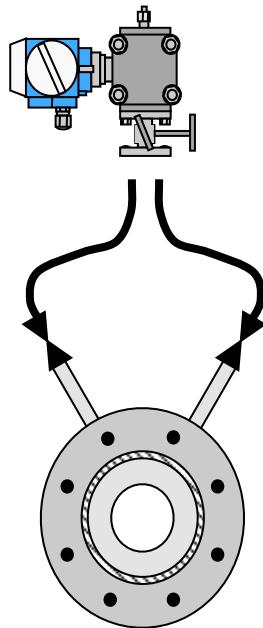
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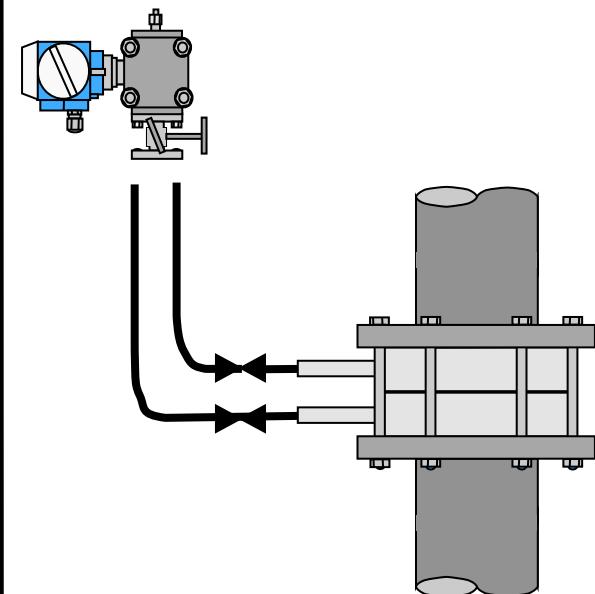
Preferred installation

# Planning dP Flow in Gas for Deltaset Orifices

horizontal pipe



vertical pipe



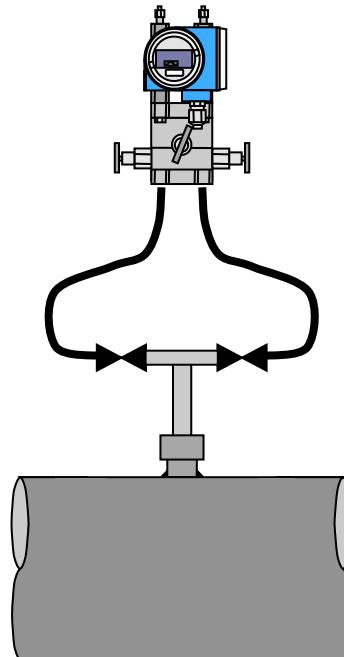
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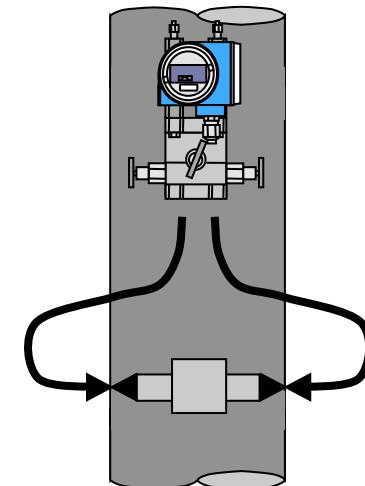
# Planning dP Flow in Gas for Deltaset Pitot tubes

