Co-operative Education Report

Detailed Engineering for Oil Refinery Plant

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Cooperative Title: Detailed Engineering for Oil Refinery Plant

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ABSTRACT

This Co-operative Education project is written to explain about detail of the design of Instrument Datasheet for Material Requisition of instruments that is used in oil refinery plant. This project describes the process of operation, consist of: Study of relevant and necessary information for oil refinery plant , Preparation of detail for Instrument Datasheet , Preparing Material Requisition document and also do a Review Vendor Quotation.

Keywords: Instrument Datasheet , Material Requisition , Review Vendor Quotation

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The author

Thanaporn Namsongkram

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CHAPTER 1

INTRODUCTION

1.1 Background

Foster Wheeler (Thailand) Limited is an engineering company that provides engineering services for Basic Engineering Design (BED), Front End Engineering Design (FEED), Engineering Procurement and Construction management (EPCm) and Project Consultant Management (PMC) in an industrial like Oil & Gas, Refinery and Petrochemicals.

Foster Wheeler (Thailand) Limited is hired to be a contractor for an oil refinery. Now the project is in EPC phase which is to make a responsibility for design, procurement, construction and commissioning.

The thesis is written to present the operation of EPC phase of Instrumentation Engineer for an oil refinery, the study of instruments, the process of doing instrument datasheet and the document preparing for material requisition.

1.2 Objective

1. To prepare necessary detail for instrument datasheet
2. To create instrument datasheet
3. To prepare material requisition document
4. To create DCS Typical Control Loop Drawing Document
5. To review vendor quotation

1.3 Scope of Project

1. Preparing necessary details for instrument datasheet.
2. Create instrument datasheet using SmartPlant Instrumentation Software
3. Create DCS Typical Control Loop Drawing Document using Microsoft Visio
4. Preparing material requisition document
5. Review vendor quotation

1.4 Process

1. Study about organization's structure and the operation of instrument engineer for the project.
2. Study about P&ID legend sheet, temperature instrument and pressure transmitter.
3. Study about control loop characteristics

4. Study about design requirements for instruments.

5. Preparing necessary details of instrument for instrument datasheet.

6. Create instrument datasheet for temperature instrument and pressure transmitter.

7. Create DCS Typical control Loop Drawing Document.

8. Preparing material requisition document for pressure transmitter.

9. Review vendor document for differential pressure flow transmitter.

Table 1.1: Plan Schedule

Sequence	Operation Plan	August				September				October				November			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Prepare material requisition for temperature instrument (including necessary detail for datasheet and create datasheet)																
2	Prepare material requisition for electronic transmitter (including necessary detail for datasheet and create datasheet)																
3	Prepare DCS Typical Control Loop Drawing																
4	Review vendor quotation for electronic transmitter																

1.5 Expected Outcomes

1. Gaining experience with real work about Engineering Procurement and Construction.

2. Getting more understanding of field instrument and its application.

3. Get to know how to design instrument suitable specification for the process.

4. Be able to learn how to use several software such as Microsoft Excel, Microsoft Visio, and SmartPlant Instrumentation.

CHAPTER 2

RELATED THEORY AND KNOWLEDGE

2.1 Project Life Cycle

Project Life Cycle is the sequence of phases that the project operates from the beginning to the end of the project. The number and order of the cycles are determined by management and other factors such as the needs of the organizations involved in the project, project specification and area of use.

For the operation of project under the responsibility of Foster Wheeler (Thailand) Limited can explain by the figure below:

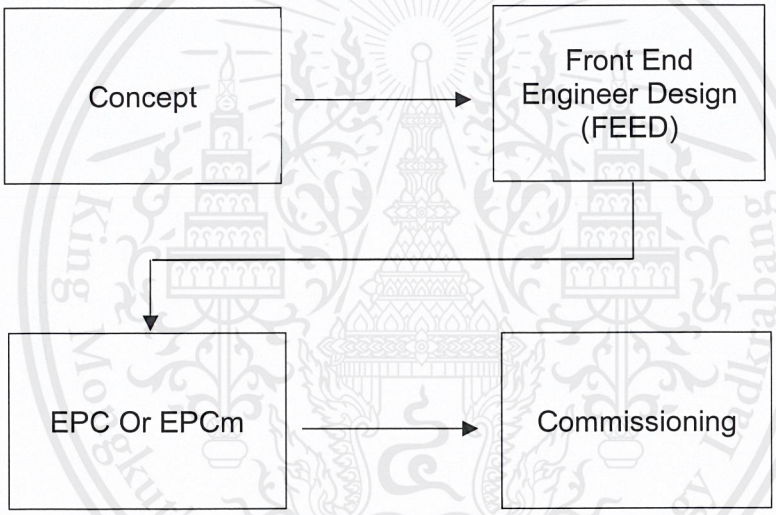


Figure 2.1: Project Life Cycle

Concept: The concept is what customer wants to do. It can be to build up the new refinery or improve the old one to get more quality products.

FEED: FEED stands for Front End Engineering Design. The FEED is basic engineering which comes after the Conceptual design or Feasibility study. The FEED design focuses the technical requirements as well as rough investment cost for the project. The FEED can be divided into separate packages covering different portions of the project. The FEED package is used as the basis for bidding the Execution Phase Contracts (EPC, EPCI, etc) and is used as the design basis.

EPC: EPC is a particular form of contracting arrangement used in some industries where the EPC contractor is made responsible for all the activities

from design, procurement, construction, commissioning and handover of the project to the end-user or owner.

EPCm: Stands for Engineering, Procurement, and Construction Management. The difference between an EPC and an EPCm is an EPCm's duty is just to manage all the activities but has no right in a procurement section of the project.

Commissioning: Commissioning is the activities performed in getting processes running to establish normal operation. As part of these activities, it includes process verification and documenting that the facility and all its system components and assemblies are designed, installed, tested and operated to meet the project requirement of individual units and systems. The Commissioning activity consists of checking and testing all functions according to their design parameters in conditions as close as possible to the design conditions, and includes performance tests on mechanical equipment, water washing, flushing and drying of equipment and piping as well as control systems operability and functionality.

2.2 Workflow

In every kind of business or industry has a sequence, that sequence we call "Workflow". Workflows are the paths that describe how something goes from being undone to done, or raw to processed. This workflow describes the briefly work for EPC and Commissioning phase.

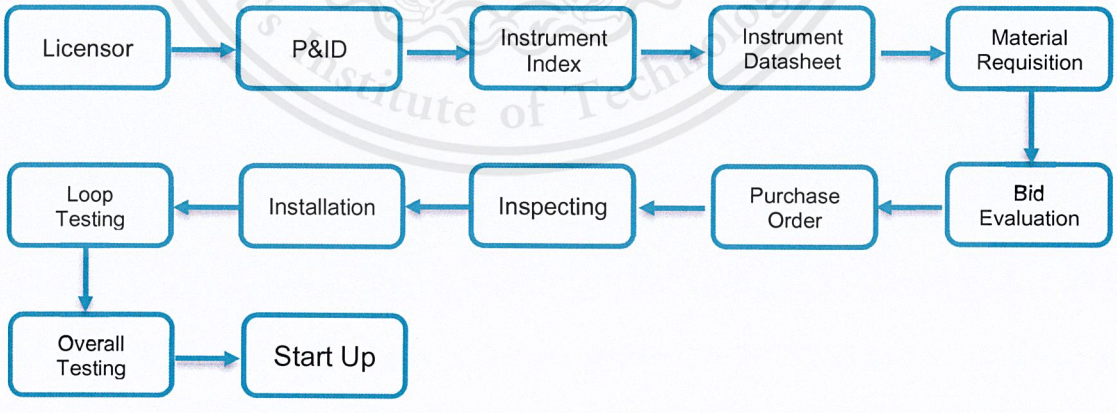


Figure 2.2: Instrument Engineer Workflow

Licensor: Licensor will give us a licensed process design package which is usually in a form of Process Flow Diagram (PFD). The PFD presents the process flow or

transfer system through equipment and does not show much on details. The PFD is used for the basis of equipment datasheet, P&ID.

