

# ***Emerson Modeling -Details***

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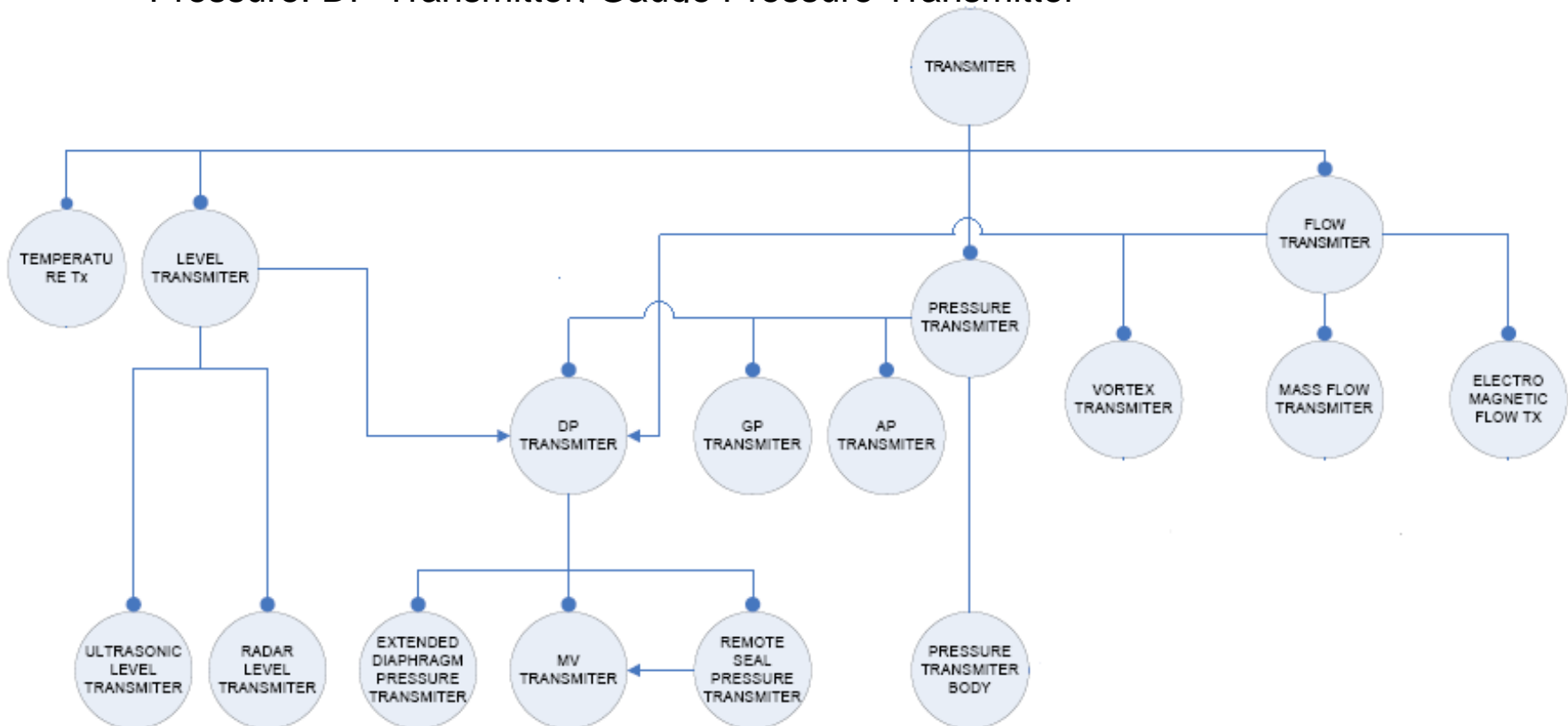
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# Transmitter Model

- Transmitters are classified based on the parameters like Level, Pressure, Flow and Temperature at the top. The transmitters measuring each type are further specialised based on their working principle like
  - Flow: Vortex Flowmeter, Magnetic Flowmeter, Coriolis Flowmeter
  - Pressure: DP Transmitter. Gauge Pressure Transmitter