horizontal pipe



DPP 50

vertical pipe



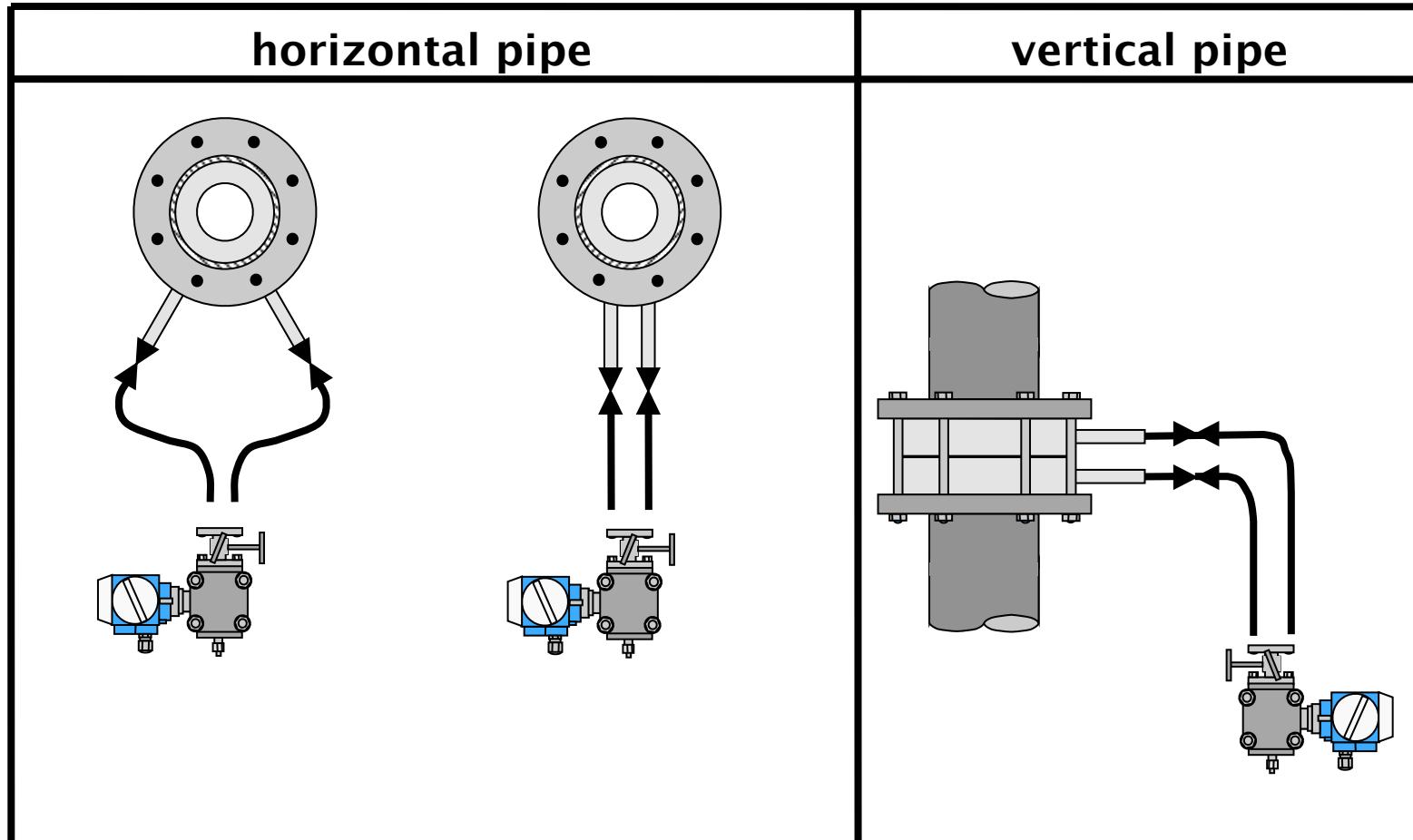
DPP 50

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# Planning dP Flow in Liquids for Deltaset Orifices



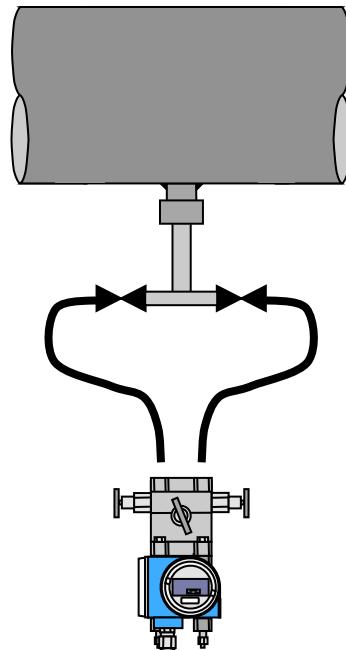
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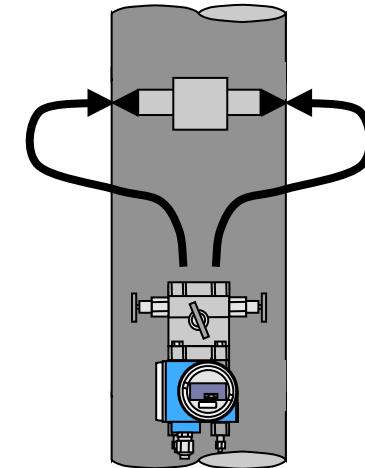
# Planning dP Flow in Liquids for Deltaset Pitot tubes