P&ID: P&ID is a schematic representation of the equipment, instrument, piping, and any miscellaneous items, with corresponding design data of a processing unit, utility system and offsite system serving a processing unit used to document the design basis and provide key process information to the other disciplines. The P&ID allows the design to progress from the Process Flow Diagram (PFD) with the standard numbering systems that facilitates the design process, manufacture, or construct and communicate information to the Client and all involved disciplines.

Instrument Index: Instrument Index is a document containing list of instrument devices within a plant. The Instrument Index includes description and complete listing by tag numbers, installation and procurement information as well as loop drawing number and field installation details. The Instrument Index is the responsibility of the Control Systems and Instrumentation group.

Instrument Datasheet: Instrument Datasheet is a document containing specification and information of an instrument device. It specifies general information of instrument such as tag number identification, service description, location (line number/equipment number), P&ID number or drawing number reference, process data (if applicable), calibrated range (if applicable), material, performance details (such as accuracy, linearity – if applicable), hazardous certification (for electrical device), accessories required, etc. The details of information in data sheet may differ among each types of instrument such as transmitter, switch, gauge, control valves.

Material Requisition: Material Requisition is a procurement document prepared and developed by engineering disciplines that uses to request materials for technical supplying or manufacturing requirements: data sheet, quantity, applicable code and specifications, etc.

Bid Evaluation: Bid Evaluation is an evaluation work process to select the successful supplier or contractor (or subcontractor) among proposed bidders in accordance with bid evaluation criteria. The Bid Evaluation consists of a Commercial Bid Evaluation (CBE) and Technical Bid Evaluation (TBE).

Purchase Order: Purchase Order is a type of agreements for the acquisition of materials, equipment, or services that is a procurement contract issued by a buyer to a seller. A PO document includes both party signatures, dates including key milestones,

a purchasing specification, description of purchasing goods or services, a quantity and quality, performance, delivery timing, prices, payment conditions, and a general and special terms and conditions.

Inspecting: Inspecting is the act of measuring something carefully involving examining, testing, and gauging materials or equipment in accordance with the procedure and specifications to ensure its conformance with specific requirements. This may be performed visually or with special tools or equipment.

Installation: Installation is to put or install equipment or material at the permanent position, or make ready to use, or ready for operation.

Loop Testing / Overall Testing is the determination or verification of the capability of an item confirms the specified requirements and the acceptability for further work or activity proceeding. The Test is an examination, assessment or evaluation to check, measure and find out the ability, capability, suitability of the specific requirements, quality performance of work and the reliability of work process.

Start Up is the plant operation activities that commences on the date of initial operation after achieved the construction works and commissioning activities and continues until the acceptable production capacity and quality are achieved (commercial operation start).

2.3 Piping & Instrumentation Diagram (P&ID)

2.3.1 General Information of P&ID

Piping and Instrumentation Diagram (P&ID) is a schematic illustration of functional relationship of piping, instrumentation and system that uses specific symbols to show the connectivity of equipment, sensors, and valves in a control system. These symbols can represent actuators, sensors, and controllers. P&IDs provide more detail than a process flow diagram (PFD) with the exception of the parameters, i.e. temperature, pressure, and flow values. It includes major and minor flows, control loops and instrumentation. P&IDs are used by process technicians and instrument and electrical, mechanical, safety, and engineering personnel. P&IDs play a significant role in the maintenance and modification of the process that it describes. During the design stage, the P&ID also provides the basis for the development of system control schemes. The standard notation, varying from letters to figures, is important for

engineers to understand because it a common language used for discussing plants in the industrial world.

There are many standards used to draw P&ID. But the commonly used standards are 4 following standards:

1. DIN (German Industrial Standard)

2. JIS (Japanese Industrial Standards)

3. ISA (Instrument symbols and identification)

4. PIP (Process Industry Practices)

In this oil refinery project uses ISA standard to draw P&ID. In order to have a consistent understanding of designers and users. In the diagram, there is a document called the Legend Sheet. This document is used to display the symbols of equipment used in the plant and various explanations that would be shown on P&ID.

2.3.2 P&ID Symbols

The following symbols used in this oil refinery project. These symbols are contained in P&ID Legend sheet.

1. Pipeline Symbol

A pipe is a tube that transports fluid substances. Piping can be made of various materials, including metal and plastic. The piping group is made up of one-to-many pipes, multi-line pipes, separators, and other types of piping devices.

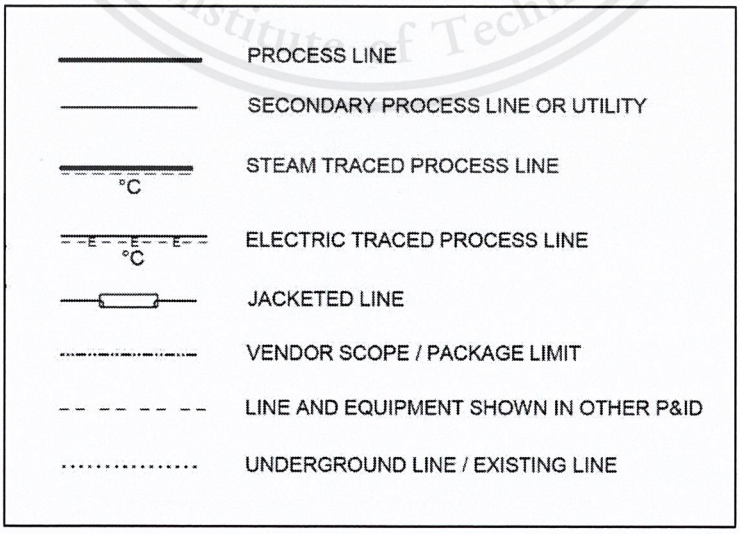


Figure 2.3: Pipeline Symbol

The pipelines are the lines where the process media flows through. They are represented by different types of lines. On a complete P&ID each line will be labelled with a line number.

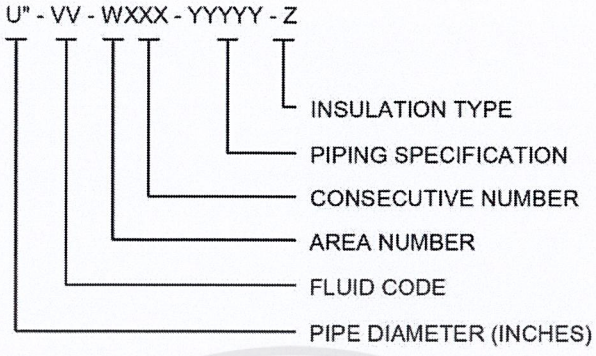


Figure 2.4: Line number or Line identification

2. Vessel

A vessel is a container that is used to store fluid. It may also alter the characteristics of the fluid during storage. The vessels category includes tanks, cylinders, columns, bags, and other vessels.