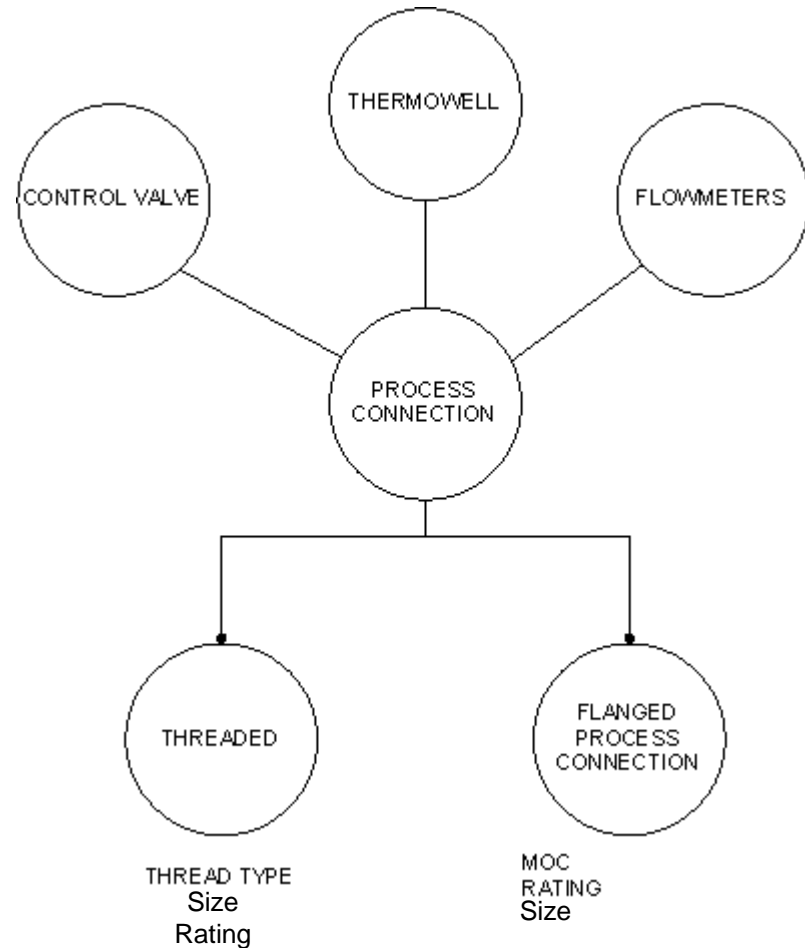


# Transmitter Model

- DP transmitters are used to measure Flow and Level with minor modifications in the construction.
- Flow measurement requires Square Root extraction facility or Level measurement requires Zero elevation / Suppression as add on feature
  - What is the correct way of showing the relationship between Level Transmitter Class and DP Transmitter or Flow Transmitter Class and DP Transmitter?
  - Remote Seal transmitter is a specialisation of Pressure / DP Transmitters. Where should remote seal transmitters appear in the hierarchy of bubble diagram?
  - Multi variable transmitters are instruments which can measure more than one variable at a time. How should these be classified?

# Process Connection

- Thermowell has ‘Thermowell Process Connection’.
- EPC specifies Thermowell Process Connection Type as
  - Threaded or Flanged
    - If it is ‘Threaded’, the EPC needs to specify only Size and Rating. However, if it is ‘Flanged’, the EPC needs to specify Type, MoC, Size and Rating
    - How to handle this If-Then-Else situation in Modelling?



# Certificates

- Modelling of Certification is a major issue, as certificates applicable to a device / instrument are large in variety.
- A vendor needs to know which certificate(s) are applicable to each individual Tag. This is not blanket information.
- How to model Certificates to provide multiple choice?

# ***Direction / Position / Orientation***

- We need to model the Direction / Orientation / Location of certain devices or parts of devices or Process Fluid. For Example,
  - FLUID STREAM Direction (Top to bottom / Bottom to Top)
  - ACTUATOR Orientation
  - HAND WHEEL Position (Top / Side)
- Is it appropriate to use ClassificationProperty template in such cases?

# *Inlet / Outlet Pressure*

- A Flow meter (Vortex, Mag or Mass) is an In-Line instrument. Inlet / Outlet Pressure (Min/Max/Oper) of the Fluid Compound needs to be specified while designing a Flowmeter. Same applies to a Control Valve Body.
  - Although the said Pressure can be modelled as a Direct Property of the Fluid Compound, the words 'Inlet' and 'Outlet' are specific to the In-Line Instrument or Valve. In that case, Inlet /Outlet Pressure Min/Max/Oper becomes a Indirect property of In-Line Instrument and Valve. How do we handle this without duplication of model?



# ***Modeling Approach***

- Current Modeling approach appears to be focusing on individual components in isolation
  - Instrumentation items being modeled by us
  - Process equipment being modeled without considering the associated supporting equipment like DCS, Safety systems, instrumentation, electrical equipment etc
- In a process industry the process equipment is at centre supported by other engineering items
- The process operation data actually impacts the design of the supporting equipment

# ***Modeling Approach - Common Factors***

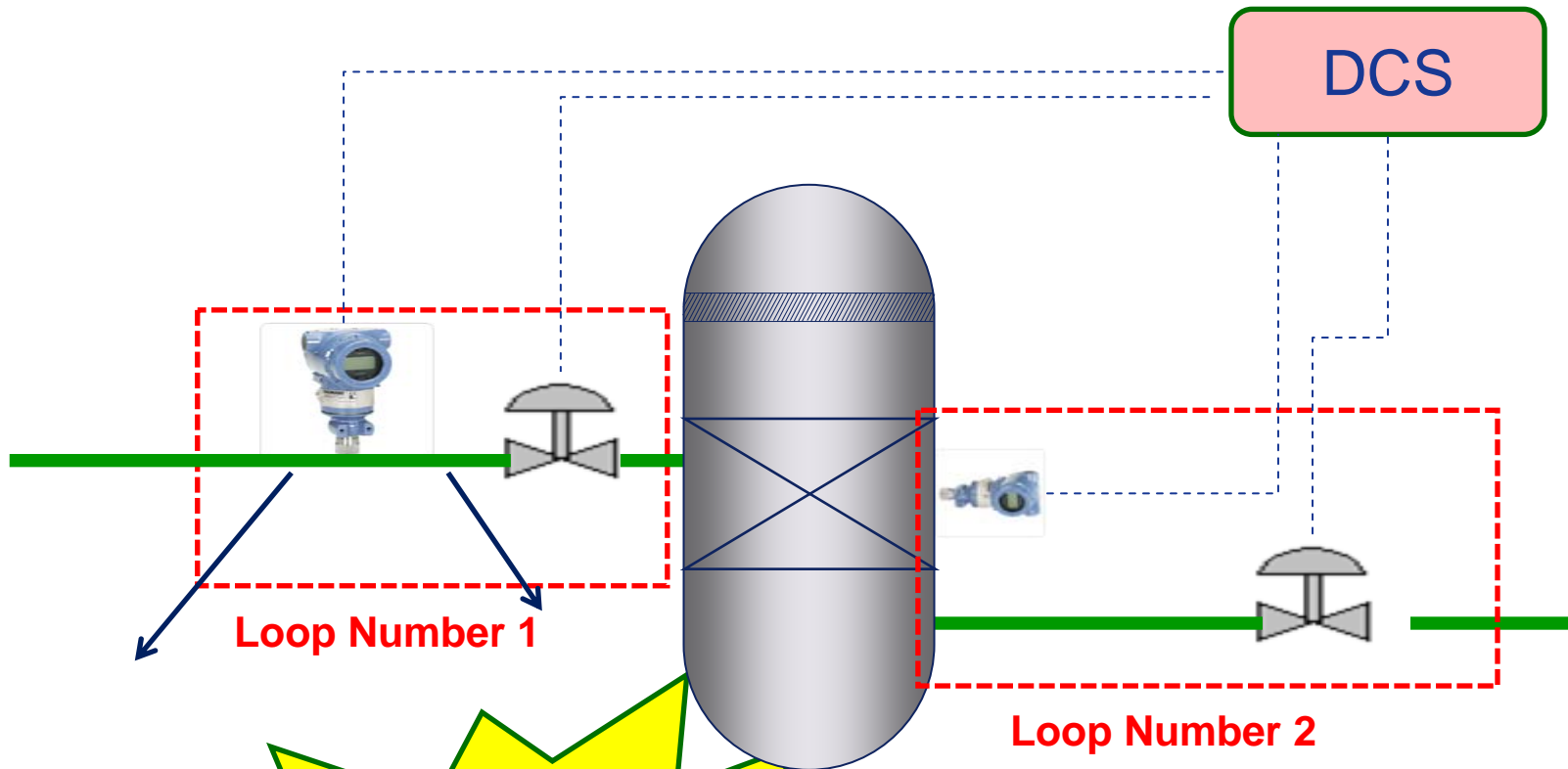
- There are common factors for a plant area
  - Like ambient conditions, Hazardous area classification which impact the design of the associated equipment
- Information of the associated equipment impacting each other.
  - Size of piping decides the size of flowmeters and control valves associated with particular equipment

