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A Guide on Instrumentation

PIP Standards

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Table of Contents

Part 1 : The Fundamentals

1. You will never be a True Engineer 05
2. Should we abandon “Out of the box thinking” 06
3. Dream Big but start small 08
4. Why should we learn PIP standards 11

Part 2 : The PIP Naming system

4. Breaking down PIP standards 15
5. Exploring digits in PIP standards 16
6. Conclusion of PIP Naming system 22

Part 3 : Organizing Instrumentation PIP standards

7. Mental Representation technique 25
8. Dividing standards in two stages 28
9. Instrumentation PIP standards 33
10. Summary of my notes on PIP standards 40
11. Smile and Knowledge have something in common 41
12. Free Gift 43
13. Thank you 44

What will you learn in this guide?

1. Why Engineering Standards are critical to our career development

2.What approach should be adopted to learn engineering standards

3.What is “Golden egg” technique and why it works

4.How important are PIP Standards and which global engineering giants use it

5.What is the unique naming system behind PIP standards

6.What is “mental representation” technique by Andres Ericson

7.How to organize standards in a way that we can easily recall them when needed

8.How a sweet smile can lead you to the path of acquiring great wealth of knowledge

Part 1

The Fundamentals

“You will never be a True Engineer”

This is what my mentor once reprimanded me.

Being Honest, I was really shocked at his reply.

I was trying my best to impress him by my efforts to learn and ask questions.

Then he explained that "Don't run after quick fixes by asking questions to your seniors and getting a spoon-fed answer"

He then added "Even though how tough it might seem study the engineering standards "

“Without understanding these standards, you will never become a true engineer.”

It is like a foundation, where your building of knowledge stands.

Since Standards are made without any vendor biases and highly knowledgeable engineers from diverse engineering background contribute for its preparation.

Should we abandon “Out of the Box thinking”?

The next question that I had, and maybe even you would be wondering is that if we keep following standards then what about Out of the box thinking and the creative & innovative ideas that we engineers must produce!!

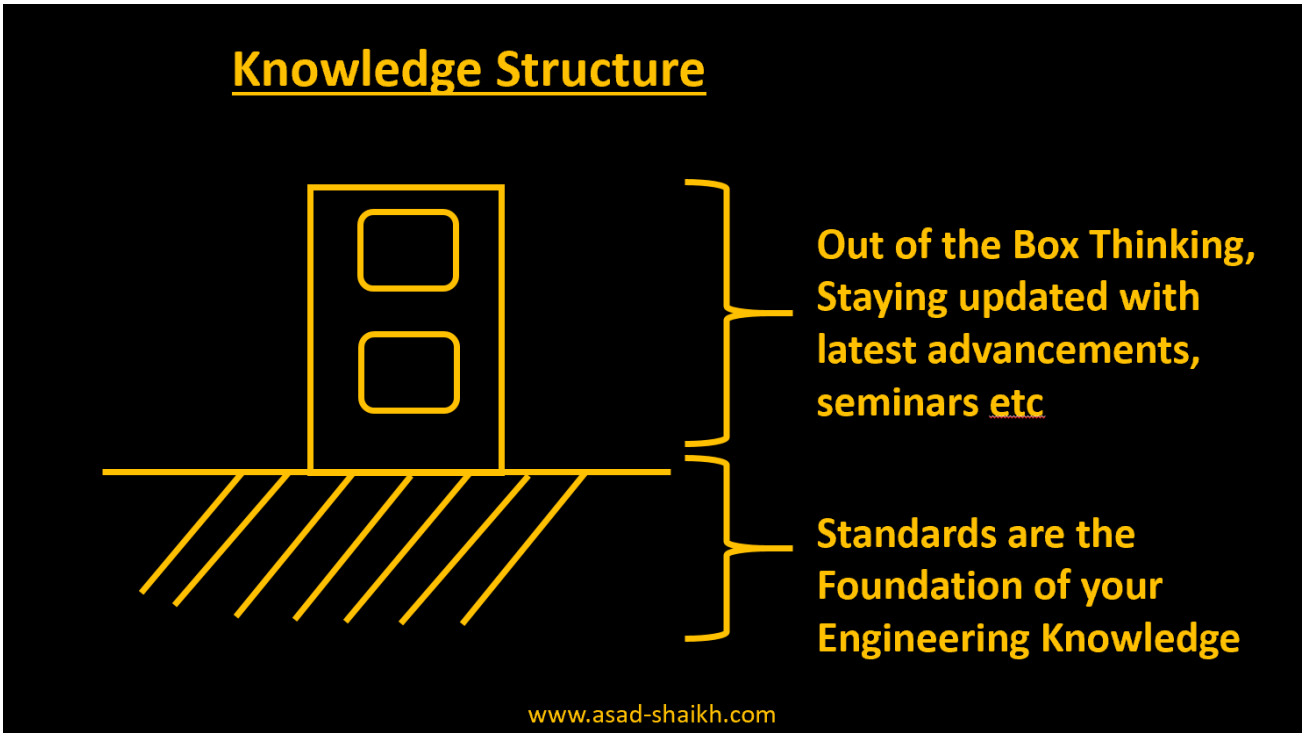
My mentor had also worked in the likes of companies like Shell etc and he would keep taking about how engineer’s must have the spark to create innovative ideas and that’s what differentiated him from his peers.

So, don’t you think this seems to be contradicting advice?

Then I learnt the depth of his advice, he said, “**Learn the standards**” and not “**Follow the standards**”.

Since standards are like a foundation for receiving authentic unbiased knowledge, so when our foundations are strong, we are more confident to challenge the status quo and share our innovative solutions.

This learning mechanism could be modelled as below



Personal Story:

During one of my Projects the vendor had provided FKM Viton gasket for Steam service and I raised a query about the selection of gasket.

Since the vendor was also world renowned, they did not pay attention to this query and stated that this is their standard offering.

So, I suggested that API RP 551 states that FKM Viton gasket is not suitable for steam service and if they provide a written confirmation that this would not cause any issue in the plant then we would be glad to accept their offering.

Guess What? Next day we received a revised quote with PTFE gasket at no additional cost 😊

Dream Big but Start Small

When I had started my career, I was very hyped up about becoming the most knowledgeable engineer

Then I realized, becoming an overnight expert is a myth.

We can be the tony stark of our field only if we keep up our “student” attitude towards learning and realize that this is a gradual process.

Initially I made the mistake of taking too much to learn at a time, which leads to burn out and a feeling of despair that we will never be good enough.

Human nature wants quick results!

However, I would love to share a strategy that I have implemented in my own life called “Golden Egg Principle”

Do you remember the story of the Farmer who had a magical hen that would give golden eggs?

The farmer was too hasty and wanted to become rich too quickly, so he decides instead of getting just one egg per day why not slaughter the hen and get all the eggs at once. Thus, he got nothing.

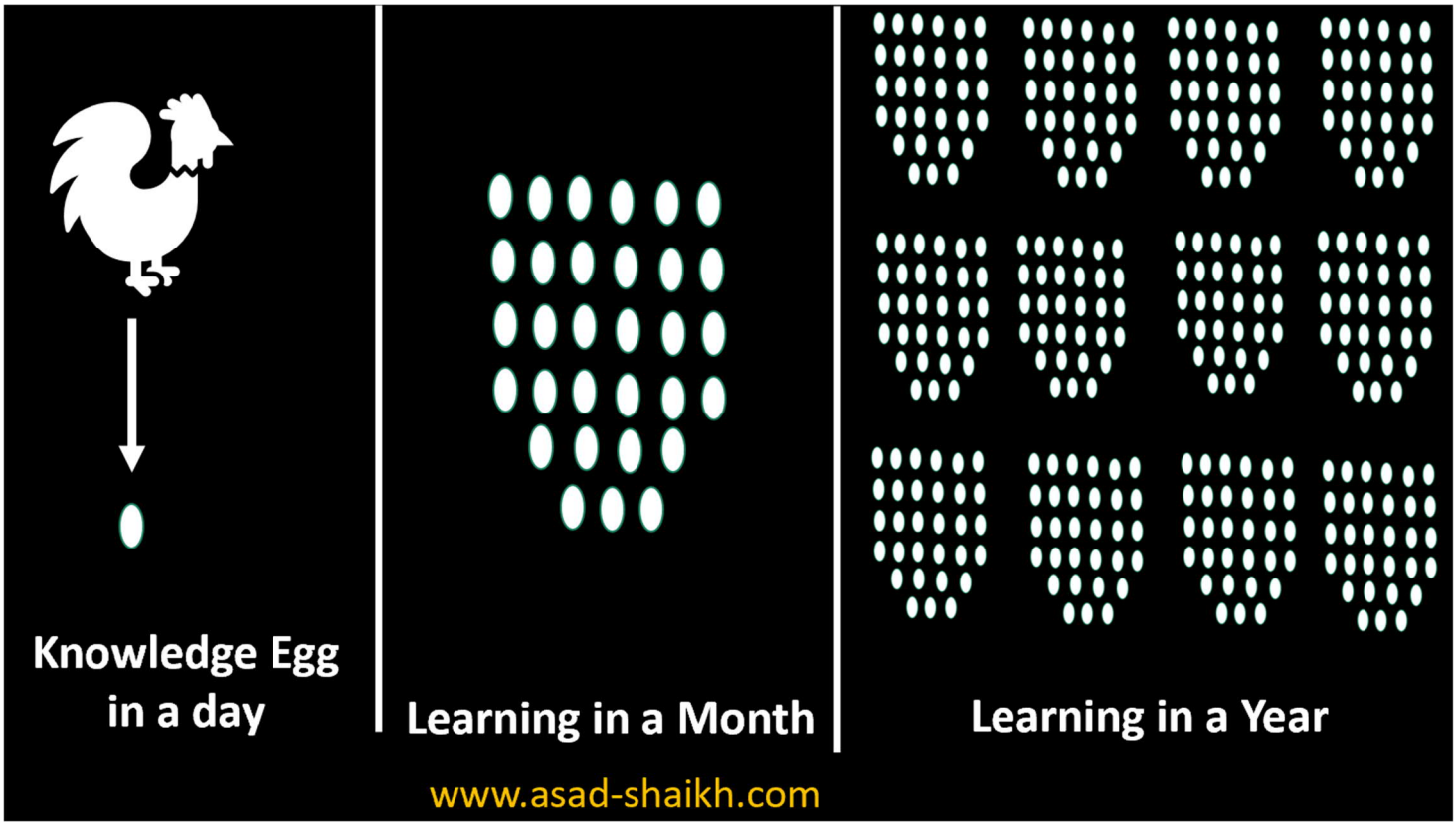
This story sounds silly but even we make such mistakes in our career and life in general.

We are hyped up about a single certification course that would uplift our career to new heights, but we never give due importance to the commitment to learning something new every day.

Imagine learning one new thing each day is like getting one golden egg per day.

This might not seem significant at first but imagine what if we keep up with this consistent routine for days and months.

We would learn 365 new things in a year, and as we know knowledge compounds!



Now imagine what you could achieve if you keep up with this routine for a **decade**!

And anyways time keeps passing so why not make the most of it

You are not alone even I have made this mistake multiple times.

I had heard that API RP 551 is a standard for field instrumentation, and I made a commitment to learn the entire standard word by word.