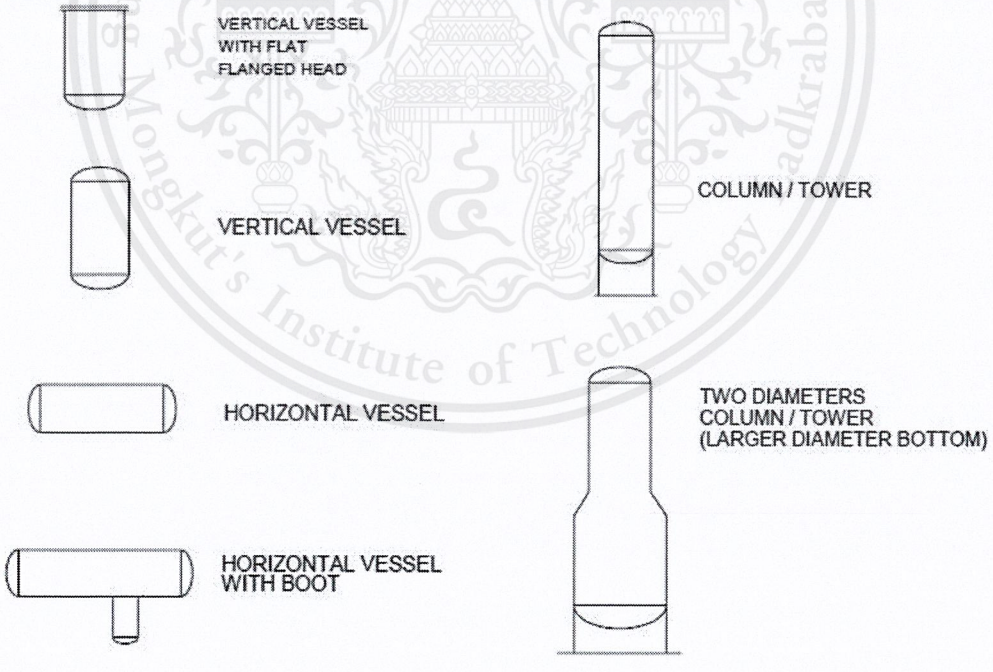


Figure 2.5: Vessel Symbol

3. Valves

A valve regulates, directs, or controls the flow of a fluid by opening, closing, or partially obstructing passageways in a piping system. This category includes rotameters, orifices, and other types of valves.

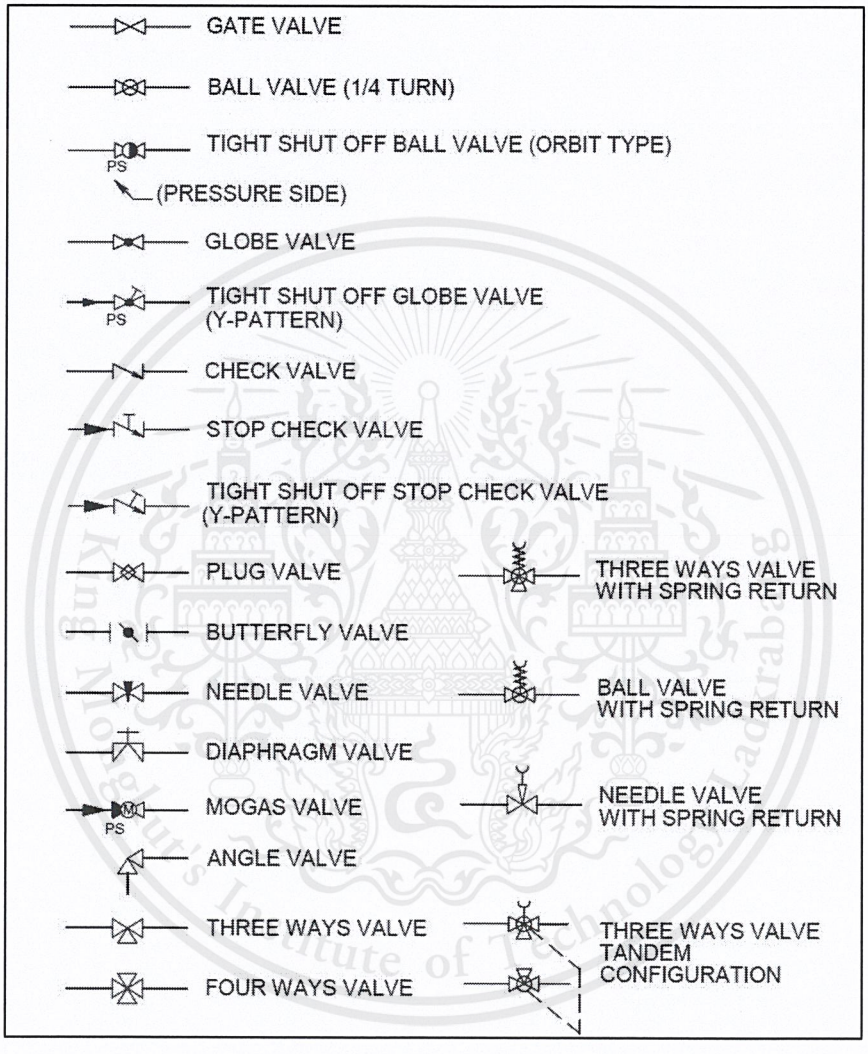


Figure 2.6: Valve Symbol

4. General Instrument or Function Symbol

An instrument is a device that measures—and sometimes controls—quantities such as flow, temperature, angle, or pressure. The instruments group houses indicators, transmitters, recordings, controllers, and elements.

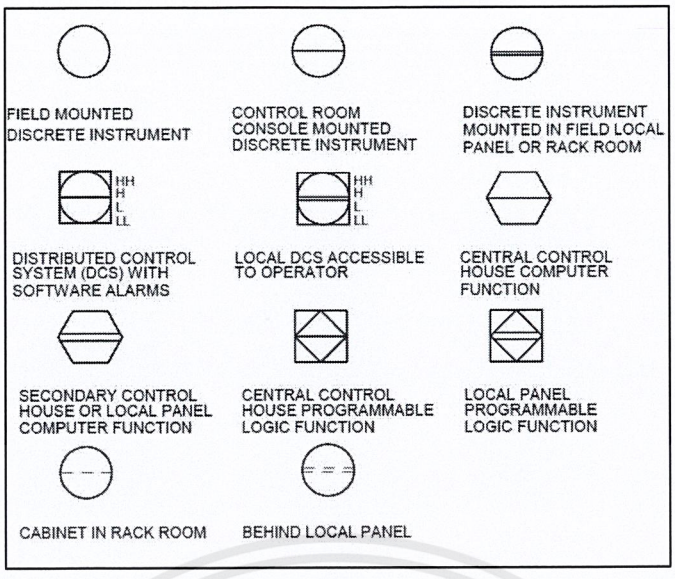


Figure 2.7: Function Symbol

Tag Number

An Instrument number or tag has two parts which is combination of letter and number.

- Identification letter for indicating the function and purpose of use.
- An individual tag number/Loop No./serial number.

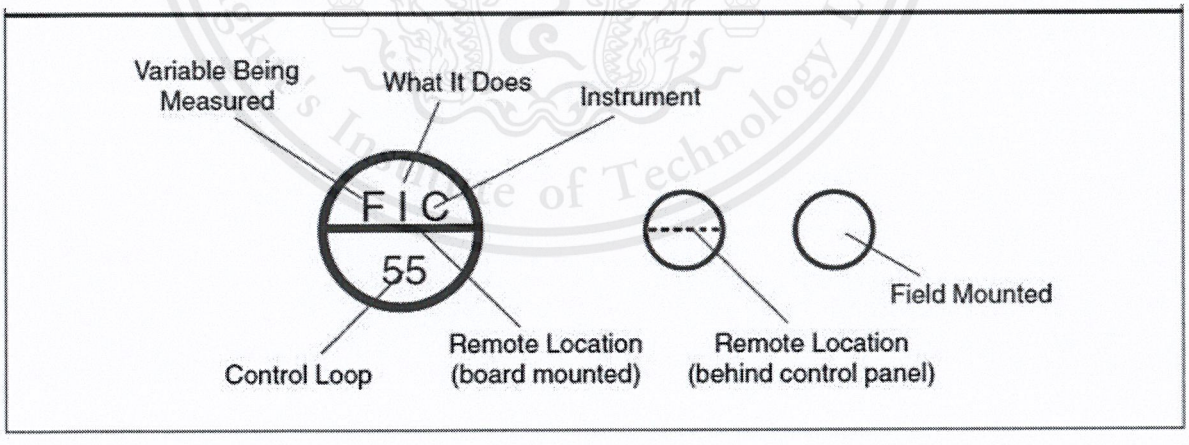


Figure 2.8: Tag Number Description

Letter is used to classify the instrument by its function and number is used to identify the loop/interlock. Identification letters on the ISA symbols indicate:

- The variable being measured (e.g. flow, pressure, temperature).
- The device's function (e.g., transmitter, switch, valve, sensor, indicator).
- Some modifiers (e.g., high, low, multifunction).