# ***Modeling Approach - Process Parameters or Instrument Properties?***

- The parameters like Control loop setpoints, Alarm limits, Loop name are perceived as instrument settings
- Essentially these are the properties of process and not of a particular instrument though they are implemented using instruments
- These properties should be attached to the process and transferred to all the associated supporting equipment

# Modeling Approach – Process Parameters

ACTUAL PROCESS EQUIPMENT SCENARIO



Loop Number 1

Loop Number 2

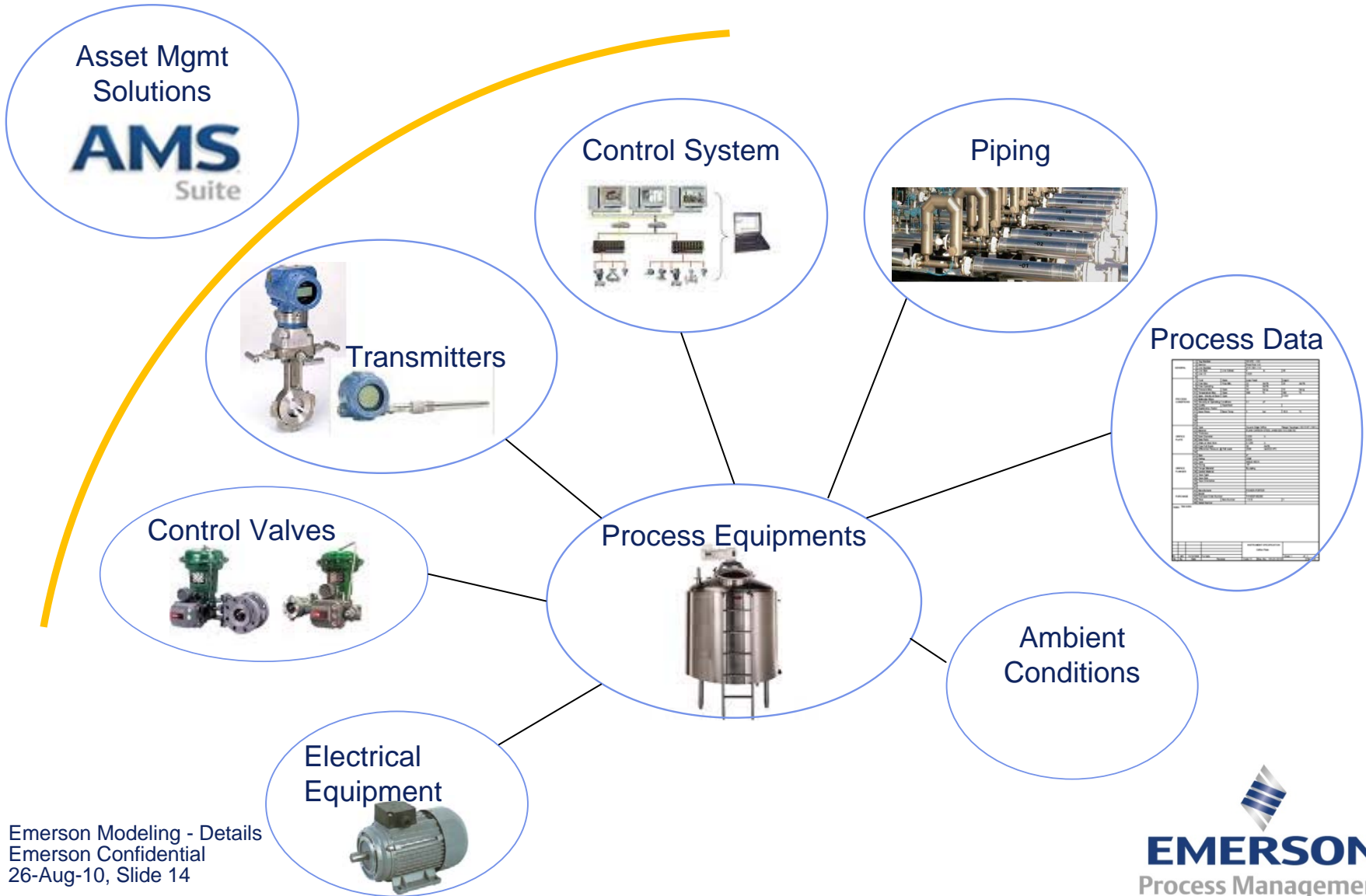
Alarms settings,  
Control Setpoints  
are really the  
properties of  
process