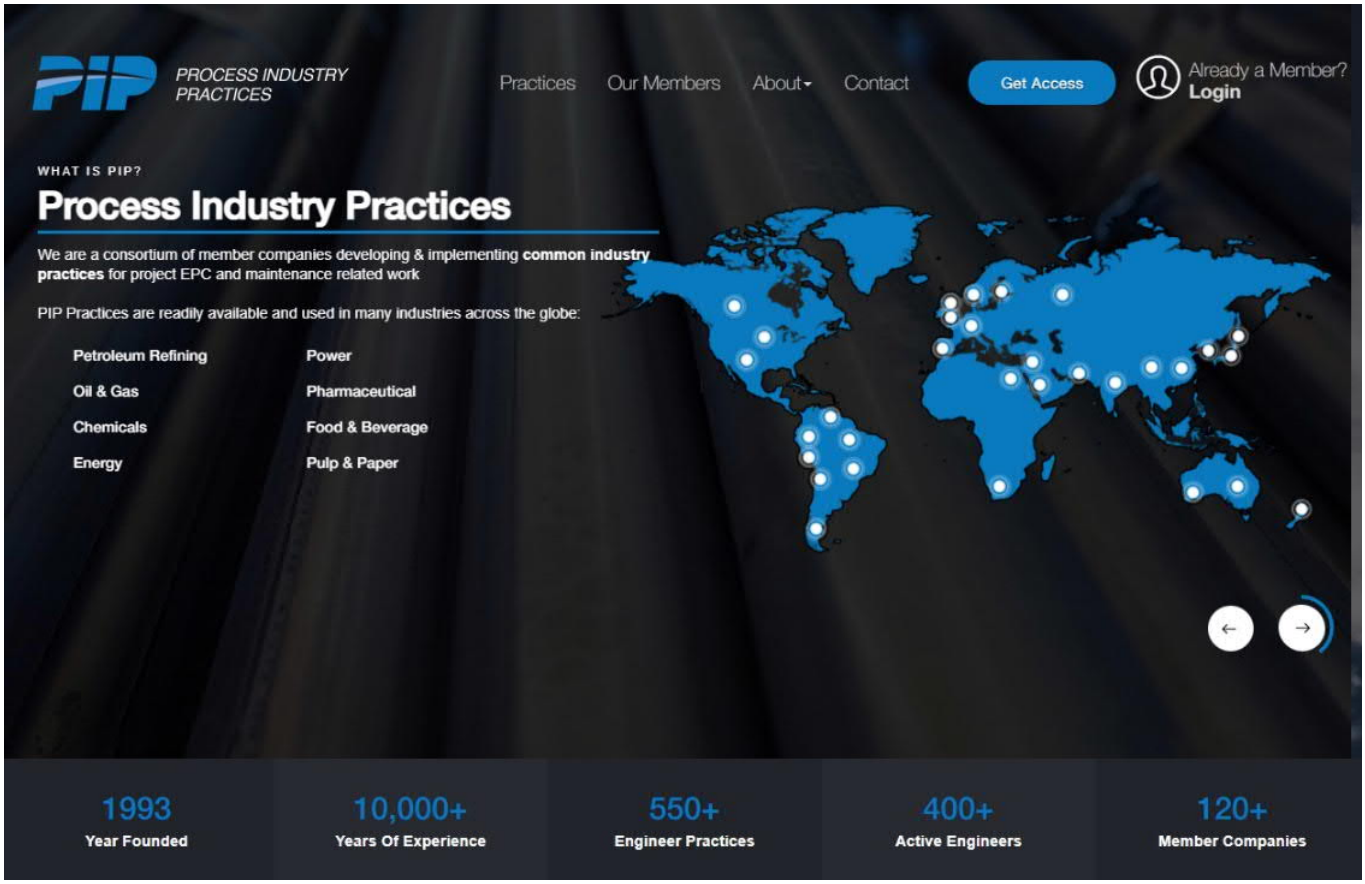
Soon I got burnt out and realized that starting with a 200+ page standard might not be a good idea to start learning.

Thus, I modified my goal and started with PIP standards that are simple and brief.

And now once I have built momentum and a habit to study standards, now API RP 551 standard no more seems intimidating to me.

With all due love and respect, I encourage you to embark on this journey of learning Instrumentation PIP standards.

Why should we learn PIP standards?



(Source: https://pip.org/about/about-pip)

1.These standards are brief and to the point (The maximum could be roughly around 15 to 20 Pages)

2.They have in-depth segregation.

Example: - The Orifice fabrication is covered in a separate standard while there is a separate standard for Orifice installation.

3.They have wide acceptance and world-renowned companies contribute for its preparation and adoption.

How important are PIP Standards?

The most renowned engineering giants are part of PIP, a few are listed below. (Source: https://pip.org/our-members)

A Free Gift at the End

If you are enjoying this guide then I am highly positive that you would enjoy the FREE gift at the end of the book as well !!

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Part 2

The PIP Naming System

How are PIP Standards different from other International standards?

Example:

ISO standard for DP flow meter is **ISO 5167**

However, The **PIP** standard for Flow meter's Installation is named as follows :-**PIP PCIFL100**

Don't you feel that these PIP standards have longer names and have higher complexity to remember as compared to conventional names of standard.

This is done for a specific reason, let us explore this concept in detail

Breaking down PIP standards

Let us break down this standard's name into individual digits and explore how this naming philosophy is developed.

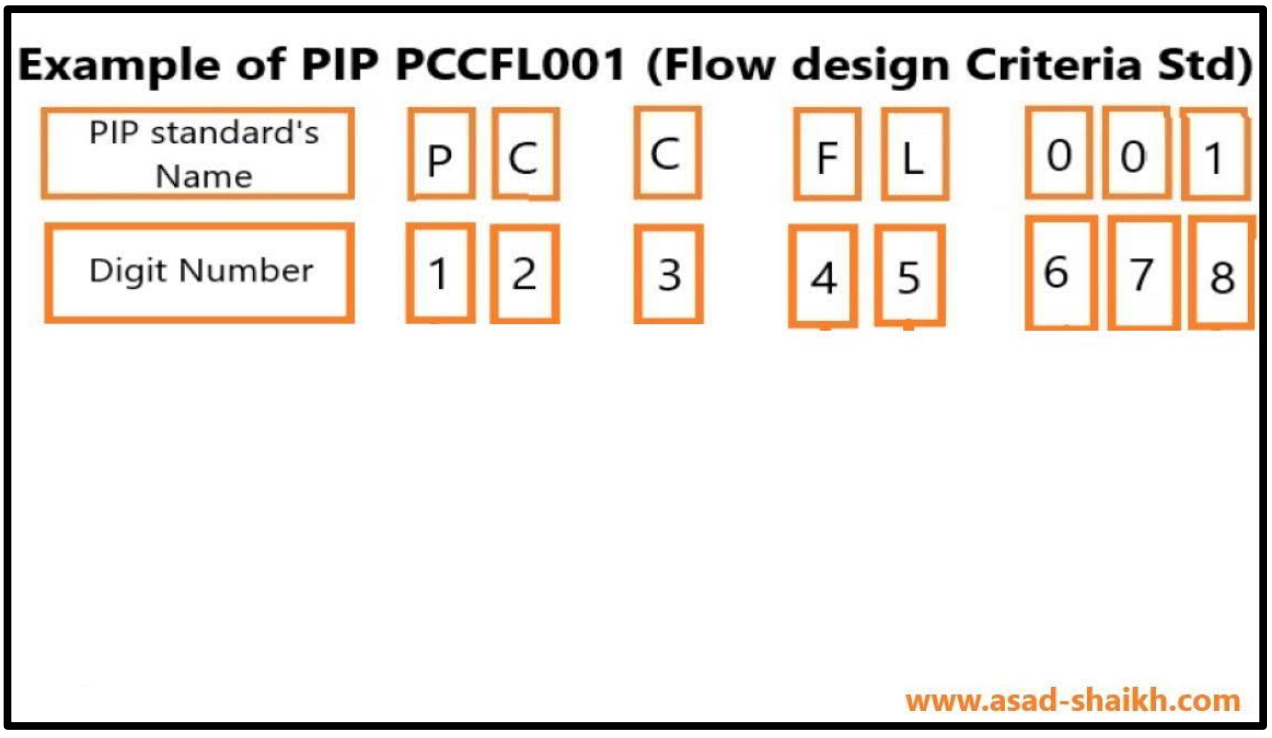
Note that PIP instrumentation standards are majorly divided into **8 Digits**

Every digit has a significant role to play.

Example:

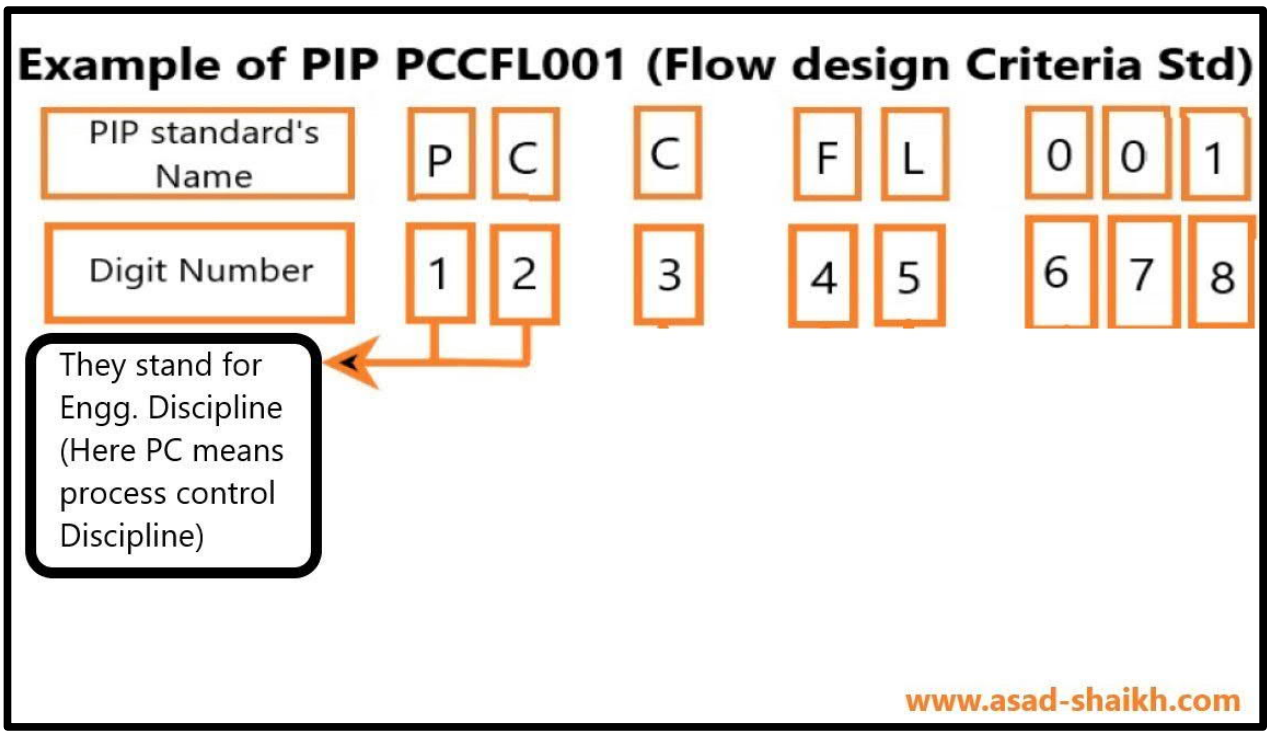
PIP standard for Flow meter's criteria of design is called **PCCFL001**