In the instrument tag number in above figure the initial letter indicates the measured variable. The second letter indicates a modifier, readout, or device function. The third letter usually indicates either a device function or a modifier.

	MEASURED VARIABLE	MODIFIER	READ OUT	DEVICE FUNCTION	MODIFIER
A	Analysis		Alarm		
B	Burner, Combustion		User's choice	User's choice	User's choice
C	User's choice			Control	
D	User's choice		Differential		
E	Voltage		Sensor (Primary element)		
F	Flow rate	Ratio (Fraction)			
G	User's choice		Glass, viewing device		
H	Hand				High
I	Electrical Current		Indication		
J	Power	Scan			
K	Time, time schedule	Time rate of change		Control station	
L	Level		Light		Low
M	User's choice	Momentary			Middle, intermediate
N	User's choice	User's choice	User's choice	User's choice	User's choice
O	User's choice		Orifice, restriction		
P	Pressure, vacuum		Pressure, vacuum Point, test connection		
Q	Quantity	Integrate, totalizer			
R	Radiation		Record		
S	Speed, frequency	Safety		Switch	
T	Temperature			Transmit	
U	Multivariable		Multifunction	Multifunction	Multifunction
V	Vibration, Mechanical analysis			Valve, damper, louver	
W	Weight, force		Well		
X	Unclassified	X axis	Unclassified	Unclassified	Unclassified
Y	Event, state, or presence	Y axis		Relay, compute, convert	
Z	Position, dimension	Z axis		Driver, actuator	

Figure 2.9: Functional Identification

5. Signals

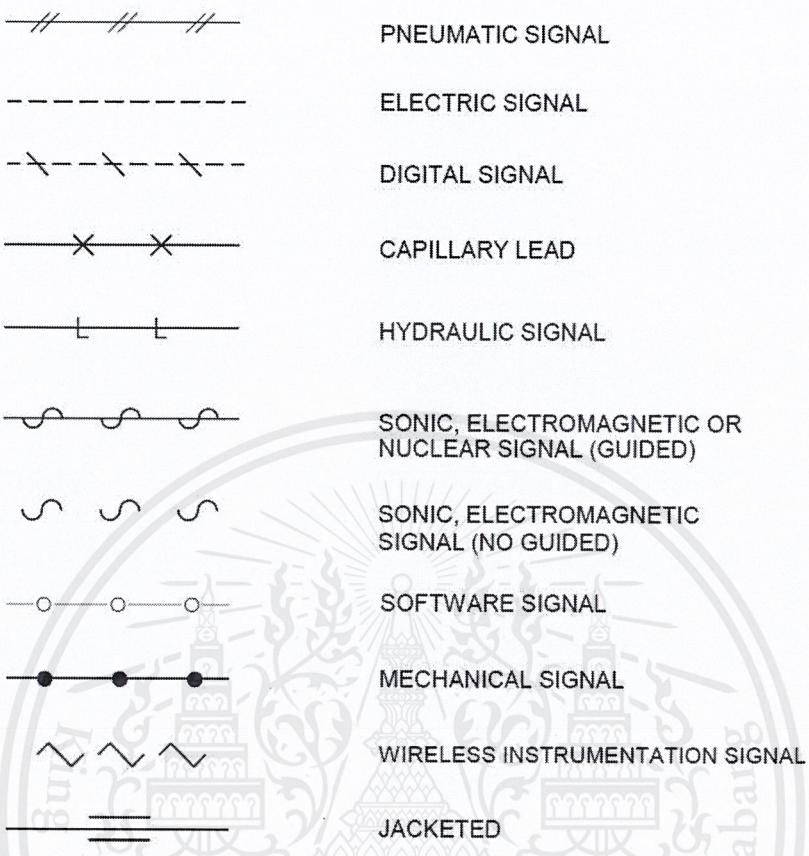


Figure 2.10: Signal Types

2.4 Hazardous Area – Explosive Atmosphere

An explosive atmosphere results from a mixture of inflammable substances in the form of gas, vapor, mist or dust with air in such proportions that excessive temperature, an electrical arc, spark or any other energy ignition source produces an explosion.

In the creation of an explosion, it needs three components:

1.Oxygen in the air

2.An inflammable substance, mixed with air. This substance can be gas (methane, acetylene), liquid (petrol, solvent), solid (Sulphur, wood dust, sugar dust, grains dust...)

3.An ignition source with sufficient energy, an electrical arc or a spark, and/or a rise in temperature

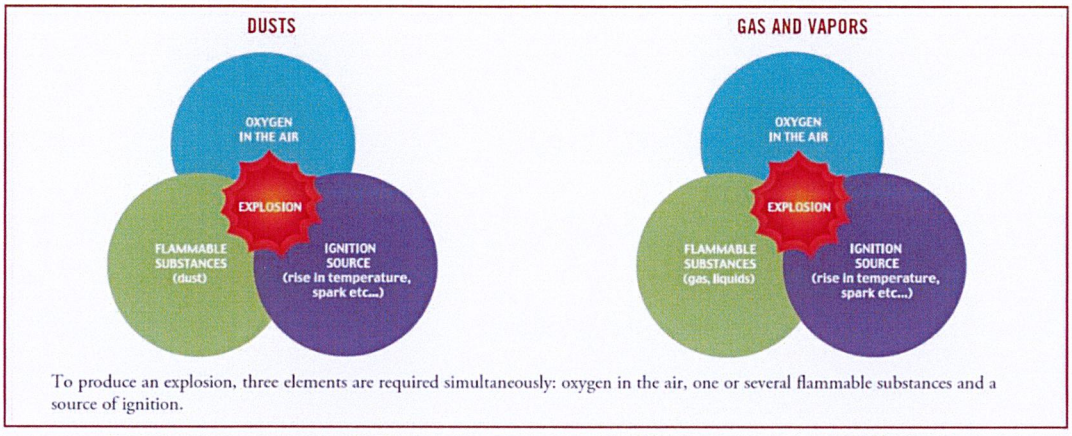


Figure 2.11: Explosive Atmosphere

The worldwide electrotechnical standard for electrical apparatus for explosive atmosphere is covered by two major standards including:

1.IEC/ATEX/CENELEC (common standard following agreement in 1991 on procedures for developing standards)

IEC: International Electrotechnical Commission

ATEX: Atmosphere Explosible

CENELEC: European committee of Electrotechnical Standard

2.NEC, CEC (products approved by UL, FM, CSA...)

NEC: National Electrical Code

CEC: Canadian Electrical code

Products which conform to IEC/ATEX/CENELEC or NEC standards have identical protection, even though they are designed differently to meet the specific installation regulations.

2.4.1 Zone classification

There are three types of Zone:

ZONE 0 – 20

Zone that an explosive mixture of gas, vapor or dust is continuously present or for long periods (over 1000 hours per year or > 10% of the time). The gaseous phase inside a receptacle or a closed-off chamber constitutes a Zone “0”.

ZONE 1 – 21

Zone that an explosive mixture of gas, vapor or dust is likely to occur during normal operation (10-1000 hours per year or 0.1 to 10 % of the time).

ZONE 2 – 22

Zone that an explosive mixture is not likely to occur in normal operation, and if it occurs will only exist a short time (leaks or negligent use).(under 10 hours per year or 0-0.1% of the time.)