horizontal pipe



DPP 50

vertical pipe



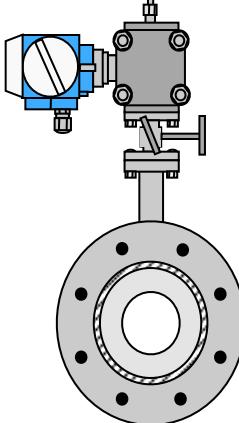
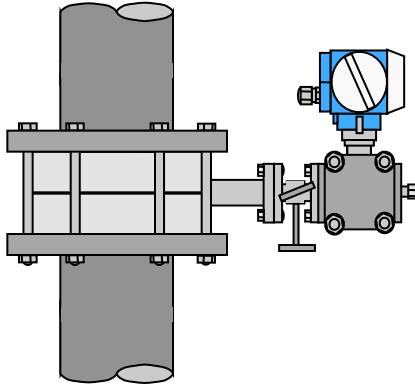
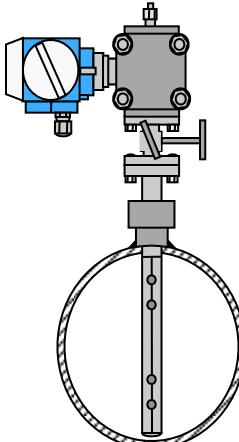
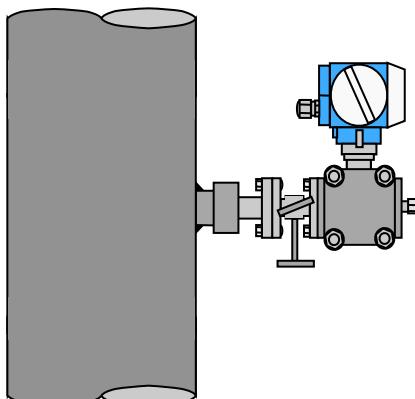
DPP 50

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# Planning dP Flow: Deltatop for gas

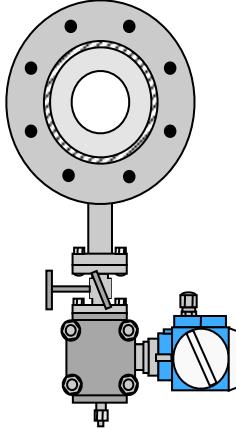
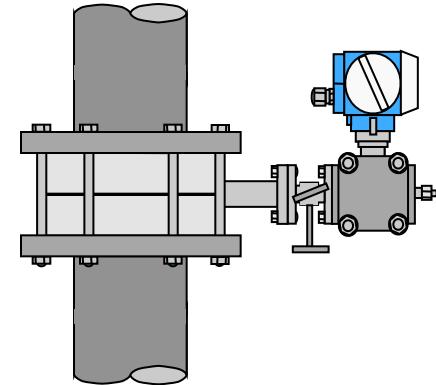
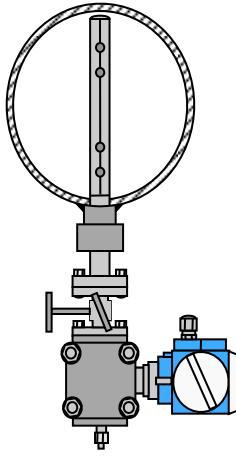
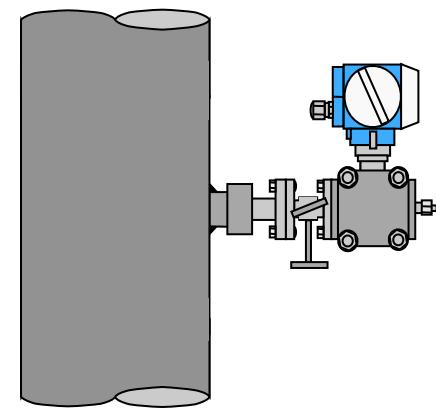
| Pipe                         | horizontal   | vertical   |
|------------------------------|--|--|
| <b>Orifice</b><br>DPO 1*-    |   |   |
| <b>Pitot tube</b><br>DPP 10- |  |  |

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# Planning dP Flow: Deltatop for liquids