Here's the breakdown and significance of each digit



Exploring the digits in depth

1. Digits 1 & 2 stand for the Engineering discipline.



This is the first criteria for segregating PIP standards as per applicable engineering discipline

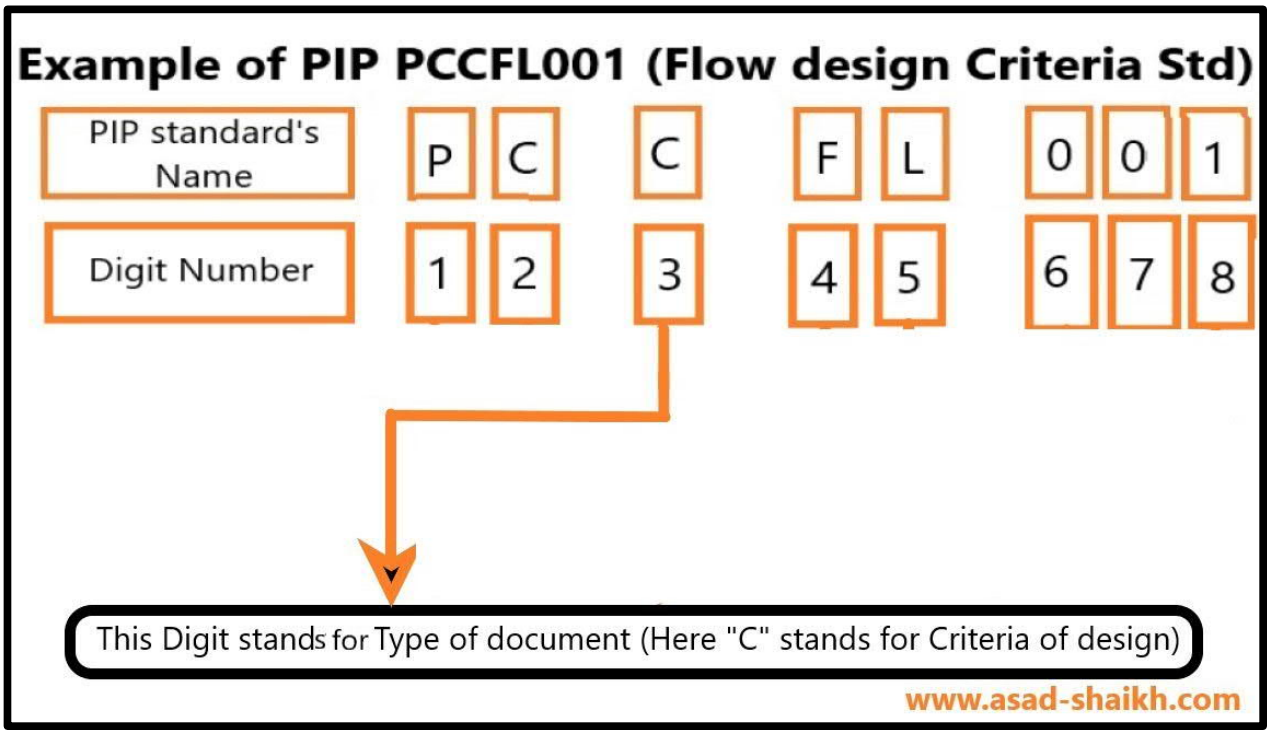
Example –

1.PC: - stands for Process Control (i.e. Instrumentation and Control Engineering)

2.PN: - stands for Piping Engineering

3.EL: - stands for Electrical Engineering

2. Digit 3 stand's for type of document



Digit 3 classifies PIP standards as per their applicability in procurement cycle

1ST stage of procurement cycle is selecting the right measurement technology.

Hence the third digit should be "**E**" which stands for **Engineering Guide**

Example :

PC**E**FL001 is standard for flow meter engineering guide and thus the 3rd digit is "**E**"

2ND stage of procurement cycle logically seems to be specifying the instrument measurement technology selected above.

Hence the 3rd digit should be "C" that stands for **Criteria of design** (Design specification)

Example:

PC**C**FL001 is standard for flow meter criteria of design (Design specification) and thus the 3rd digit is "**C**"

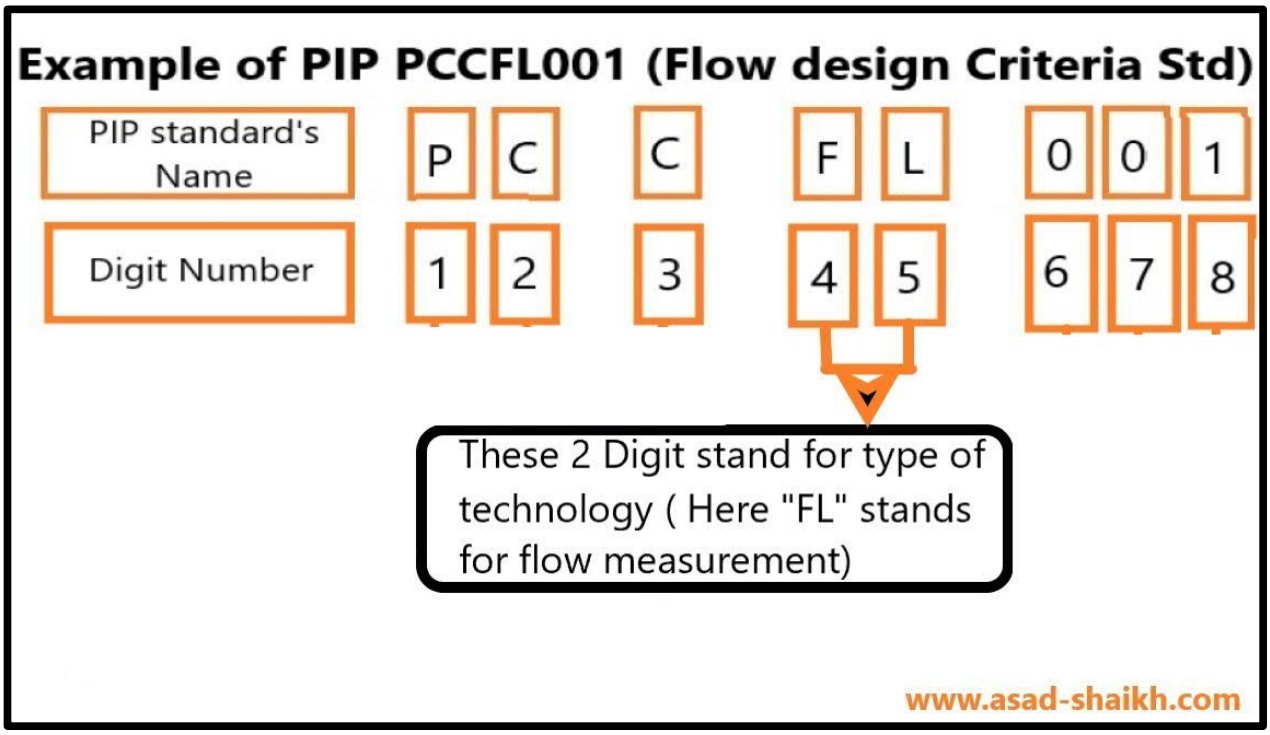
Similarly, the rest of the procurement cycle follows

"F" stands for **Fabrication Details**

"I" stands for **Installation Details**

"T" stands for **Inspection and Testing Requirements**

3. Digits 4 & 5 stand's for type of technology



For level measurement the 4th & 5th digits are "LI"

Example :

PCI**LI**100 is standard for Level Transmitter Installation Details.

Hence digits 4 & 5 in above example are "LI" which stand for level measurement

Similarly,

The digits 4 & 5 with the following alphabets are abbreviated as mentioned below

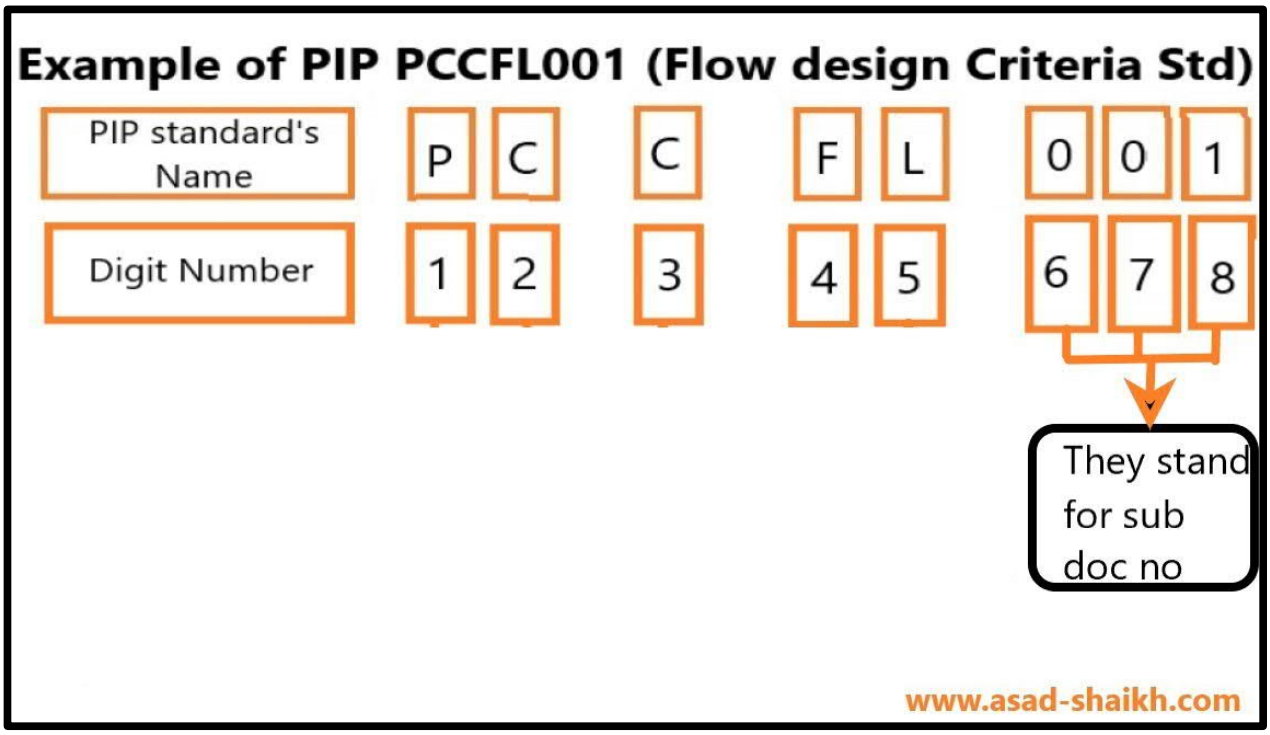
“TE” stands for Temperature measurement technology

“FL” stands for Flow measurement technology

“PR” stands for Pressure measurement technology

“CV” stands for control valve technology

4. Digits 6,7 & 8 stand's for sub document numbering



PIP standard's website has not defined these digits in great detail.

However, after a careful observation these seem to aid in identifying pages within the PIP standard

Example:

PCFTE100 is the standard for thermowell fabrication details

Within this standard there is subdivision on fabrication drawings of various thermowell types.