# ***Modeling Approach - Proposal***

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- The modelling efforts done by various participants involved in modelling of different equipment can be centralised with the equipment centric focus
- The common factors will be modelled only once and they can be shared by all. This will also help in building a complete model

# Modeling Approach – Equipment Centric



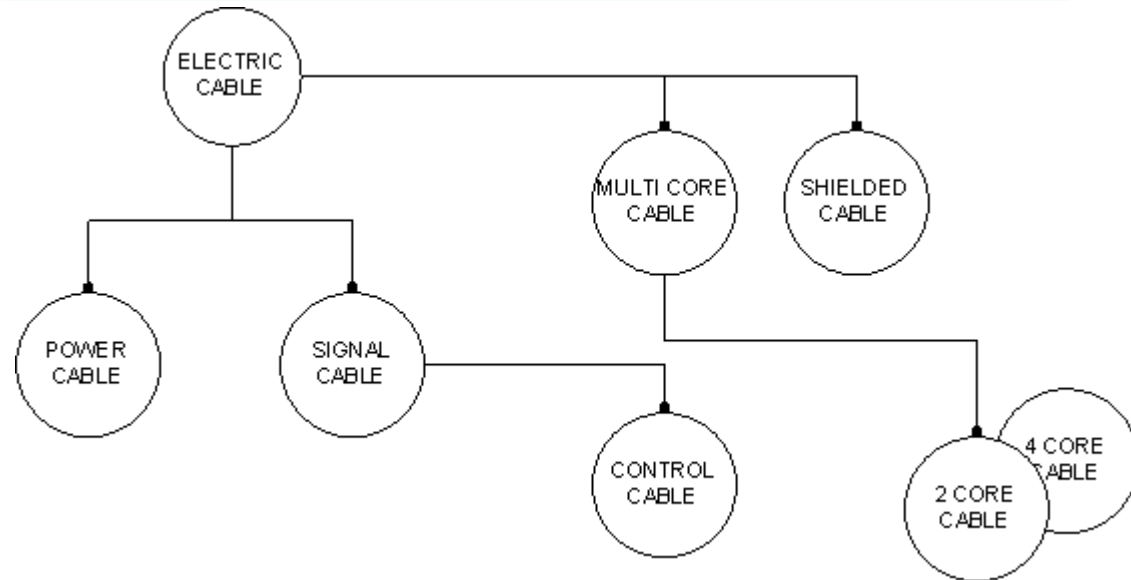
# ***Modeling Approach - Questions?***

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- What is the correct method of modeling the equipment such that
  - The modeling data can be shared at process level
  - Modeling efforts can be distributed, based on areas of expertise

# Cable Modeling

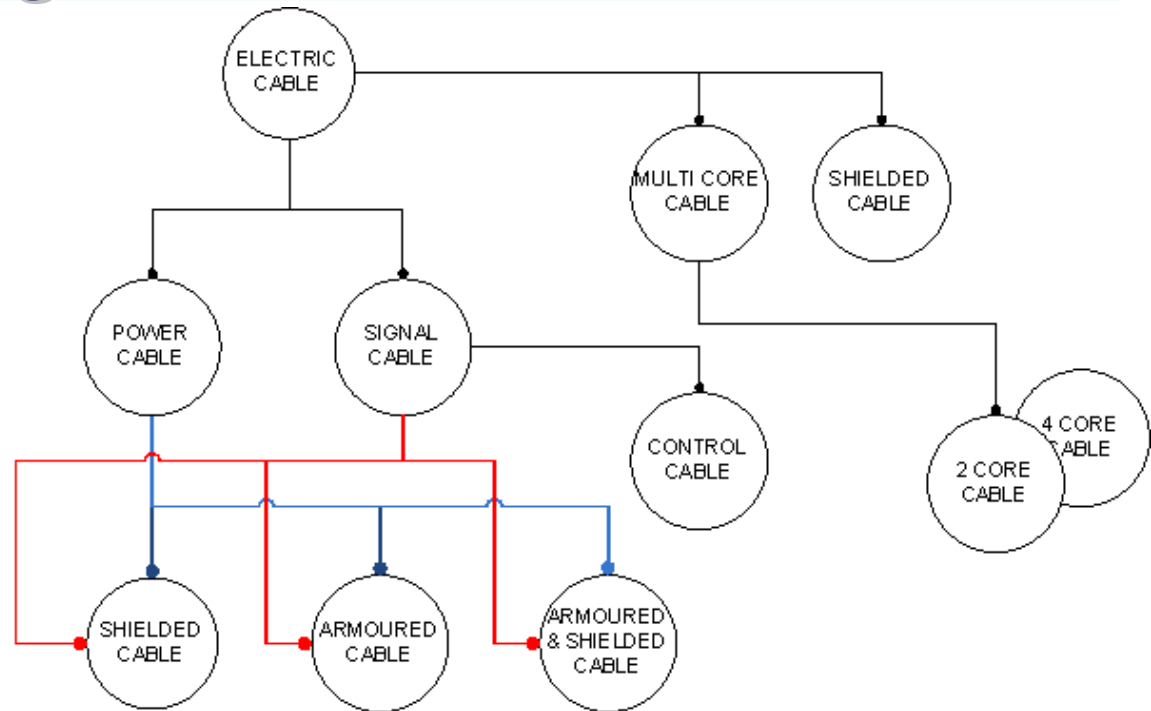
- Existing RDL Relationships



- There is no RDL Class for Armored Cable in RDL
- Shielded Cable exists only as a Sub Class of Electric Cable



# Cable Modeling



- Armored Cable can also be a Shielded Cable.
- Armored Cable and Shielded Cable can exist separately as Sub Classes of Power Cable as well as Signal Cable
- Multi Core cables can be Armored or Shielded or both.