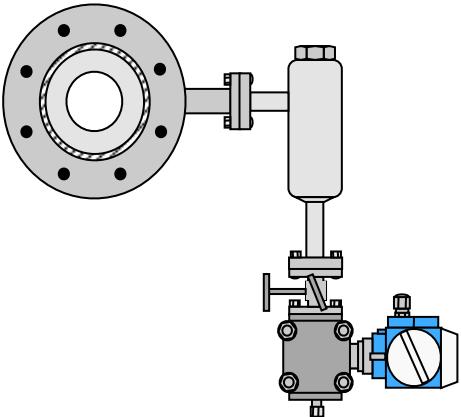
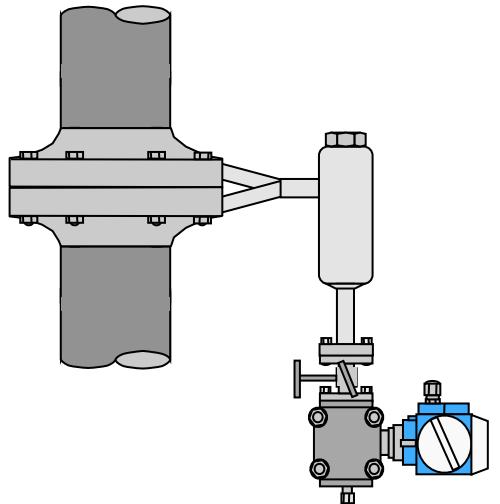
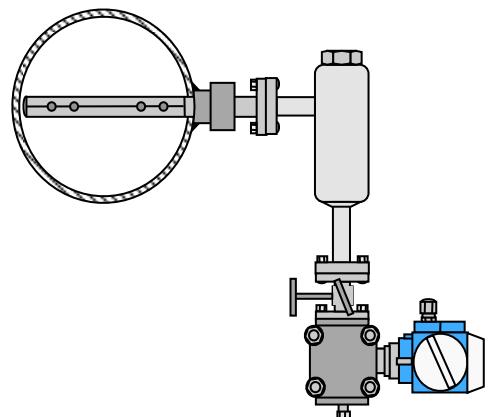
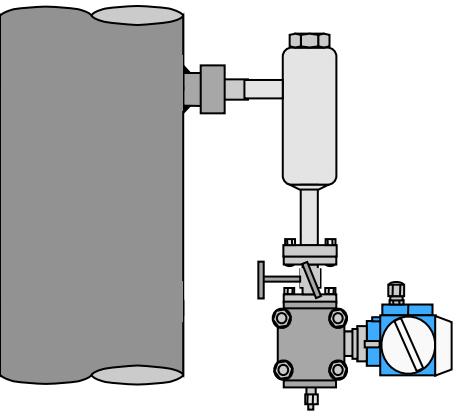
| Pipe                 | horizontal  | vertical   |
|----------------------|---|--|
| Orifice              |   |   |
| Pitot tube<br>DPP 10 |  |  |

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# Planning dP Flow: Deltatop for steam

| Pipe                        | horizontal  | vertical   |
|-----------------------------|---|--|
| <b>Orifice</b><br>DPO 12    |   |   |
| <b>Pitot tube</b><br>DPP 10 |  |  |