Hence these are separate within this standard as follows (The last digit of this sub document number keeps changing)

PCFTE**101** – Threaded Tapered Thermowell fabrication drawing

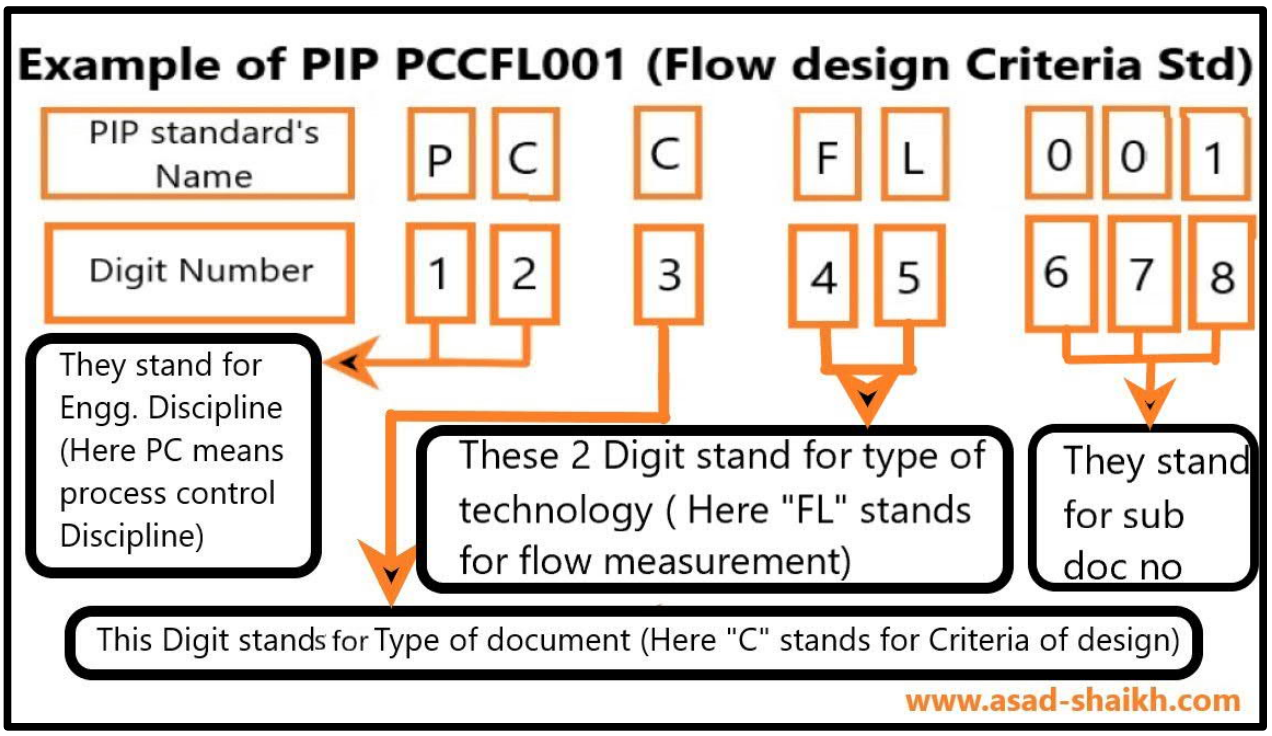
PCFTE**102** – Flanged Tapered Thermowell fabrication drawing

PCFTE**103** – Weld-in Tapered Thermowell fabrication drawing

PCFTE**104** – Socketweld Tapered Thermowell fabrication drawing

Conclusion

Let us summarize the entire coding system below



Part 3

Organized Pattern to Remember Instrumentation PIP Standards

“Mental Representation” Technique

Our brains can remember better when we create patterns instead of just mugging up data

You might find it difficult to memorize a mobile number

However, can you imagine a human being who can recall from his memory 100 random digits in row.

I came across this concept in the book “Peak” by Anders Ericsson where he has explained this remarkable feat.

And one peculiar secret I could discover in his technique was the ability to develop patterns or what he terms as “**mental representations**”.

We face similar challenges when it comes to Instrumentation Engineering standards since the quantum of standards is huge.

And thus, I have made some personal notes and mental representations to organize these standards in a logical way.

Instrumentation PIP Standards

Do you know the total number of PIP standards that are applicable to Instrumentation & Control discipline?

In total there are 57 active PIP standards that cater to the needs of Instrumentation and control discipline (as of March 2021)

Intimidating Numbers?

57 standards might seem intimidating at first and it would seem confusing where to start!

When I first came across these standards even, I felt the same!

Sharing My Personal Notes

In order to track and learn these standards I had made some personal notes.

In these notes I have divided the standards into stages so that it becomes easy and handy to understand the applicability of these standards.

The below segregation consists of PIP standards that are divided into 2 broad stages.

Note: - This segregation into 2 stages is based on my personal understanding.

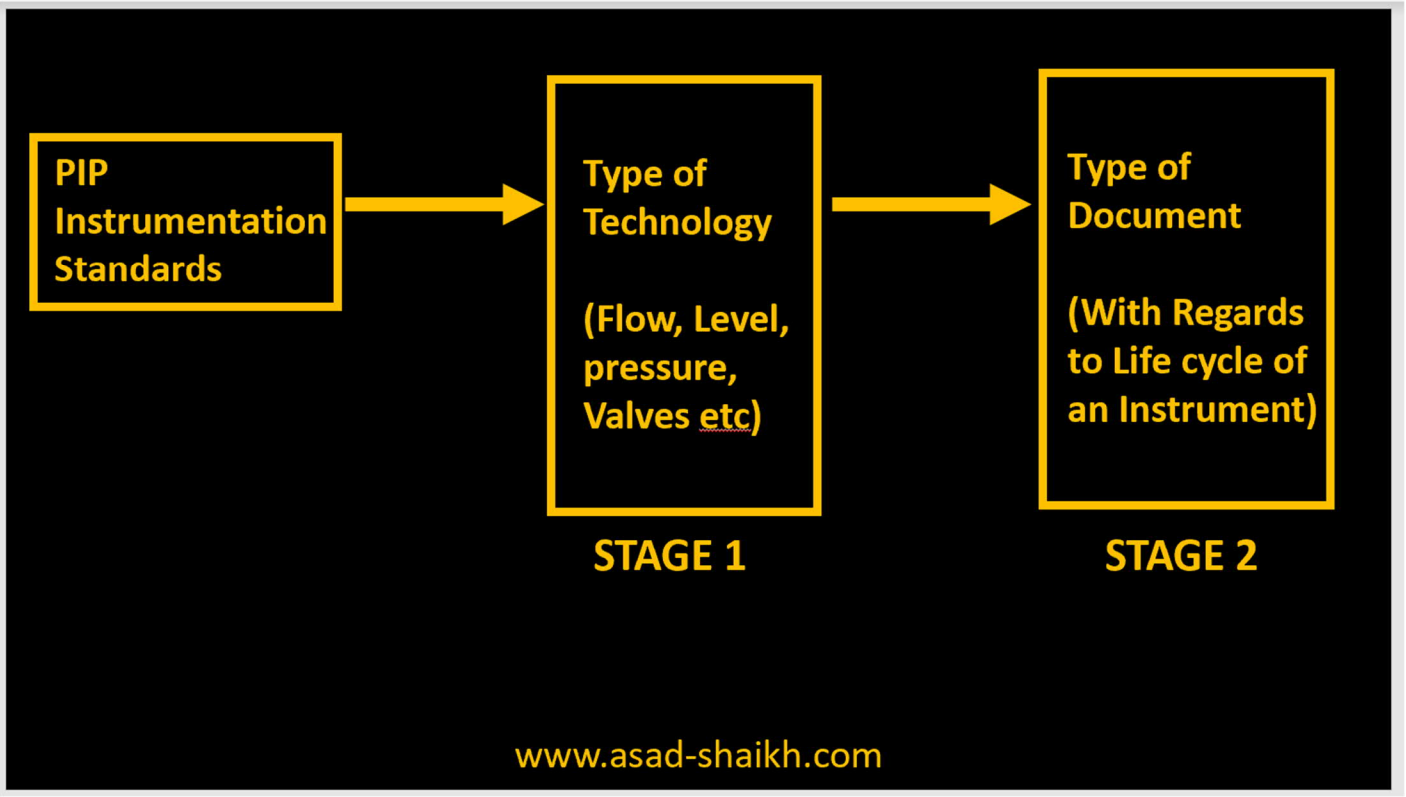
The official PIP organization does not divide these standards into these two stages.

After learning this pattern, you can develop your own technique to classify these standards as per your taste and preference!

Basic Segregation of Instrumentation PIP standards

Stage 1: Deals with the Type of technology

Stage 2: Deals with the Type of procurement/ life cycle that the instrument is in (or in other words it can be termed as Type of Document)



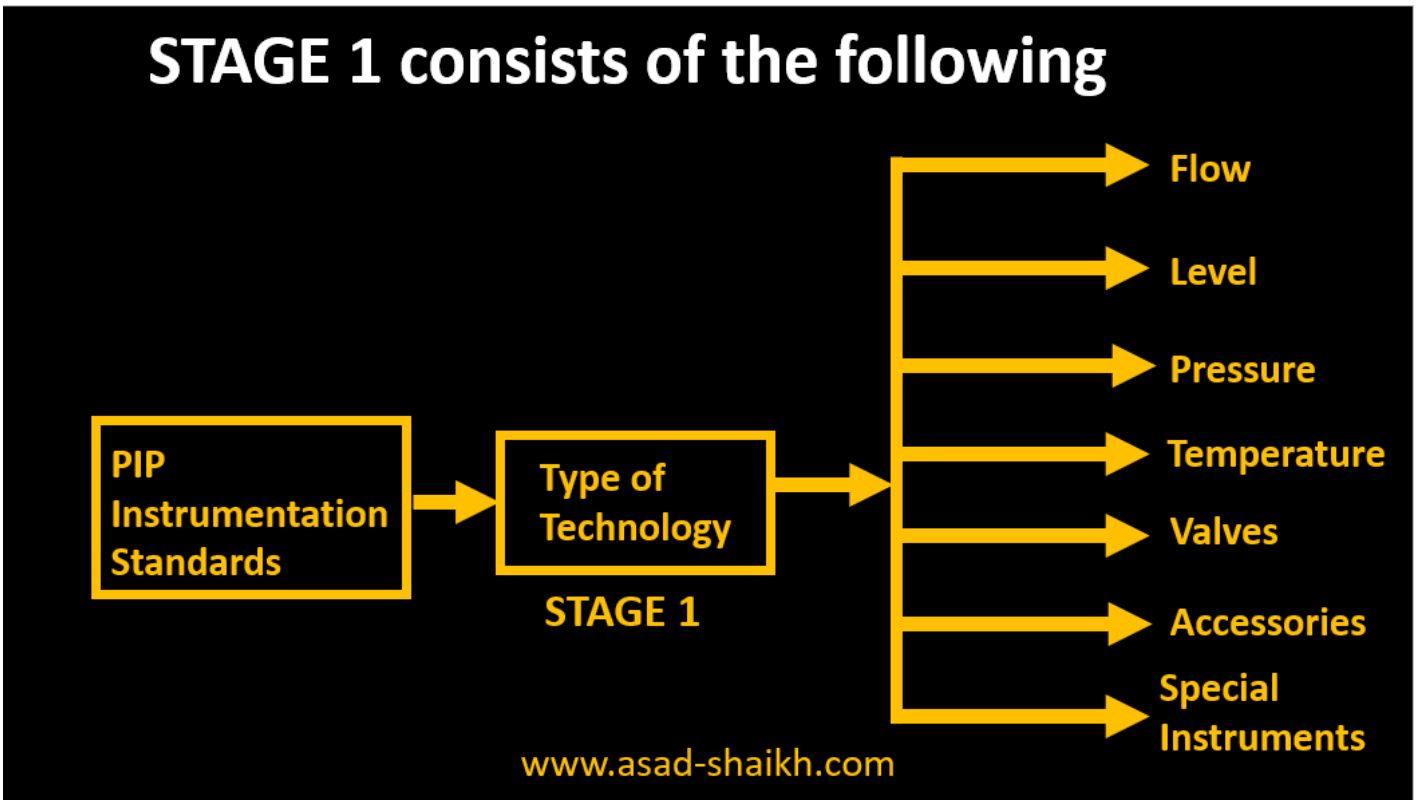
Let’s explore Stage 1 in detail

I have divided stage 1 into seven types

These are usually the major types that we I&C engineers come across.