# ***Cable Model***

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- How to establish relationship among all these possibilities?
- A comprehensive model of Cable is required

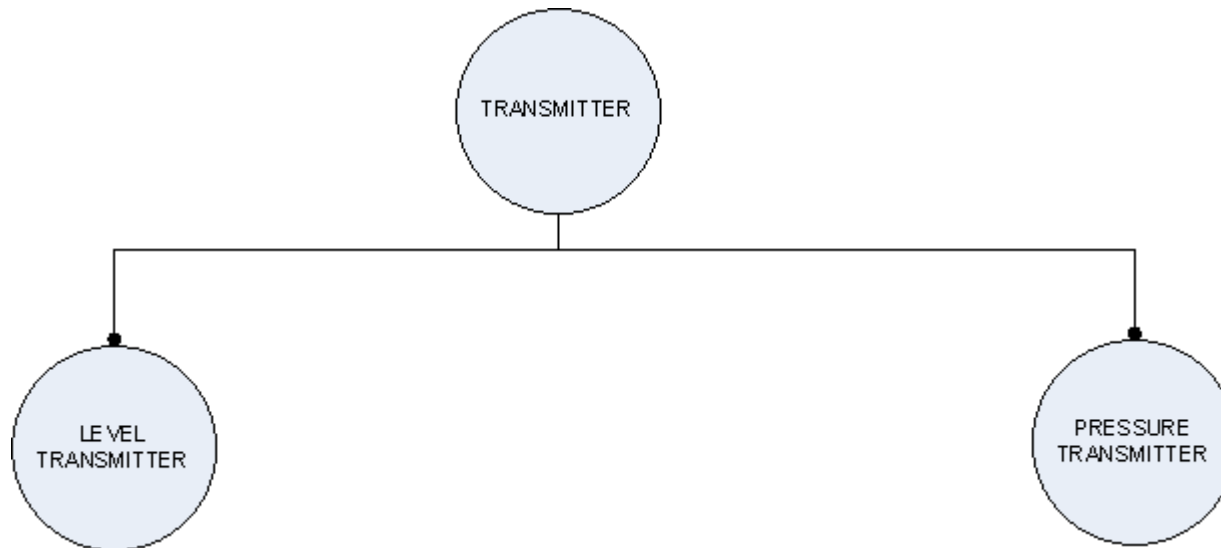
# ***RDL Structure***

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- Issues with RDL Class Structure: The current RDL class structure has many confusing combinations due to following reasons
  - There are multiple classes for the same object with different names
  - The hierarchical structure is not consistent across the classes created for the similar devices.

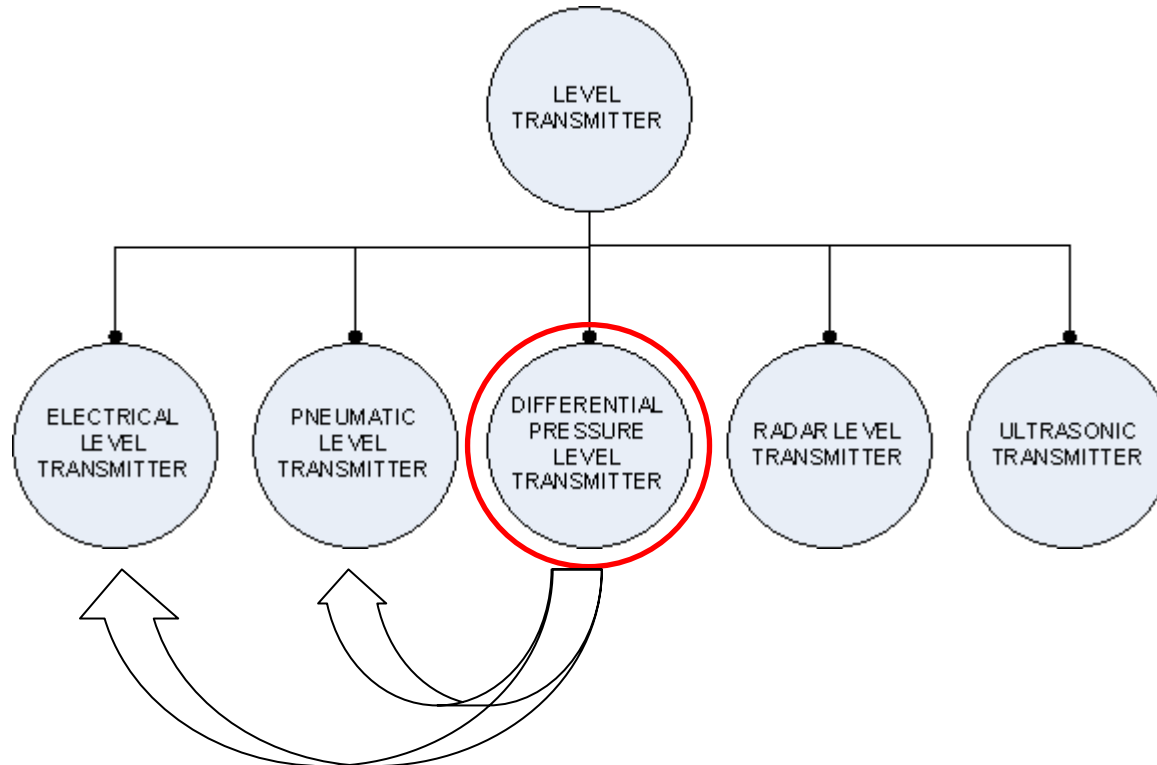
# ***RDL Structure - Example***

- Too many RDL classes make it difficult to determine correct Super Class – Sub Class
- Example from RDL