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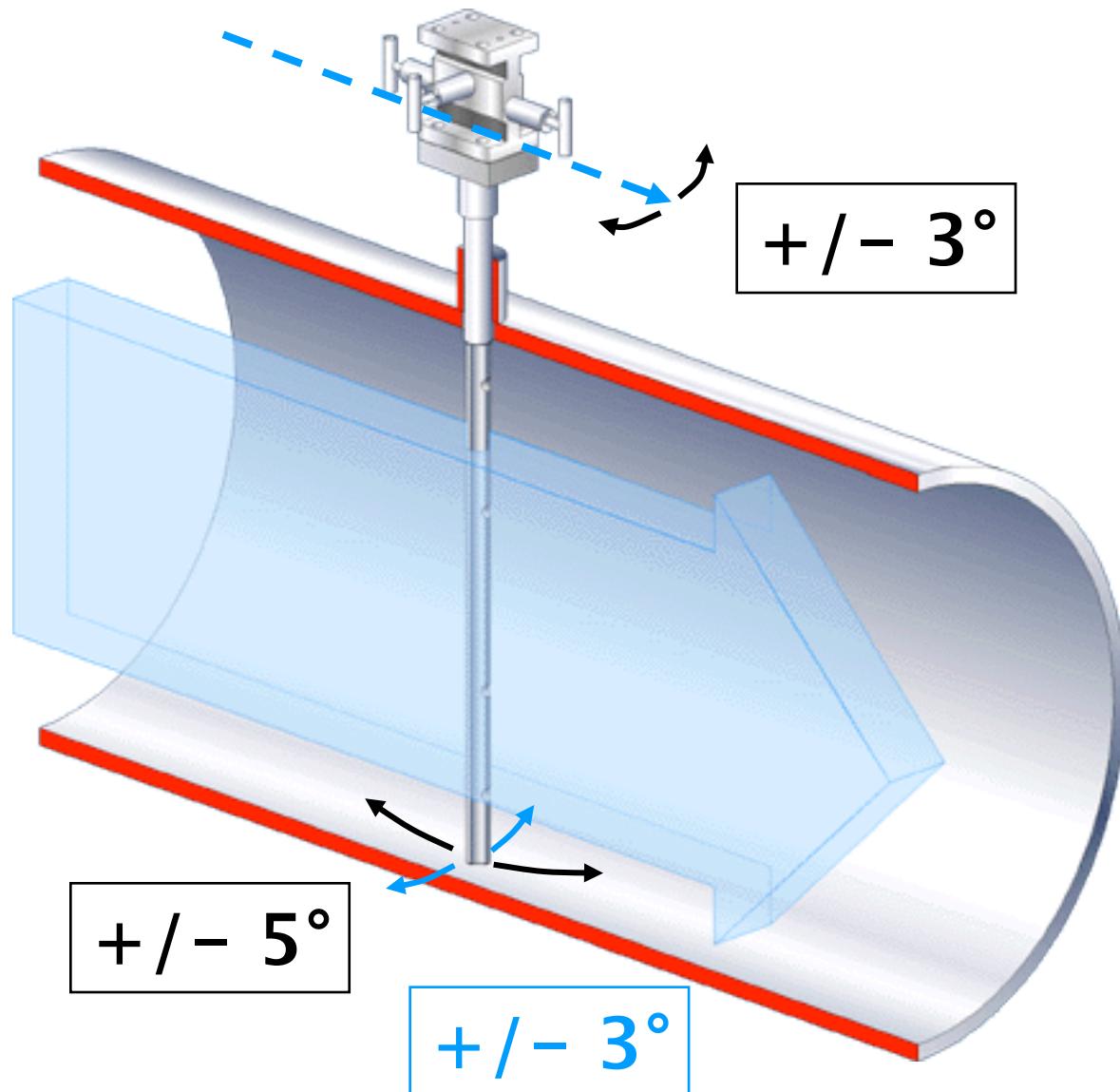
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Pressure

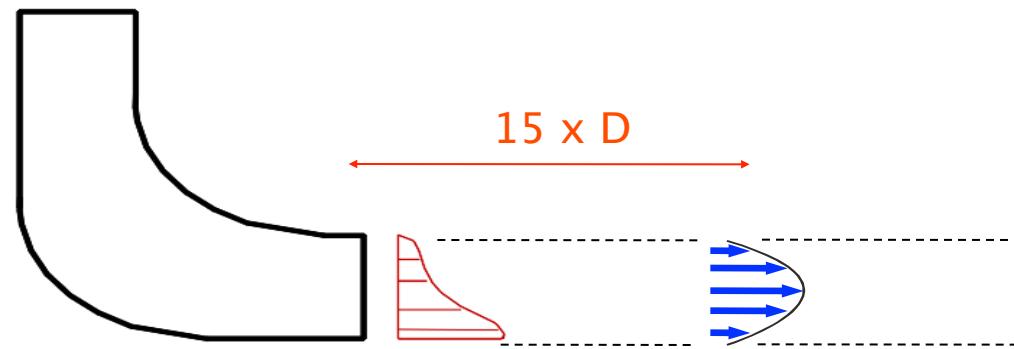
# Pitot tube installation



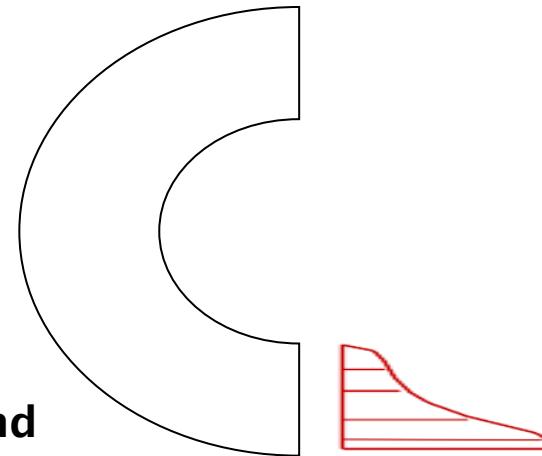
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# Flow profile after a bend