i.e. Flow, Pressure, Temperature, Level, Valves, Accessories and Special Instruments

Special instruments include analyzers, weight measurement instruments etc. which we will discuss further towards the end

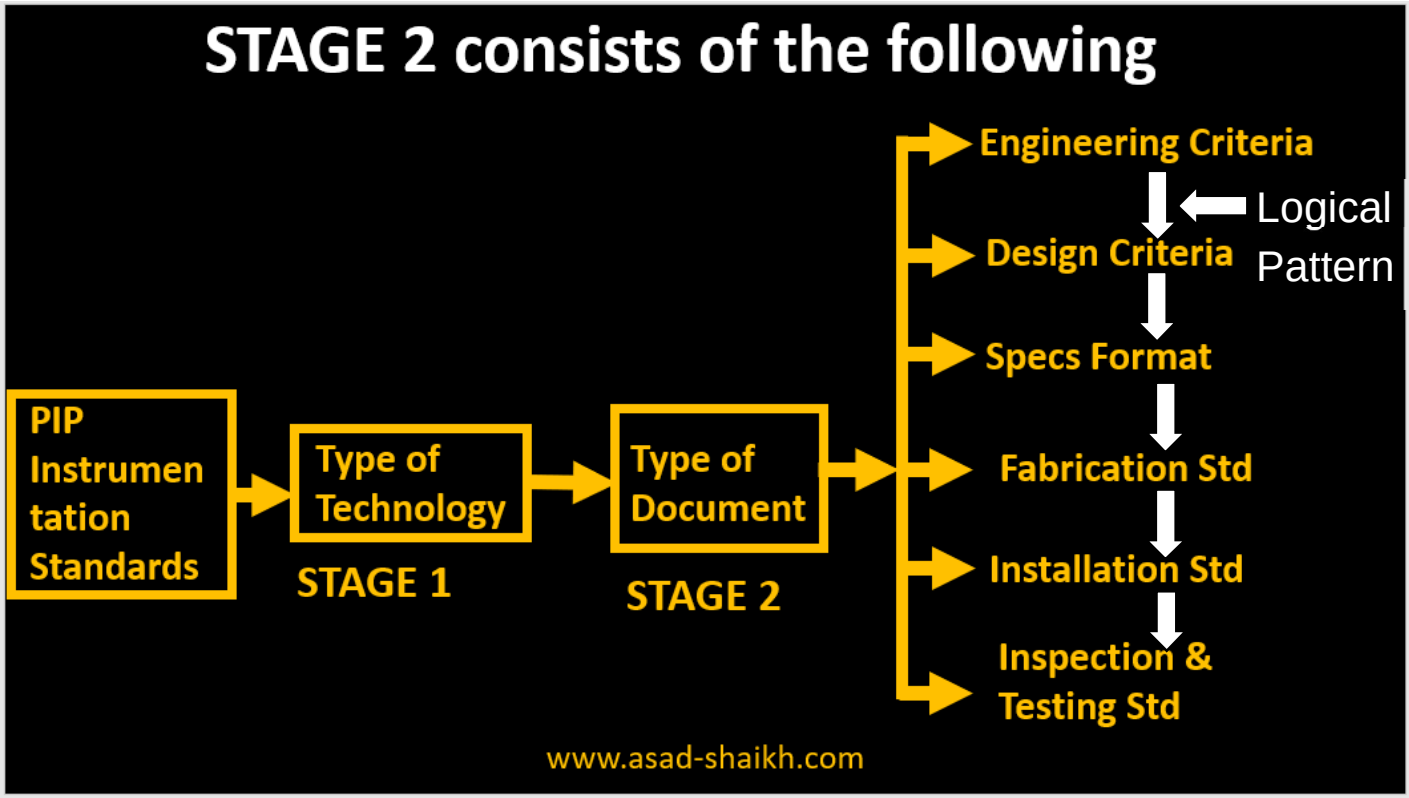


Let’s explore Stage 2 in detail

Stage 2 is divided into Six types

Stage 2 is an enhanced segregation of Instrument types covered in Stage 1

These types are a logical sequence for engineering any technology.



- **Engineering criteria** facilitates the **selection of type of Instrument (**i.e. whether we should use orifice or Coriolis for flow technology)
- **Design criteria** facilitates the **requirement to design the Instrument** (i.e. what details are required for orifice meters like beta ratio limit, turndown etc.)
- **Specs** facilitates the **framework/format for preparing a datasheet**

- **Fabrication Std** facilitates the requirement for **fabrication of the instrument** (i.e. what should be the taper ratio of thermowell etc.)

- **Installation standard** as the name suggest facilitates the procedure and the hookup required to **install an Instrument on the field** (i.e. the DP transmitter are to be required to be installed below the piping for Liquid service)

- **Inspection and testing** as the name suggest specifies the requirements for **Inspection and testing requirements of Instrumentation**.

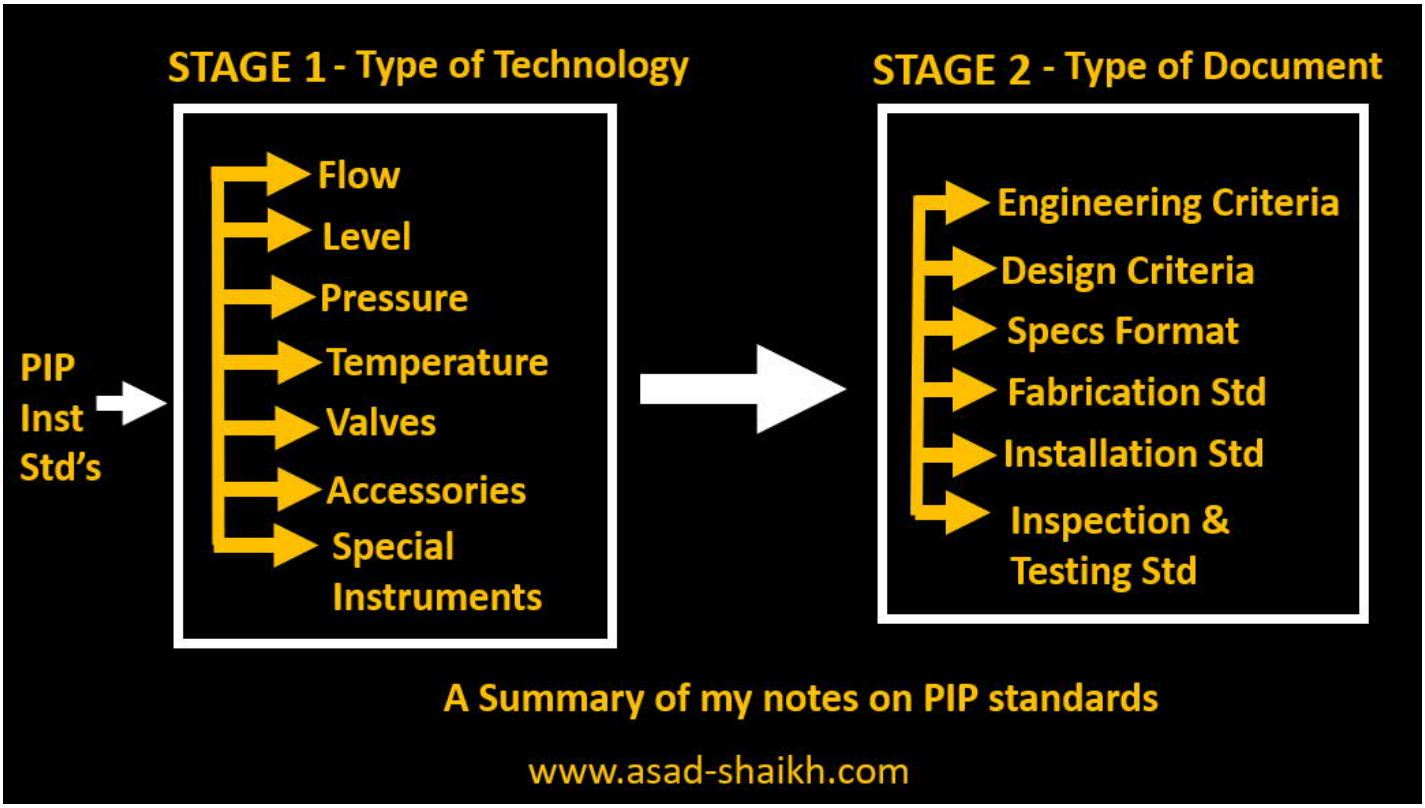
Note: Not all these 6 types don't apply to every Instrument technology

Example: -

For Radar or other Level instruments, fabrication standard is not mentioned since most of the details are vendor specific and very less details are required to be specified for its construction.

However, For Thermowell or Orifice plates, fabrication standard is provided since it has a lot of details that need to be specified to the vendor.