Table 2.1: Zone Classification

Zone (IEC Standard)		NEC Standard
Gases & Vapours	Dust	
Zone 0	Zone 20	Division 1
Zone 1	Zone 21	Division 1
Zone 2	Zone 22	Division 2

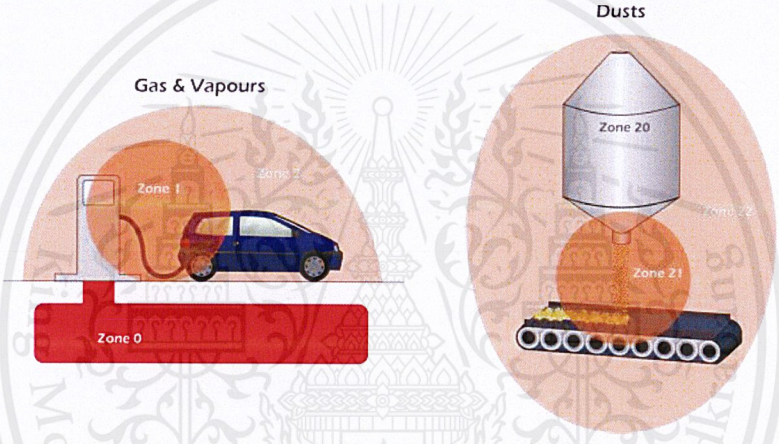


Figure 2.12: Zone Classification

2.4.2 Temperature Classification

Temperature classification (also known as temperature class, or T class) defines the maximum surface temperature that a product destined for use in a potentially hazardous atmosphere can operate at, relative to an ambient temperature of -20°C to +40°C.

All flammable gases have an auto-ignition temperature. If a flammable mixture of the gas is exposed to a component above the auto-ignition temperature, then the mixture will ignite. Therefore, when selecting equipment, the Temperature class must be below the auto-ignition temperature of the potentially explosive atmosphere where it will be installed. If several different flammable materials may be present within an area, the material that gives the lowest auto ignition temperature dictates the overall area classification, and hence T-class.

Table 2.2: Temperature Classification

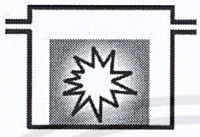
Temperature in °C	Classification	
	IEC	NEC (NORTH AMERICA)
450	T1	T1
300	T2	T2
280		T2A
260		T2B
230		T2C
215		T2D
200	T3	T3
180		T3A
165		T3B
160		T3C
135	T4	T4
120		T4A
100	T5	T5
85	T6	T6

2.4.3 Types of Protection to electrical apparatus

It applies to all types of protection where parts that are in unhindered contact with the explosive atmosphere are not permitted to reach unacceptably high temperatures.

Considering both the environmental temperature and the heating effect, the temperature may attain maximum values which corresponds to the temperature class or the permissible surface temperature specified for flammable dusts in accordance with which the explosive atmosphere has been classified.

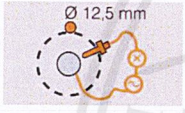
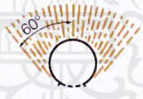
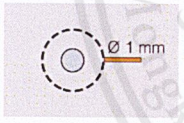
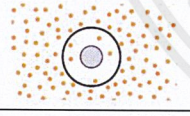
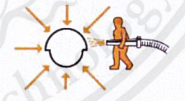
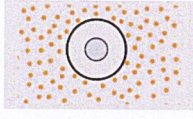
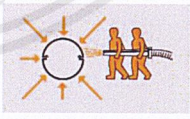
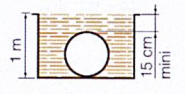
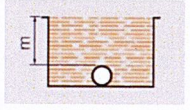
Table 2.3: Type of Protection to electrical apparatus

Concept	Symbol	Icon	Description	EN Standard
Increased Safety	Ex e		Design excludes the possible of incendive arcs, sparks or hot surfaces	EN 60079-7
Encapsulation	Ex ma Ex mb Ex mc		Flammable gas excluded by encapsulating the ignition source in resin	EN 60079-18
Flameproof	Ex d		Ignition within the apparatus enclosure is contained and will not ignite surrounding explosive atmosphere	EN 60079-1
Intrinsic Safety	Ex ia Ex ib Ex ic		Energy in circuit and temperature on components reduced to a safe level	EN 60079-11
Oil Immersion	Ex o		Explosive gas excluded by immersing ignition source in oil	EN 60079-6
Powder Filling	Ex q		Explosive gas excluded by immersing ignition source in sand	EN 60079-5
pressurization	Ex p		Explosive gas excluded by surrounding ignition source with pressurized inert gas	EN 60079-2
Non-incendive	Ex n		Will not ignite explosive gas in normal operation, faults unlikely to occur	EN 60079-15

2.4.4 Protection Indexes for Electrical Enclosures

The IEC IP classification system designates the degree of protection provided by an enclosure against impact and/or water or dust penetration (ingress). It has two numbers: first—protection against solid objects, second—protection against liquid.

Table 2.4: Protection Indexes for Electrical Enclosures

1ST FIGURE: PROTECTION AGAINST SOLID BODIES			2ND FIGURE: PROTECTION AGAINST LIQUID		
IP	TEST		IP	TEST	
0		No protection	0		No protection
1		Protected against solid bodies larger than 50 mm (e.g. accidental contact with the hand)	1		Protected against vertically-falling drops of water (condensation)
2		Protected against solid bodies larger than 12.5 mm (e.g. finger of the hand)	2		Protected against drops of water falling at up to 15° from the vertical
3		Protected against solid bodies larger than 2.5 mm (tools, wires)	3		Protected against projections of water from all directions
4		Protection against solid bodies larger than 1 mm (fine tools, small wires)	4		Protected against jets of water from all directions
5		Protected against dust (no harmful deposit)	5		Protected against jets of water from all directions
6		Completely protected	6		Completely protected against jets of water of similar force to heavy seas
			7		Protected against the effects of temporary immersion
			8		Protected against effects of prolonged immersion under specified conditions

2.5 Temperature Instrument in Project

There are many types of temperature measuring instruments. Each instrument is based on the principle of changing the specific properties of the substance, which must be changed when the temperature has changed. In this section, we will discuss temperature instruments found in this project.

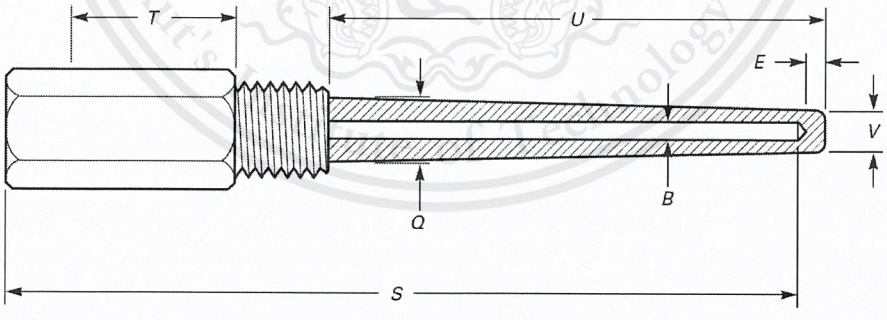
2.5.1 Thermowell

Thermowells are used to guard temperature sensors such as thermocouples, thermistors and bimetal thermometers against damage from excessive pressure, material velocity and corrosion. They also increase the longevity of the sensor, allow sensor replacement without draining the system and reduce the probability of contamination. The wells are secured by threads, flange, or welds. Thermowell that is designed for high pressure applications are typically machined from bar stock to ensure integrity. Smaller thermowells for use in low pressure environments may be constructed from tubing with one end welded closed.

In addition, in pipelines, thermowell is facing stresses and strains produced by process flow. In order to reduce the effect on response time and mechanical stresses and forces on the thermowell, it is proper to reduce the thermowell tip as much as possible.

ASME B40.200-2008 (B40.9)

Fig. 1 Standard Dimensions



Symbols	Dimension
B	Bore diameter
E	Tip thickness
Q	Base diameter
S	Bore depth
T	Lagging extension
U	Insertion length
V	Tip diameter

Figure 2.13: Thermowell Dimension

In order to reduce time lag and errors of measurement, thermowell tip should be located at middle third of pipeline. It means that thermowell "U Length" should be calculated considering pipe diameter, pipe thickness and nozzle height. Nozzle height is generally provided by Piping Engineer in piping installation detail drawing document.