**Single bend**



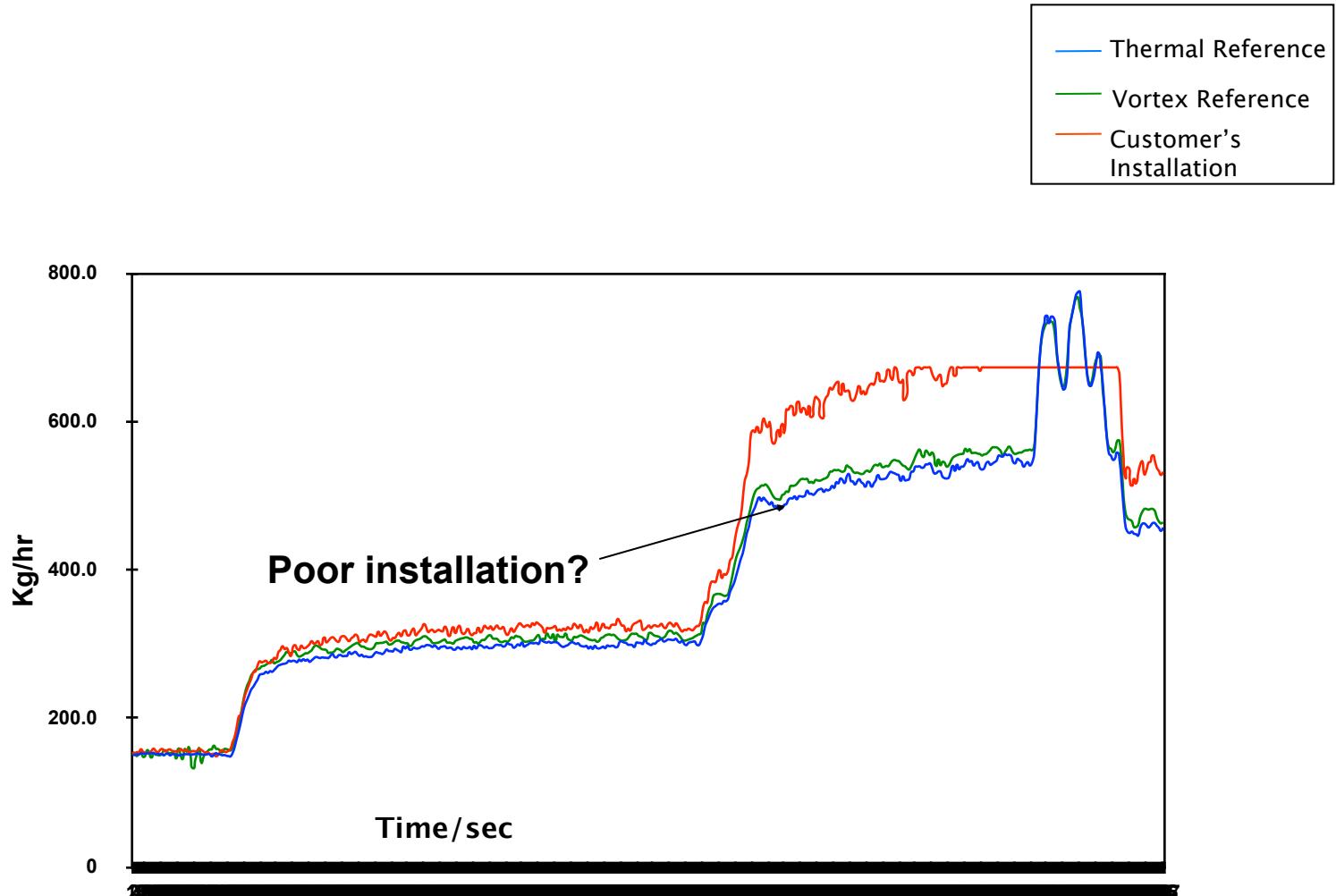
**Double bend**

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# Flow disturbance – velocity



# Thank you for your attention



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# Thank you for your attention



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# Thank you for your attention



Deltatop – 让你意想不到!

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