Now we would combine this combination of stage 1 and stage 2 and create combinations for various Instrumentation technology

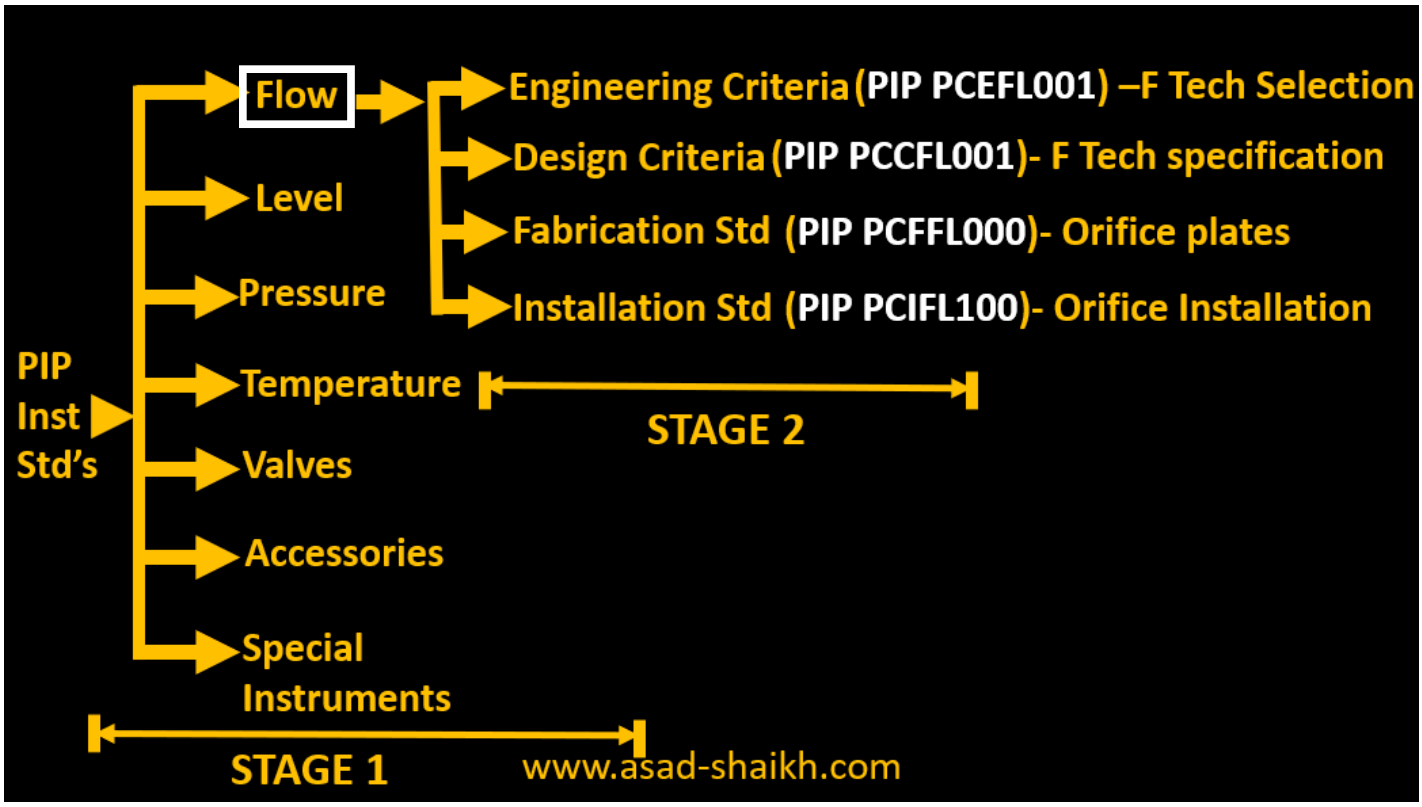


PIP standards for Flow Technology

We would be starting with Flow Technology.

There are 4 PIP standards that cater to the needs of Flow measurement technology

The Name of the standard is highlighted in white and a brief description is highlighted in yellow.



Understanding the Flow Technology standards

As we had previously discussed the standards are aligned in a logical sequence.

1. Engineering standard

The **Engineering standard** **PCEFL001** helps us to understand which flow meter technology would be suitable for our application.

2. Design criteria

Once the technology gets finalized then the **design criteria** **PCCFL001** would help us to define what needs to be specified to design the instrument for our application.

3. Fabrication of Orifice plate

Orifice plates require a lot of details for fabrication like plate thickness, Bore diameter etc.

Hence a standard for **fabrication of orifice plate** which caters to this need is called as PIP **PCFFL001**

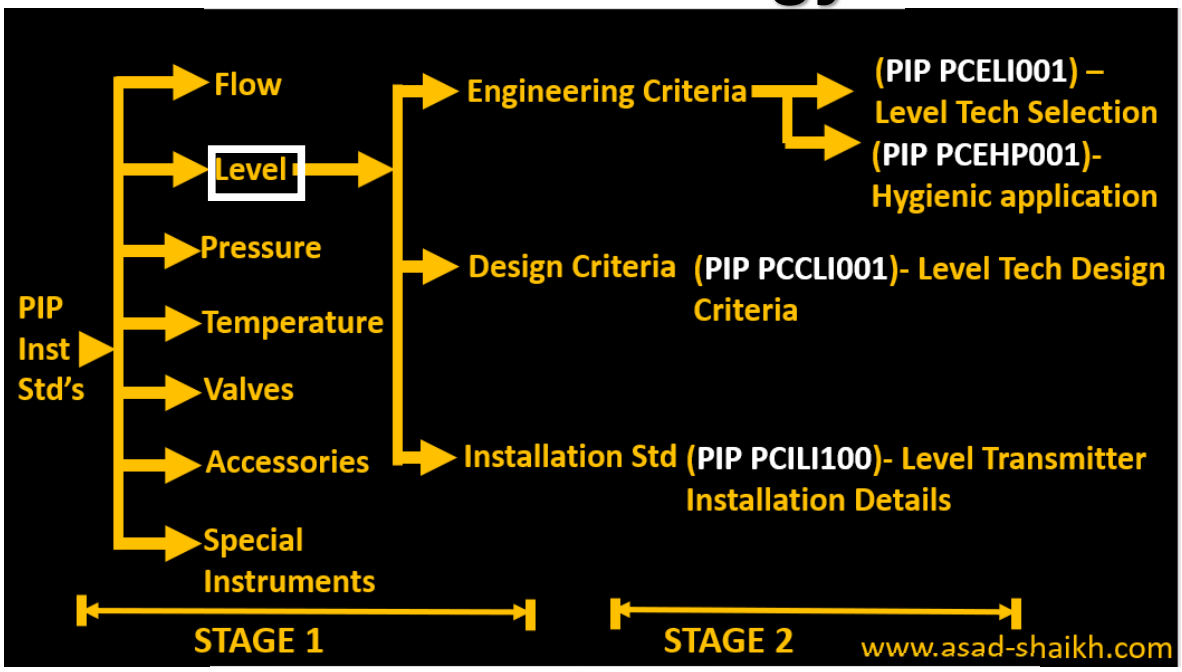
4.Installation Requirements

Finally, we know that for orifice flow transmitter installation there are certain requirements like installing the transmitter below tapings for Liquid service and above tapping for steam service and thus we have a dedicated standard **PIP PCIFL100** that defines the **installation requirements**.

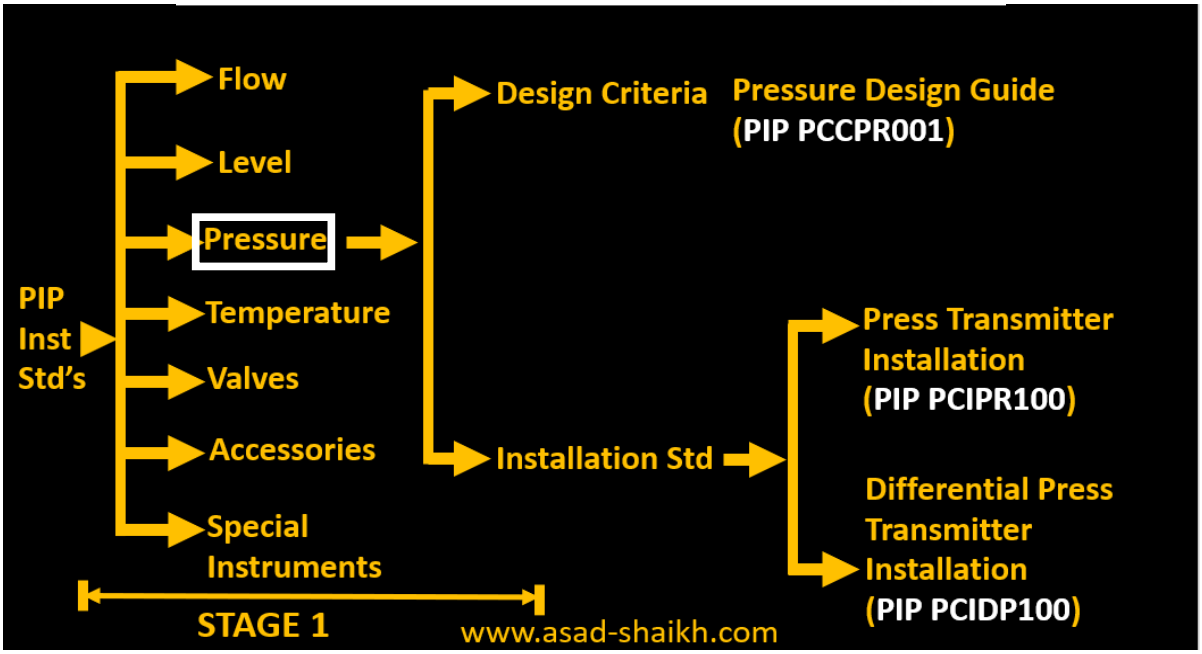
similarly, all the other technologies follow a similar pattern.