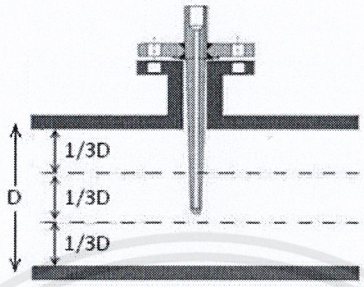


Figure 2.14: Thermowell Installation Length

Thermowells may be made out of any material that is thermally conductive, pressure-tight, and not chemically reactive with the process. Most thermowells are formed out of either metal (stainless steel or another alloy) or ceramic materials.

2.5.2 Thermocouple

A Thermocouple is a sensor used to measure temperature. An ordinary thermocouple consists of two different kinds of wires, each of which must be made of a homogeneous metal or alloy. The wires are fastened together at one end to form a measuring junction, normally referred to as the hot junction, since a majority of the measurements are made above ambient temperatures. The free ends of the two wires are connected to the measuring instrument to form a closed path in which current can flow. After the thermocouple wires connect to the measuring instrument, the junction inside is designated as reference junction, or the cold junction.

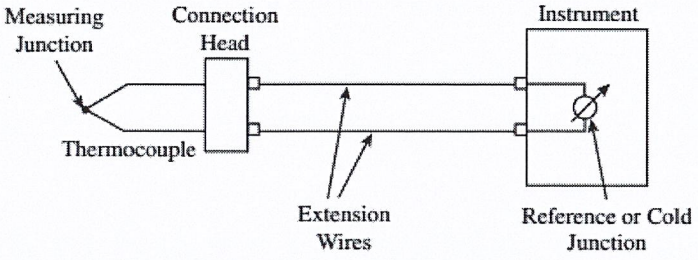


Figure 2.15: Thermocouple Terminology

Types of Thermocouple

There are many types of thermowell used. The type can be considered by the combination of metals

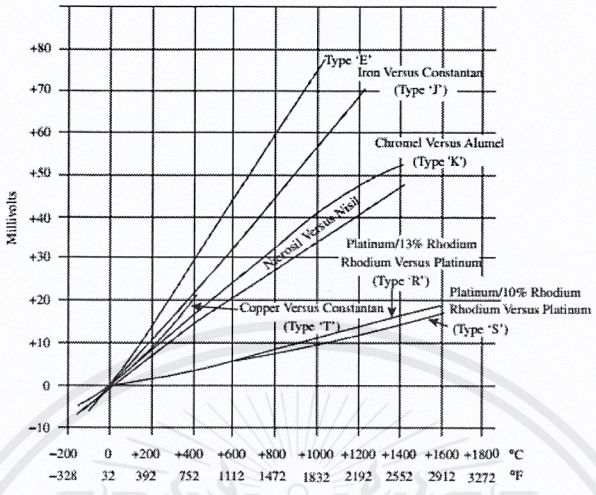


Figure 2.16: The millivoltage generated by thermocouples varies with wire materials and is a nonlinear function of temperature.

Table 2.5: Types of Thermocouple

Type	Description
J	Iron-constantan can be used in reducing atmospheres. This thermocouple provides a very nearly linear EMF output. This type is suitable using at temperature that is not exceed 760 °C and not lower than 0 °C. It is commonly used in plastic industry and is the least expensive commercially available type.
S	The platinum-platinum 90%/rhodium 10% thermocouple. It is used to define the International Temperature Scale between 630.5°C, the point at which antimony freezes, and 1063°C, the gold point. This thermocouple is not limited to the above range. It can be used from about 150 to 1768°C with excellent results. Industrial thermocouples of this material will match the standard calibration curve to better than ±0.25%.
T	Copper-constantan thermocouple can be used in either oxidizing or reducing atmospheres. The thermocouples of this type exhibit a high resistance to corrosion from moisture, provide a relatively linear EMF output, and are good from the medium to the very low temperature range such as measuring in cold storage and freezer. This type is not suitable for the work that is exposed directly to thermal radiation.
R, B	Several other thermocouples are commonly used including platinum-platinum 13% rhodium (type R) and platinum 30% rhodium-platinum 6% rhodium (type B),

	which are recommended for use in oxidizing atmospheres. They are relatively easily contaminated in other atmospheres.
K	Chromel - alumel thermocouple can be used in oxidizing atmospheres. It is the most linear thermocouple in general use. It can measure temperature better than type J , more inexpensive and withstands temperature up to 1300 °C and at temperature as low as -250 °C. Moreover, it provides the most linear EMF output among other types. This type can use in thermal radiation application and not suitable for vacuum atmosphere. (Exclusive of short time.)
E	Chromel-constantan (type E) TCs provide the highest EMF per degree of temperature change. However, it also tends to drift more than the others. It can be used in oxidizing atmospheres.
N	A relatively new base-metal thermocouple is designated type N (Nicrosil vs. Nisil). It provides stability as good as the more expensive noble metal thermocouples up to about 1204°C , where type K starts to become unstable. The stability of type N thermocouple is due to increased percentages of chromium, silicon, and magnesium.

2.5.3 Temperature Transmitter

A temperature transmitter is a device that connects to a temperature sensor to transmit the signal elsewhere for monitoring and control purposes. Typically, the temperature sensor is either an RTD, Thermistor or Thermocouple type sensor and will interface with a PLC, DCS, data logger or display hardware.

The temperature transmitter's role is to isolate the temperature signal, filter any EMC noise, amplify and convert the temperature sensor's signal to a 4-20mA or 0-10V DC range for further use.

The 4-20ma temperature transmitters are common in manufacturing as the majority of industrial equipment communicates via this signal range. The transmitted temperature signal can be scaled inside the temperature transmitter to accommodate the needs of the application, e.g. the 4mA can be used to represent -17.7°C (0° Fahrenheit) and the highest value in the range (20mA) can be used to represent 37.7° C (100° Fahrenheit)

Figure 2.17: Temperature Transmitter

2.5.4 Bimetallic Thermometer

Bimetallic Thermometer uses the bimetallic strip which converts the temperature into the mechanical displacement. The working of the bimetallic strip depends on the thermal expansion property of the metal. The thermal expansion is the tendency of metal in which the volume of metal changes with the variation in temperature.

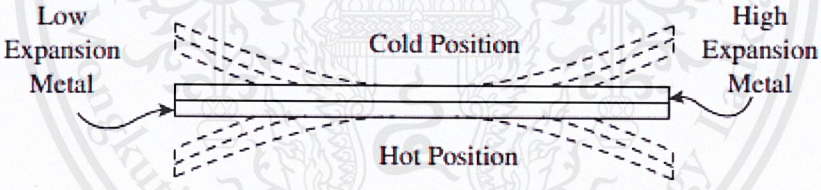


Figure 2.18: The operation of bimetallic strip

Most industrial or residential bimetal thermometers use a helical coil which can be designed to fit into a stem more easily than the spiral. The element is surrounded by a protecting tube or thermowell. The device can be mounted to measure the temperature of the gas or liquid inside a duct. The design is frequently used on domestic furnaces and over the years has replaced most of the glass stem thermometers used earlier.

The advantages over glass stem thermometers include that the bimetallic design is less likely to break and is easier to read. Relative to the filled or electronic temperature indicators, the main advantages of bimetallic thermometers are their lower cost and simplicity. Disadvantages include that the calibration of

bimetallic thermometers can change due to rough handling and that the overall accuracy is not as good as that of the glass stem design. The bimetallic thermometers are generally confined to local measurement.

2.6 Electronics Transmitter in Project

A transmitter is a device that translates physical input to an electric signal. A transmitter is connected to sensing element for each application that needs to use its output to control system or just to indicate the value. In this section, the author is written about a transmitter used in the project for pressure and flow media.

2.6.1 Pressure Transmitter

Pressure transmitters are devices that convert low-level electrical outputs from pressure-sensing elements to higher level signals that can be transmitted over a long distance for further processing and use in various systems.