# RDL Structure - Example ...contd

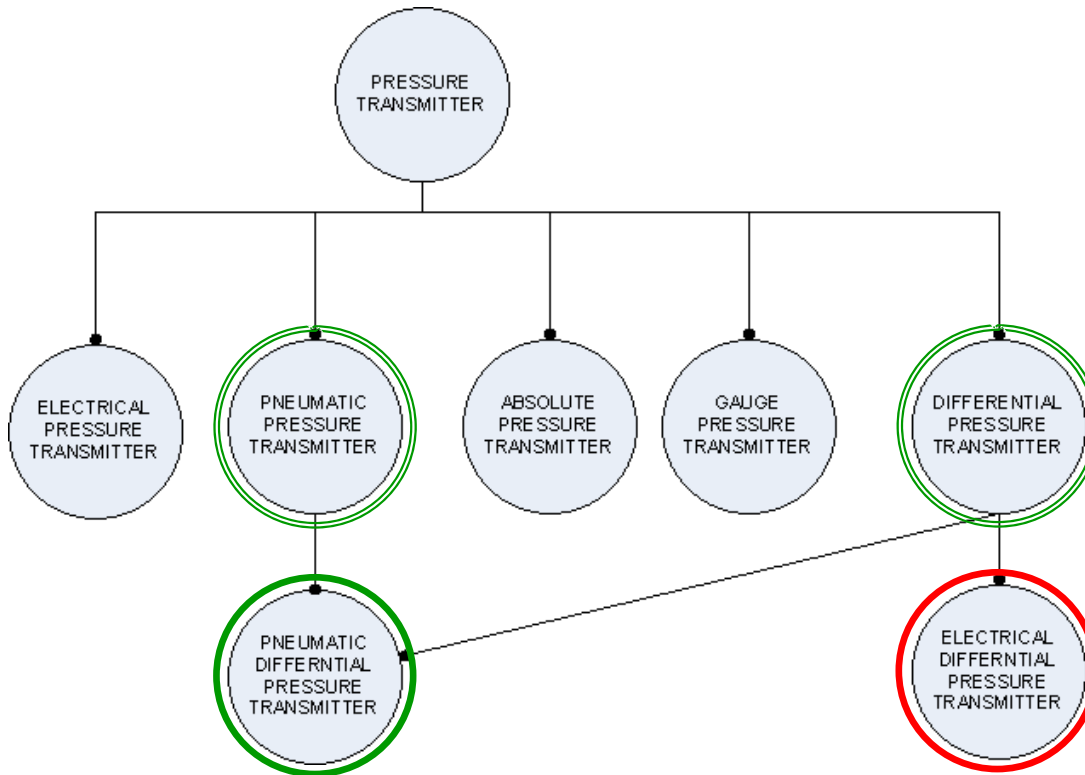
DP level Transmitter could be Electrical Transmitter or Pneumatic Transmitter



It is difficult to decide the class to be used for modeling of DP Transmitters

# RDL Structure - Example

...contd



- Differential Pressure Transmitter could be Pneumatic or Electrical
- Pneumatic Differential Pressure Transmitter is a Sub Class of Pneumatic Pressure Transmitter as well as Differential Pressure Transmitter
- But Electrical Differential Pressure Transmitter is NOT a Sub Class of Electrical Pressure Transmitter

- This is completely inconsistent with Level Transmitter

# *Emerson Modeling*

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- Walkthrough and Queries

# Classified Identification

Roles	Base Template	Specialized Template	Instance
	<b>Classified Identification</b>	<b>IdentificationByTag</b>	
<b>Role 1</b>			
hasObject	ISO 15926-4 THING	TAGGED ITEM	INSTRUMENT
<b>Role 2</b>			
valIdentifier	string	string	FT-203
<b>Role 3</b>			
hasIdentificationType	ISO-IS 15926-2 CLASS OF CLASS OF IDENTIFICATION	TAG NAME	

- Other Templates on similar lines:

- Project Number
- Plant Name
- Plant Area
- Instrument Model Number
- Instrument Serial Number
- Manufacturer Name
- Pipeline Number
- Control Module Name
- Controller Name



# ClassifiedDescription

Roles	Base Template	Specialized Template	Instance
	<b>ClassifiedDescription</b>	<b>Instrument Service Description</b>	
<b>Role 1</b>			
Object	ISO 15926-4 THING	INSTRUMENT	FT-203
<b>Role 2</b>			
description	string	string	Steam
<b>Role 3</b>			
descriptionType	ISO-IS 15926-2 CLASS OF CLASS OF DESCRIPTION	SERVICE DESCRIPTION	

- Other Templates on similar lines:
- Project Description
- Fluid Description

# ClassifiedAssemblyOfIndividual

Roles	Base Template	Specialized Template	Instance
	ClassifiedAssemblyOfIndividual	Transmitter-Enclosure Relationship	
<b>Role 1</b>			
part	ISO 15926-4 POSSIBLE INDIVIDUAL	ENCLOSURE	
<b>Role 2</b>			
whole	ISO 15926-4 ARRANGED INDIVIDUAL	TRANSMITTER	FT-203
<b>Role 3</b>			
assemblyType	ISO 15926-4 ARRANGED INDIVIDUAL	TRANSMITTER has ENCLOSURE	

- Other Templates on similar lines:
  - Enterprise - Project Relationship
  - Plant - Plant Area Relationship
  - Thermowell - Thermowell Flange Relationship
  - Diaphragm Actuator -Actuator Yoke Relationship
  - Plant-Process Control System Relationship

# ***Assembly of Individual(s)***

- Whole-Part Assembly relationship is meant for Arranged Individuals.
  - For Example, a Transmitter and its Enclosure
- However, if we want to consider an Assembly relationship between a Transmitter and Flowmeter Integrated Assembly (Manifold), then:
  - It will not be a Whole-Part relationship
  - It is more like a Whole-Whole relationship
- Does a Whole-Whole Assembly relationship exist?