PIP standards for Level & Pressure

Level Technology

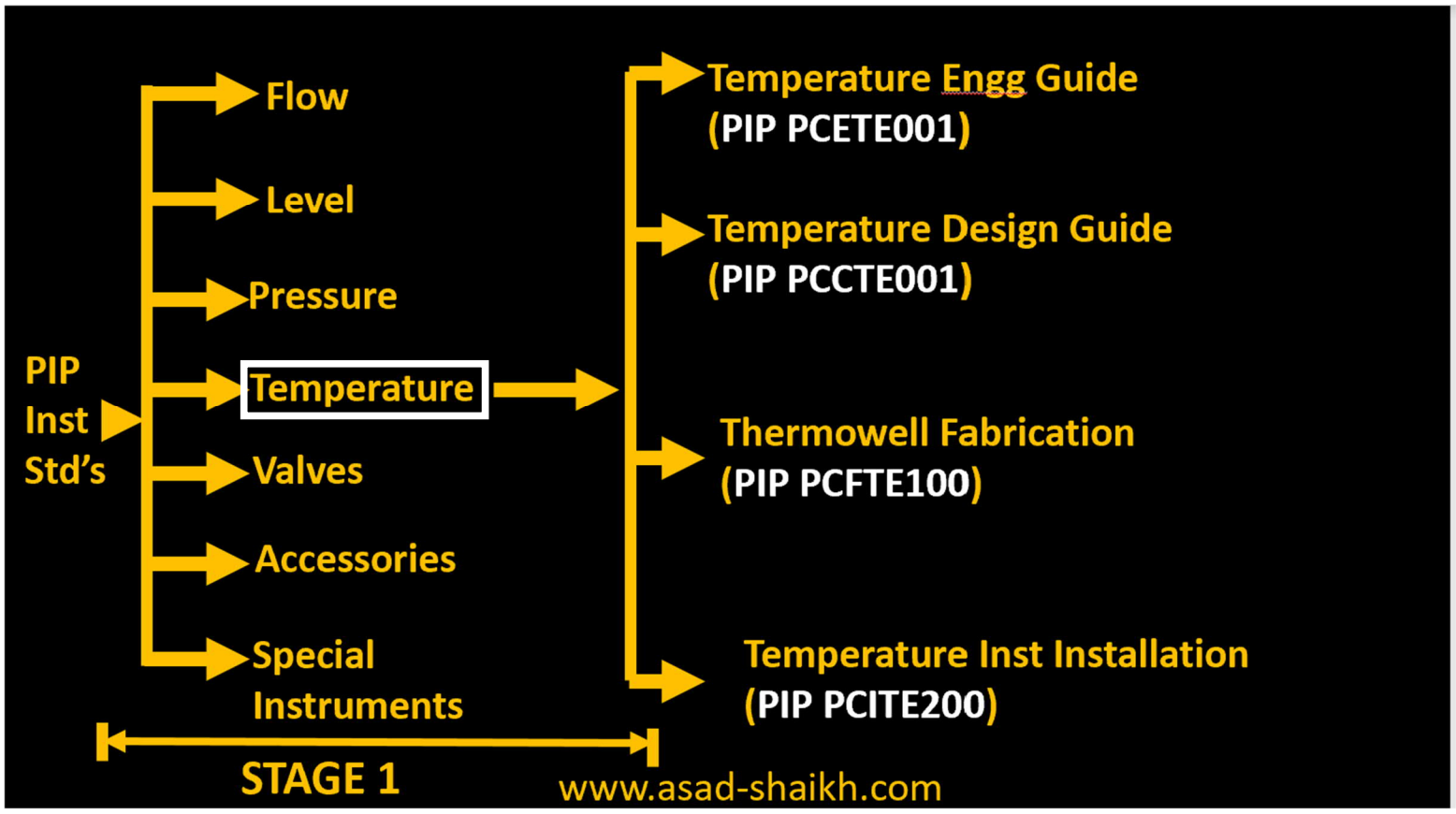


Pressure Technology



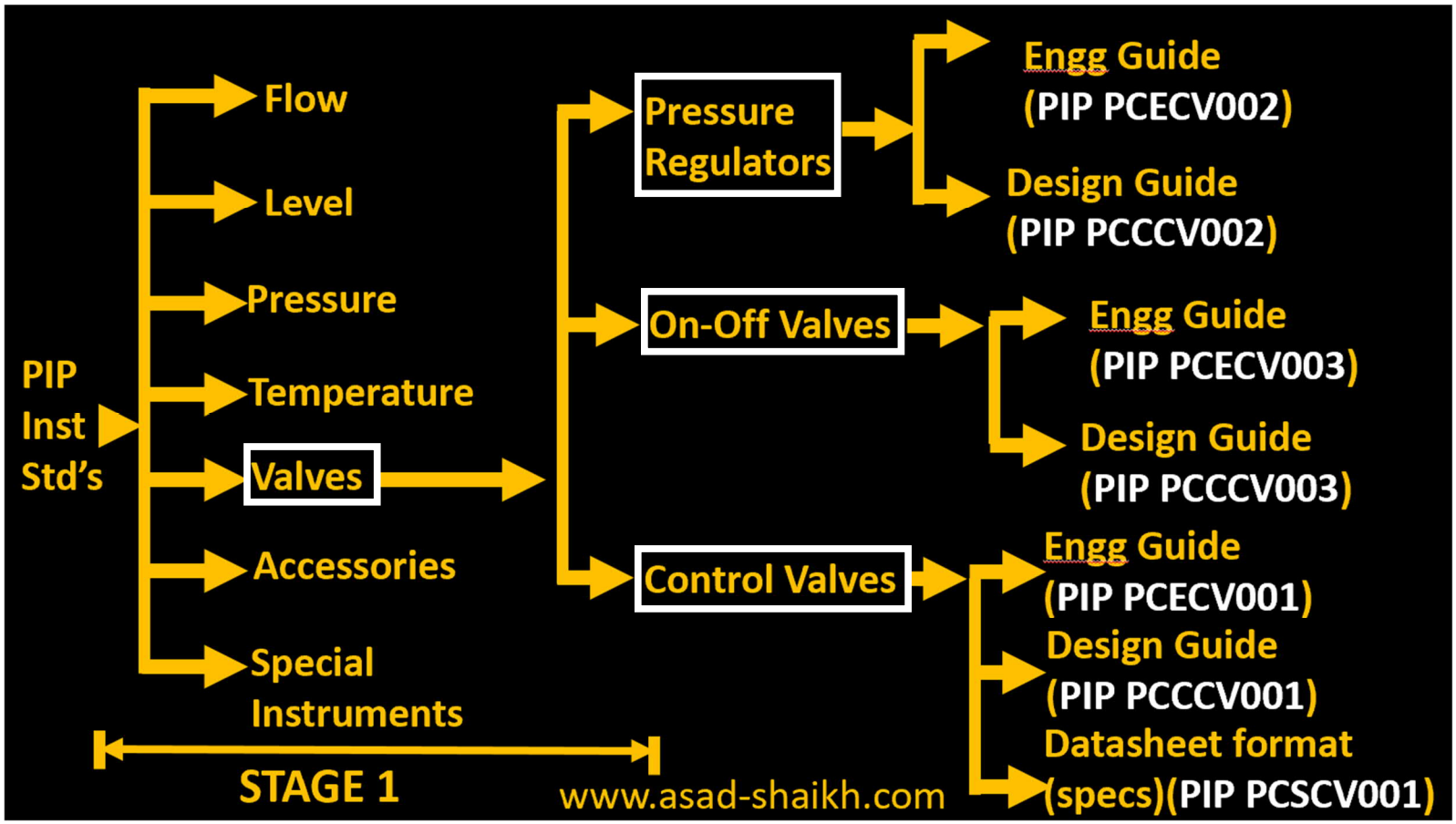
PIP standards for

Temperature Technology



PIP standards for

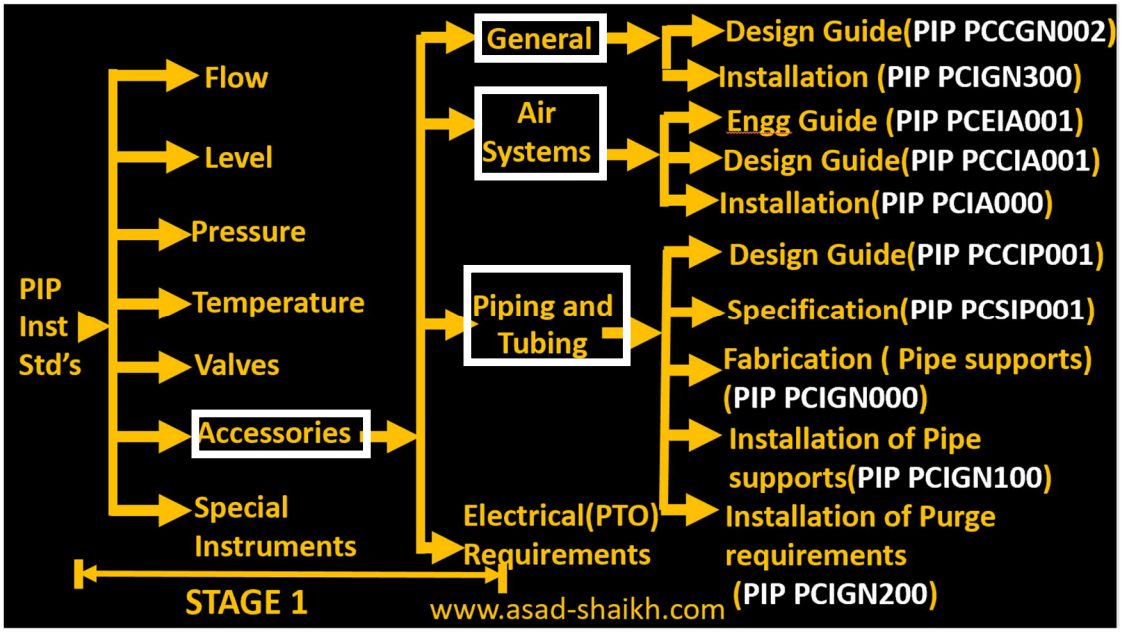
Valves (On-Off/Control/Regulators)