The most common type of sensing element uses a diaphragm, piston, bourdon tube, or bellows to sense the physical force.

2.6.2 Differential Pressure Flow Transmitter

Differential pressure flow transmitter is one of three essential elements for differential pressure flowmeter. Three essential elements are required to engineer a differential pressure flow meter. The primary element creates a pressure drop across the flow meter by introducing a restriction in the pipe, and this engineered restriction enables Bernoulli's equation to be used for a flow rate calculation. There are many types of primary element such as orifice plate, venturi tube, nozzle etc.

The pressure drop is measured by a secondary element, a differential pressure transmitter, while tertiary elements consist of everything else within the system, such as impulse piping and connectors. Differential pressure flowmeters can be used as liquid flowmeters or gas flowmeters; however, a single flow meter may not be configured to measure both liquid and gas phases.

2.6.3 Components of Pressure Transmitter

In this section can separate transmitter components into two group, wetted and non-wetted, which is depends on if they connect directly with the process or not.

1.Wetted components

Wetted component consists of process isolating diaphragm, drain/vent valves, process flange and O-ring. Material selection of wetted components depends on the process detail such as the operating pressure, temperature, and process fluid. This section guidelines how to use the detail to select suitable material for wetted components.

1.1 Process isolating diaphragm

The process isolating diaphragm separates the sensor fill fluid from the process it is measuring. It is important to select a material that is compatible to the process, otherwise the transmitter could experience failure.

1.2 Drain/vent valves

Drain/vent valves are located on the flange or manifold attached to the transmitter and are used to drain or vent the process from the transmitter.

1.3 Process flanges and flange adapters

The process flange or flange adapter is used to connect the transmitter to the process.

1.4 Wetted O-rings

The wetted O-rings are used to seal the sensing diaphragms to the flange or manifold, as well as sealing flange adapters to flanges.

2. Non-Wetted components

Non-wetted component consists of bolt, electronics housing, cover O-rings, and mounting brackets. Material selection of non-wetted components depends on the process detail such as ambient temperature, humidity and corrosive conditions. This section guidelines how to use the detail to select suitable material for non-wetted components.

2.1 Bolts

Bolts are used to attach the transmitter to the flange or manifold. Although bolting is not process

2.2 Electronics housing

The electronics housing is the enclosure surrounding the electronics board and terminal block to ensure they are protected from the environment and can function reliably. The standard painted aluminium housing is

suitable for the majority of industrial environments. SST is typically used in marine environments.

2.3 Sensor module fill fluid

Sensor module fill fluid is contained behind the process isolating diaphragms and transmits the source pressure from the process to the sensor.

It is important to select a fill fluid that is compatible with the process fluid should the sensor module isolating diaphragm become damaged. If this occurs, fill fluid can contact the process.

2.6.4 Additional Accessories for Transmitter Installation

This section is about manifold valve. Valves are one of the most important components of fluid based industrial systems. From controlling fluid flow to regulating the pressure, these valves perform a variety of functions.

In accordance with their usage, these valves come with several different configurations. Most prominently, pneumatic check valves, high pressure needle valves, ball valves, toggle valves and purge valves are used.

In certain conditions, two or more different requirements must be fulfilled. This necessitates use of two or more valves at a single location in the system. However, this can be inefficient since it takes double the space. The problem was thus solved by configuring a valve manifold.

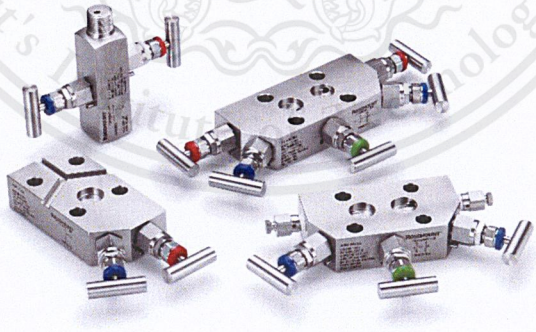


Figure 2.19: Manifold Valve

Manifolds are equipment which connects two or more valves of a hydraulic system. A variety of block/isolate valves can be combined in a single body configuration. Each of these valves has a separate opening below in order to connect a pipe. The main body or valve chamber is common to all.

These manifolds commonly include ball, bleed, needle, and vent valves. Their use results in savings in terms of space and installation costs.

Advantages of a manifold valve

Manifold valves are used in several different applications, ranging from mobile machineries to heavy industrial equipment. When included in a fluid control and/or regulation system, valve manifolds have shown to improve efficiency as well as reduce energy costs. Other advantages include:

- Shorter path flows which reduces pressure drop and heat fluctuations, improving overall energy efficiency of the system
- Reduction in installation costs as well as fluid connections because of a simpler, more compact design
- Minimum chances of oil leak due to a smaller number of connections, further reducing the need for upkeep against fatigue, wear and lose joints
- Improved layout due to less hoses and connections
- Small, compact cartridge sizes which suits confined spaces

2.6.5 Material Selection for Transmitter

In this project, pressure transmitter and differential pressure flow transmitter have the same requirements in order to select material for transmitter

The potential for damage due to corrosion is an important concern in the design of instrumentation for most process control systems. The following information is to guide to the selection of material options. Any material will behave differently under influence of such variables as temperature, pressure, flow rate, abrasives, and contaminants. This will help the user in making appropriate material choices for an application.

1.Corrosion basics

Corrosion is the destruction of metals in small increments by chemical or electrochemical methods. The most general corrosion is galvanic corrosion. There must be a combination of a cathode, an anode and electrolyte in order to achieve this type of corrosion. This combination of anode, cathode and electrolyte is called galvanic cells. Galvanic cell consists of an electrically connected metal, two different metal and a medium, usually a watery solution that can transfer electrons

1.1 Type of corrosion

Typically, all corrosion is not completely different, it is interrelated but can take many forms. In the following discussion is presented the common form of corrosion involved the process of project.

1.1.1 Hydrogen permeation

Hydrogen permeability is the process by which hydrogen atoms spread through the metal diaphragm that are separated into the liquid filling sensor module by using an interstitial mechanism or a free space mechanism. Although the mechanism is more relevant but for simplicity, this definition is sufficient.

The transmitting diaphragm is thinner than the rest parts of the transmitter. The hydrogen atoms can penetrate the diaphragm and combine to form hydrogen molecules. Because the hydrogen molecule is too large to penetrate the diaphragm, it will be captured and formed into a hydrogen bubble in the liquid. The presence of hydrogen gas bubbles can have a serious impact on the efficiency of the transmitter.

In general, in applications where atomic hydrogen is present, materials that are not susceptible to permeation should be chosen. Because of the loose lattice structure, nickel-based alloys are more susceptible to permeation. Increased hydrogen activity occurs when the gas pressure reaches above 1000 psi or the process temperatures rise above 350 °F (176 °C) increasing the risk of permeation. The following table is a guide to select a suitable diaphragm material for any pressure and temperature in hydrogen application.

Table 2.6: Material Selection Guide for Pressure Transmitters in Hydrogen Application

Process fluid	Diaphragm material
Hydrogen gas below 1000 psi (68.9 bar) and below 350 °F (176 °C)	SST, Gold-plated SST
Hydrogen gas below 1000 psi (68.9 bar) and/or above 350 °F (176 °C)	Gold-plated SST
Hydrogen gas with H2S	
Aqueous solutions with hydrogen	
Aqueous solutions with hydrogen and H2S	

1.1.2 Sulfide stress cracking

Sulfide stress cracking is a common form of corrosion in oil field environments. When exposed to sour environments, sulfide stress cracking may occur in susceptible materials. Sour environments can be defined as a fluid containing liquid water and hydrogen sulfide such as sour gas and sour crude.

2. Materials of construction

2.1 Type 316 SST

An alloy that has more than 11 percent chromium content and a better 50 percent iron content is called stainless steel. The designation of "stainless steel" can be attributed to the ability to withstand the most corrosion under conditions.