# ClassifiedAssemblyOfIndividual

- We have been using ClassifiedAssemblyOfIndividual template with following roles. The query is about the third role i.e. assemblyType. An example of Transmitter and Enclosure assembly relationship is also mentioned.
  - Role 1: part: ISO 15926-4 POSSIBLE INDIVIDUAL: ENCLOSURE
  - Role 2: whole: ISO 15926-4 ARRANGED INDIVIDUAL: TRANSMITTER
  - Role 3: assemblyType: CLASS OF ASSEMBLY OF INDIVIDUAL: TRANSMITTER has ENCLOSURE
- Having mentioned part and whole, it is already known that "TRANSMITTER has ENCLOSURE".
- (The template would carry more meaning if the 'type of assembly' is mentioned against "assemblyType" such as riveted, press-fitted, screw-tightened and so on.)
- A class named "TRANSMITTER has ENCLOSURE" gets unnecessarily created in the sandbox.

# ClassifiedContainmentOfIndividual

Roles	Base Template	Specialized Template	Instance
	ClassifiedContainmentOfIndividual	DP Cell - Fill Fluid Relationship	
<b>Role 1</b>			
contained	ISO 15926-4 POSSIBLE INDIVIDUAL	FILL FLUID	Siltherm
<b>Role 2</b>			
container	ISO 15926-4 POSSIBLE INDIVIDUAL	DIFFERENTIAL PRESSURE CELL	
<b>Role 3</b>			
containmentType	ISO-IS 15926-2 CLASS OF CONTAINMENT OF INDIVIDUAL		

- Other Templates on similar lines:
- Remote Seal Capillary - Fill Fluid Relationship
- Process Equipment Fluid Relationship

# ClassifiedConnectionOfIndividual

Roles	Base Template	Specialized Template	Instance
	ClassifiedConnectionOfIndividual	RTD - Cable Relationship	
<b>Role 1</b>			
side1	ISO 15926-4 POSSIBLE INDIVIDUAL	RTD CABLE	Siltherm
<b>Role 2</b>			
side2	ISO 15926-4 POSSIBLE INDIVIDUAL	RESISTANCE TEMPERATURE ELEMENT	
<b>Role 3</b>			
connectionType	ISO-IS 15926-2 CLASS OF CONNECTION OF INDIVIDUAL		

- Other Templates on similar lines:
  - Pressure Transmitter - Manifold Relationship
  - Flow Transmitter - Flow Element Relationship
  - Temperature Transmitter - Element Relationship
  - Fieldbus Device -Port Relationship

# ClassifiedFeature

Roles	Base Template	Specialized Template	Instance
	<b>ClassifiedFeature</b>	<b>Thermowell-Shank</b>	
<b>Role 1</b>			
feature	ISO-IS 15926-2 CLASS OF FEATURE	SHANK	
<b>Role 2</b>			
whole	ISO 15926-4 THING	THERMOWELL	
<b>Role 3</b>			
featureType	ISO-IS 15926-2 CLASS OF CLASS OF INDIVIDUAL	THERMOWELL CONTOUR	

- Other Templates on similar lines:
  - Enclosure Cable Entry
  - Orifice Plate Assembly Pressure Tap
  - Orifice Flange Surface Finish
  - Thermowell Flange Face
  - Stilling Well Process Connection
  - Valve Body-Process Connection

# RepresentationOfIndividual

Roles	Base Template	Specialized Template	Instance
	RepresentationOfIndividual	P and I Diagram Representation	
<b>Role 1</b>			
object	ISO 15926-4 POSSIBLE INDIVIDUAL	INSTRUMENT	FT-203
<b>Role 2</b>			
representation	ISO-IS 15926-2 CLASS OF INFORMATION OBJECT	P AND I DIAGRAM	ABC1234
<b>Role 3</b>			
representationType	ISO-IS 15926-2 CLASS OF INFORMATION OBJECT	P AND I DIAGRAM	

- Other Templates on similar lines:
- P and I Diagram Representation for Control Loop (In-Progress)



# MaterialOfConstruction

Roles	Base Template	Specialized Template	Instance
	<b>MaterialOfConstruction</b>	<b>O Ring Material</b>	
<b>Role 1</b>			
object	ISO 15926-4 POSSIBLE INDIVIDUAL	O-RING	
<b>Role 2</b>			
material	ISO-IS 15926-2 CLASS OF COMPOUND	ISO-IS 15926-2 CLASS OF COMPOUND	PTFE

- Other Templates on similar lines:

- Enclosure Material
- Detecting Element Material
- Fill Fluid Material
- Drain Material
- Vent Material
- Instrument Process Connection Material
- Thermal Element Sheath Material
- Centering Disc Material
- Tank Material
- Chamber Material
- Actuator Diaphragm Material
- Actuator Yoke Material

# SupplyProperty

Roles	Base Template	Specialized Template	Instance
	<b>SupplyProperty</b>	<b>Transmitter Power Supply</b>	
<b>Role 1</b>			
object	ISO 15926-4 POSSIBLE INDIVIDUAL	TRANSMITTER	FT-203
<b>Role 2</b>			
value	ISO 15926-4 SINGLE PROPERTY DIMENSION	VOLTAGE	24
<b>Role 3</b>			
scale	ISO-IS 15926-2 SCALE	VOLTAGE SCALE	VOLTS
<b>Role 4</b>			
context	ISO 15926-4 POSSIBLE INDIVIDUAL	POWER SUPPLY	