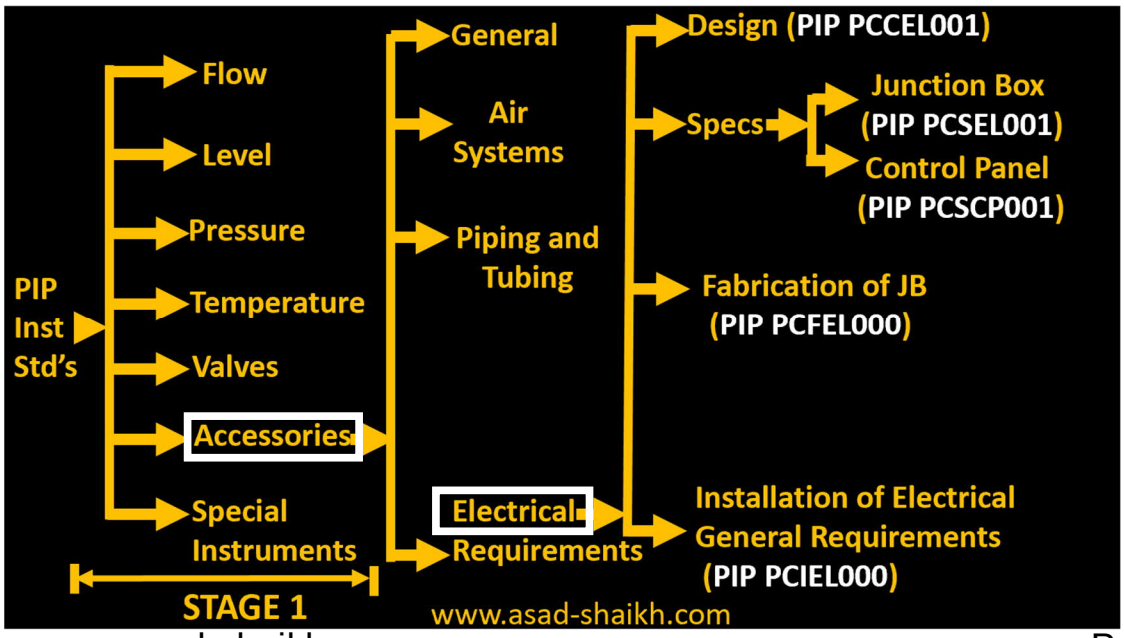
PIP standards for

Instrument accessories

Part 1 -Air & Tubing requirements



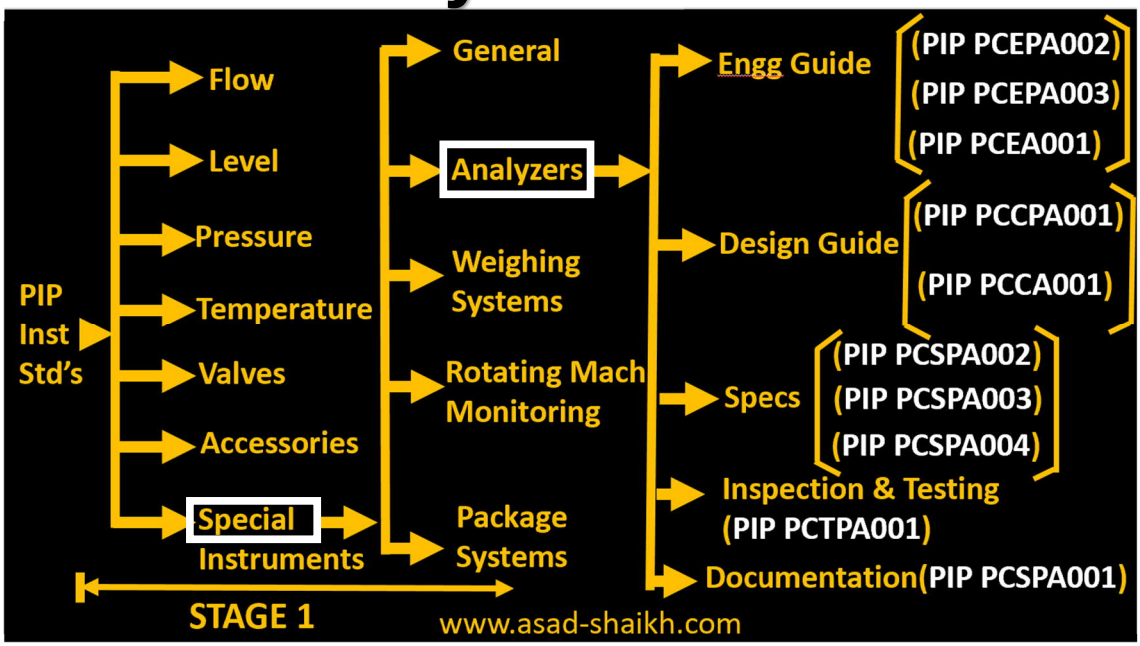
Part 2 -Electrical Requirements



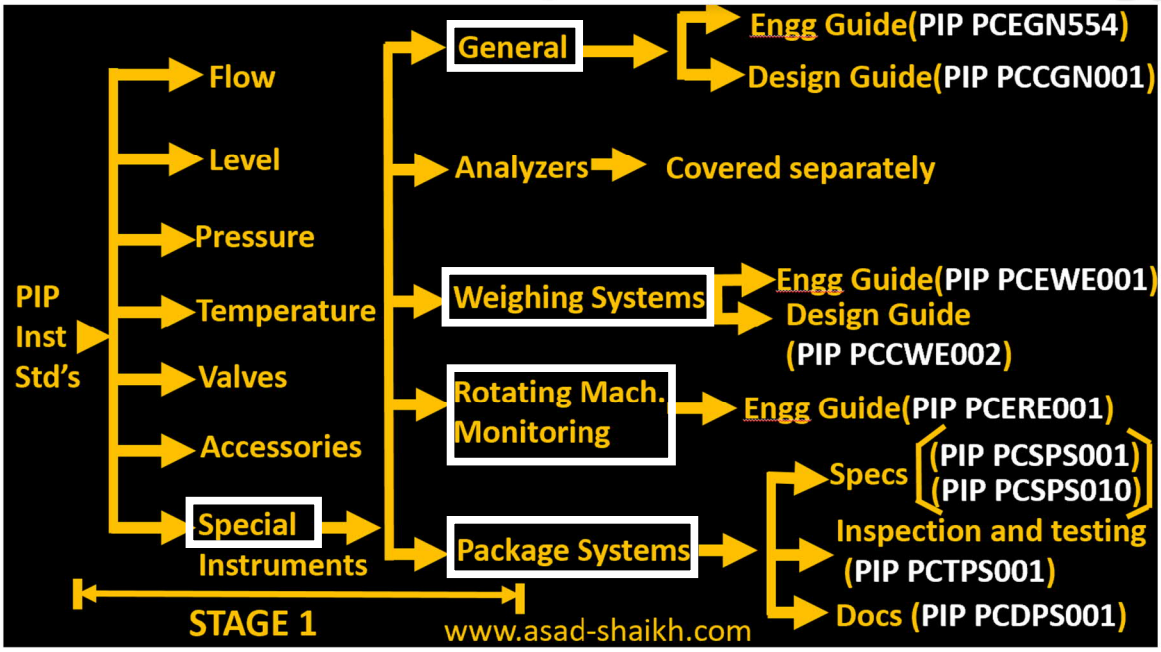
PIP standards for

Special Technology

Part 1:- Analyzers



Part 2:- Other Special Technology



Conclusion

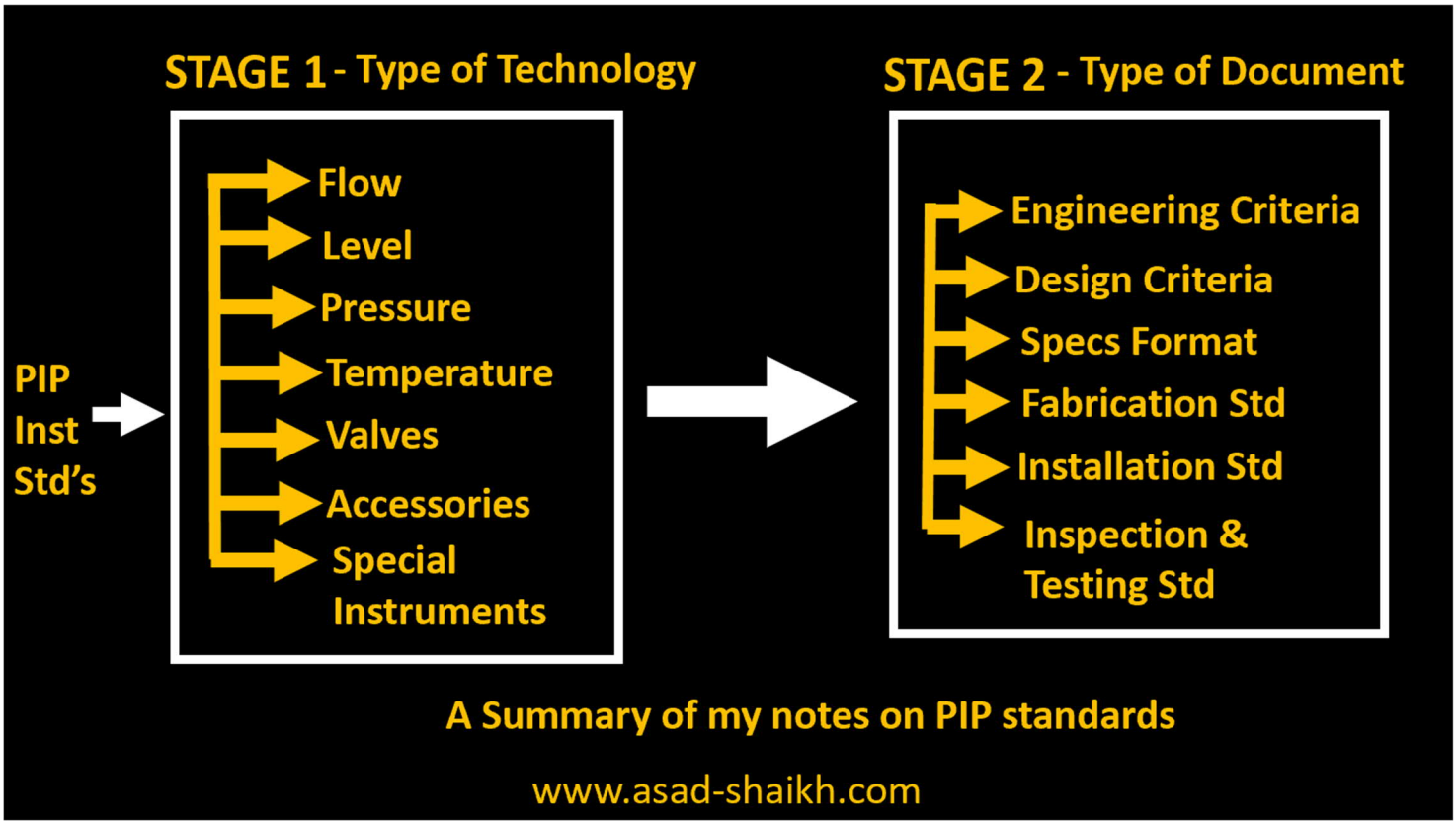
Thus, we can conclude the summary of my notes on PIP standards.

These standards are initially segregated as per type of technology and is termed as Stage 1

Then these technologies are further divided as per their applicability with regards to the life of the instrument termed as stage 2.

Hope you have found my notes on PIP standards useful.

And you can take this further and develop into a segregation style that meets your taste!!



Smile & Knowledge have something in common

Finally, I would love to share a few thoughts that had a profound impact on my life.

You would know smile is contagious but it is lesser know that same is the case with knowledge.

It is said that the best way to gain a smile from some is to ourselves smile.

Since the response of a smile, 99% of the time is always a smile in return 😊

Similarly, Others will share their knowledge with you only if you are willing to share what you know.

I am trying my part to share what I am learning through this exciting journey of life.

And, If you have found this guide useful then you could share this with others and they will share what knowledge sources they have with you.

Don’t be a Knowledge Hoarder, share with the world and make it a better place.

I have never seen a hoarder having a fantastic life

However, I have personally seen “Givers” having a wonderful life and I would wish the same for you.

And you could use this in all areas of your life!!

Instead of thinking “What my employer/ my wife /my parents should do for me?”

What if we have the following approach.

“**What can I do for my employer / my wife / my parents?”**

It seems to be a small change in attitude but the results that I have experience have been fabulous so far…….

So with all love and respect I would encourage you to keep learning and keep sharing!

Yes you are free to share this guide on LinkedIn, e-mails etc and any other place you like and keep it for FREE also, I would appreciate if you could share a little link to my website (www.asad-shaikh.com) and provide credits for these humble efforts…… 😊

Free Gift

Your Time is precious, and I appreciate you sharing some of it with me to read this guide.

I hope this guide has provided value to you.

I guess you would be having a desire to learn more and grow?

Then know that you are not alone on this journey!

Together we are a community of passionate I&C engineers from **250+** companies around the world (which includes the likes of DOW chemicals, Bechtel, Fluor, Worley, Technip, Emerson, ABB, Yokogawa)

We can share the knowledge sources and what we know with each other so that we can collectively have a fabulous career ahead.

If you have found this e-book valuable then the **below link** contains a bunch of **FREE E-books**, **Guides**, **Whitepapers**, **Courses** just for you.

(Free courses on emerging technologies like green hydrogen, Process flow diagrams, Instrumentation engineering technology etc.)

https://www.asad-shaikh.com/learning.html

Also, if you are aware of any valuable sources of knowledge then do share with us. 😊 https://www.asad-shaikh.com/contact.html

Thank you without you this book would never exist

Firstly, I am grateful to **God** for had it not been for the blessing of good health, financial stability and supportive family it would not have been possible to keep up with the efforts and re-search required to produce this book.

I have been very blessed to be part of a **company** that has inculcated in us the values that safety and quality is everyone's business and sharing knowledge about safety & quality would bring about nothing but good.

Also, I am very grateful to all **my mentors** who have helped me in this incredible journey of exploring Instrumentation engineering.

I would try to name a few of my mentors; however, this is a long list and I apologize if I have erred and missed any of my mentors. In case I have missed you (My mentor). Then you have full right to pull my ear and remind me about it 😊

It's been a lot of years but the memories are still fresh of my first mentor **Mr. Rajesh Shah** for spending hours on a stretch teaching me Instrumentation concepts when I knew nothing much about instrumentation and was just an intern with him having almost nothing to offer back for his efforts.

It was through him I learnt about the power to help people without expecting anything in return!!

Manish Mehta for trusting me and selecting via campus placement in one of the most amazing company to work “Jacobs” now Worley.

Nitesh Kshirsagar for forgiving my mistakes when I stumbled as a trainee engineer and yet giving me challenging responsibilities.

Satish Sohani who would answer the silliest of my questions and for his constant encouragement by calling me a “chota (little) scientist”.

Asif Mulla for his priceless advice during the years on maintaining a “learning” attitude and how Instrumentation standards play a critical role in career development.

Mick Vermeer from Netherlands to share his huge treasure of technical expertise.

Manash Jena for spending hours of his precious time explaining engineering concepts to me.

Prabha Verma for teaching the procedure to access IHS Portal for learning engineering standards. without knowing about IHS my journey to learn engineering standards would just not start in the first place.

Chetan Mhatre for teaching and clarifying the concepts about control valve and other instrumentation topics.

Chetan Shenvi for appreciating my little efforts on my first e-book on diaphragm seals and for the ASME B16.5 tool created by me.

It was these kind words of encouragement that enabled me to persevere and produce this little e-book on instrumentation PIP standards.

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