- Other Templates on similar lines: Control Valve Air Supply

# RangeProperty

Roles	Base Template	Specialized Template	Instance
	<b>RangeProperty</b>	<b>Transmitter Calibrated Range</b>	
<b>Role 1</b>			
object	ISO 15926-4 POSSIBLE INDIVIDUAL	TRANSMITTER	PT-203
<b>Role 2</b>			
propertyType	ISO-IS 15926-2 CLASS OF INDIRECT PROPERTY	ISO-IS 15926-2 CLASS OF INDIRECT PROPERTY	PRESSURE
<b>Role 3</b>			
scale	ISO-IS 15926-2 SCALE	ISO-IS 15926-2 SCALE	bar
<b>Role 4</b>			
lowerbound	DECIMAL	DECIMAL	0
<b>Role 5</b>			
upperbound	DECIMAL	DECIMAL	10

# FabricationRelation

Roles	Base Template	Specialized Template	Instance
	FabricationRelation	Instrument - Manufacturer Relationship	
<b>Role 1</b>			
object	ISO 15926-4 POSSIBLE INDIVIDUAL	INSTRUMENT	FT-203
<b>Role 2</b>			
fabrication	ISO 15926-4 PARTICIPATING ROLE AND DOMAIN	MANUFACTURER	Rosemount

- Other Templates on similar lines:
  - None

# DirectPropertyScaleReal

Roles	Base Template	Specialized Template	Instance
	DirectPropertyScaleReal	Orifice Bore Diameter	
<b>Role 1</b>			
hasType	ISO 15926-4 SINGLE PROPERTY DIMENSION	ORIFICE BORE DIAMETER	
<b>Role 2</b>			
hasPossessor	ISO 15926-4 POSSIBLE INDIVIDUAL	ORIFICE BORE	FE-203
<b>Role 3</b>			
valValue	DOUBLE	DECIMAL	50
<b>Role 4</b>			
hasScale	ISO-IS 15926-2 SCALE	LENGTH SCALE	mm

- Other Templates on similar lines

- Transmitter Accuracy
- Fluid Inlet Pressure Operating
- Resistance Temperature Element Temperature
- Coefficient
- Level Switch Switchpoint
- Fluid Viscosity
- Resistance Temperature Element
- Nominal Resistance
- Functional Switch Hysteresis

# DirectPropertyReal

Roles	Base Template	Specialized Template	Instance
	<b>DirectPropertyReal</b>	<b>Orifice Beta Ratio</b>	
<b>Role 1</b>			
hasType	ISO 15926-4 SINGLE PROPERTY DIMENSION	BETA RATIO	
<b>Role 2</b>			
hasPossessor	ISO 15926-4 POSSIBLE INDIVIDUAL	ORIFICE PLATE	FE-203
<b>Role 3</b>			
valValue	DOUBLE	DECIMAL	50

- Other Templates on similar lines
  - Instrument Quantity
  - Orifice Beta Ratio
  - RTD Element Wires
  - Functional Switch Number of Contacts
  - Control Valve Calculated CV
  - Control Valve Selected CV
  - Air Set Gauges

# DirectPropertyBoolean

Roles	Base Template	Specialized Template	Instance
	DirectPropertyBoolean	Custom Tag Plate Option	
<b>Role 1</b>			
hasType	ISO 15926-4 SINGLE PROPERTY DIMENSION	CUSTOM TAG PLATE	
<b>Role 2</b>			
hasPossessor	ISO 15926-4 POSSIBLE INDIVIDUAL	TRANSMITTER	PT-203
<b>Role 3</b>			
valValue	BOOLEAN	BOOLEAN	YES / NO

- Other Templates on similar lines
  - Elevation Suppression Option
  - Sanitary Application Option
  - Orifice Plate Stamping Requirement Option
  - Temperature Sensing Element Spring Loading
  - Thermocouple Grounding Option
  - Radar Level Transmitter Overfill Detection
  - Fire Proofing Option

# Indirect(??)PropertyBoolean

Roles	Base Template	Specialized Template	Instance
	<b>IndirectPropertyBoolean</b>	<b>Vacuum Possibility</b>	
<b>Role 1</b>			
hasType	ISO 15926-4 SINGLE PROPERTY DIMENSION	VACCUM POSIBILITY	
<b>Role 2</b>			
hasPossessor	ISO 15926-4 POSSIBLE INDIVIDUAL	STATIC PROCESS EQUIPMENT	V-203
<b>Role 3</b>			
valValue	BOOLEAN	BOOLEAN	YES / NO

- Other Templates on similar lines
  - Vacuum Possibility
  - Build Up Tendency
  - Pulsating Flow
  - Vibration Possibility
  - Bi-Directional Flow
  - Phase Foaming
  - Corrosive Property
  - Abrasive Property
  - Fire Proofing Option



# ClassificationOfIndividual

Roles	Base Template	Specialized Template	Instance
	ClassificationOfIndividual	Orifice Bore Type	
<b>Role 1</b>			
individual	ISO 15926-4 POSSIBLE INDIVIDUAL	ORIFICE PLATE	FE-203
<b>Role 2</b>			
Class	ISO 15926-4 INDIVIDUAL CLASS	ORIFICE_BORE_TYPE_CLASS	CONCENTRIC

- Other Templates on similar lines:

- Instrument Type Description
- Instrument Mounting Configuration
- Transmitter Output Signal
- Transmitter Mounting Bracket Type
- Transmitter Failure Action
- Transmitter Indicator Option
- Pressure Transmitter Measurement Type
- Transmitter Flange Type
- Manifold Type
- Remote Seal Capillary Type
- Differential Pressure Flow Element Type
- Orifice Bore Type

# *Virtual / Soft Relationships*

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- See Embedded Bubble Diagram



Control System  
- Bubble Diagram

# *Thank You*