Type 316 SST is nonmagnetic and cannot be hardened by heat treatment. Nickel content contributes to improved corrosion resistance and is also responsible for the preservation of austenitic structures. This material has high corrosion resistance It is resistant to atmospheric corrosion and resistant to the most concentrated nitric acid. However, it is attacked by non-oxidizing acids such as sulfuric acid and hydrochloric acid at most concentrations. Most salt solutions have little effect on the type 316 SST, although salt halides (fluorine, chlorine, bromine, iodine) can cause severe porosity and may cause stress corrosion.

Type 316 SST performs very well against hydrogen diffusion and is a good choice as a diaphragm material when the process is hydrogen gas and has good resistance to alkaline solutions, organic acids, and other organic compounds

2.2 Nickel-based alloys

Nickel is the basis of an important group of materials used for corrosion. High nickel alloys provide good resistance to a wide range of corrosion. Nickel content gives good resistance, including good physical and mechanical properties.

In general, nickel alloys have the basic corrosion resistance of nickel combined with the added resistance associated with the alloy. This combination makes the alloy better or better than nickel with corrosion.

2.2.1 Alloy-400

Alloy-400 has good resistance at ambient temperatures to most of the nonoxidizing acids, such as hydrofluoric, sulfuric, and phosphoric acids.

It also resists nonoxidizing salts. The nickel in the alloy improves its resistance toward alkalies.

2.2.2 Alloy C-276

In alloy C-276, chromium and molybdenum are added to nickel to improve the resistance of the alloy to oxidation conditions. This alloy still has a high level of resistance to non-toxic conditions. Hydrochloric acid and sulfuric acid at most concentrations do not affect C-276 alloys at medium temperatures. C-276 alloys are especially suitable for protection against alkaline, organic acids and compounds. Other organic

C-276 is sensitive to hydrogen infiltration and is therefore not suitable for a variety of hydrogen applications. If the infiltration of hydrogen is at risk, it is worth considering the coating with 316 SST gold or gold-400 alloy.

Both Alloy-400 and Alloy C-276 have excellent corrosion resistance against atmospheric conditions and fresh water. In addition, Alloy C-276 is resistant to stag

2.3 Tantalum

Tantalum has proven to be a useful material in corrosive applications involving hydrochloric acid and acidic ferric chloride solutions. This accounts for the wide acceptance of tantalum in the chemical industry. Tantalum has a high melting point and good strength even at elevated temperatures. Its high strength allows thin sections to be used. This is important because tantalum is very expensive.

It has superior corrosive resistance to most acids, chemical solutions, and organic compounds. In general, tantalum has good resistance to hydroiodic, hydrobromic, boiling hydrochloric, nitric, phosphoric, and sulfuric acids. Liquid metals generally do not affect tantalum. In addition, it has good resistance to most other acids. However, tantalum can be attacked severely by hydrofluoric acid, fluosilicic acid, hot fuming sulfuric acid, and fluorine. Also, it is attacked by strong alkaline solutions and by fused alkalies.

Tantalum can suffer severe embrittlement if in service with high-temperature oxygen or nitrogen, or with hydrogen at any temperature.

2.4 Nickel-plated carbon steel

Nickel plating is an effective means for giving metal surfaces a corrosion resistant coating. Nickel has good resistance against most of the common

acids, except those of an oxidizing nature such as nitric acid. In general, neutral and alkaline solutions leave nickel relatively unattacked. It has good resistance to the milder forms of atmospheric conditions, to oxidation, to higher temperatures, and to halogen gases.

Nickel-plated flanges and adapters can be used along with Alloy C-276 diaphragms. The large difference in potentials that is created between the use of cadmium-plated flanges and Alloy C-276 diaphragms is now eliminated.

2.5 Gold-plated materials

Adhering a thin layer of gold to a base metal will provide protection against hydrogen permeation. Gold plating is suggested in applications where atomic hydrogen is present. It is not necessary for all hydrogen service applications. The strength of the atomic bonding for hydrogen gas, for example, is strong enough that dissociation is unlikely. The base metal to which gold plating is applied should be chosen to provide suitable corrosion resistance, unless there is some other contributing factor. Alloy-400 is typically used as a base metal in hydrofluoric (HF) acid applications where the weaker bond between hydrogen and fluoride may result in the presence of hydrogen atoms. In other applications, 316L SST base metal may provide enough corrosion resistance and lower the cost of the isolating diaphragm material.

2.6.6 Diaphragm Seal

It is usually not a problem when the media used in the process is in direct contact with the pressure instrument. However, media and harsh environments can damage internal components of pressurized tools. In these cases, the diaphragm seal can make the difference between reliable and unreliable readings.

The purpose of the diaphragm seal is to separate the pressure measuring instrument from the process substance. Often used for the most difficult measuring tasks, such as when the environment is very hot or cold or the process connection is difficult to stick to the measuring device. The diaphragm seal is also used when the measured media is corrosive, viscous, sticky or easily hardened, or when the process is incompatible with chemicals.

Typically connected to a pressure gauge, process transmitter, or pressure switch, a diaphragm seal is a thin, flexible wall that separates the media being measured from the pressure measuring instrument. The space between the diaphragm

and the measuring instrument is filled with a system fluid (transmitting fluid), which hydraulically transmits pressure from the flexible diaphragm. The contact surface between the media and the diaphragm is relatively large, which ensures more accurate pressure measurements – especially for very low pressures (< 600 mbar).

By preventing media from contacting the pressure measuring element directly, a diaphragm seal also:

- Eliminates clogging and crystallization in the measuring instrument
- Minimizes corrosion
- Protects the sensing element from extreme temperatures

1.Remote Seal System

Remote seal system measurement is unaffected by agitation, foam, or internal obstacles. Remote diaphragm seals extend limitations due to process conditions such as high and low temperatures, corrosive processes, viscous mediums, and hygienic applications. Remote seal system can divide into two types by its installation.

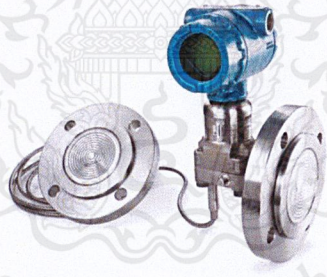


Figure 2.20: Remote Seal system

1.1 Balanced system

A balanced remote seal system is a symmetrical system that utilizes equal seals and capillary length on the high and low pressure sides of the transmitter. Since the capillary lengths are the same, each side ideally has the same amount of fill fluid, minimizing or completely eliminating the seal temperature effect due to equal pressure on both sides of the transmitter diaphragm.

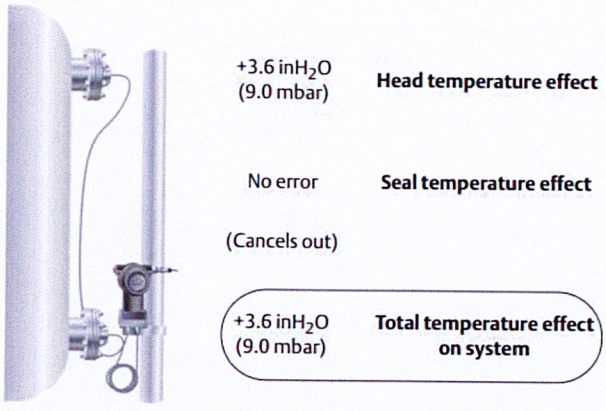


Figure 2.21: Balanced Remote Seal System Assembly

1.2 Tuned-system

Tuned-Systems assemblies are asymmetrical remote seal systems with one seal directly mounted to the high side of the differential pressure transmitter, and the other side connected to a seal via capillary. Another possible Tuned-System assembly is any remote seal system with unequal lengths of capillary or two different remote seals on the high and low pressure connections. Due to the unequal lengths of capillary, there are seal temperature effects. However, this seal temperature effect counters the head pressure from the oil-filled capillary and reduces total temperature effects on the entire system.

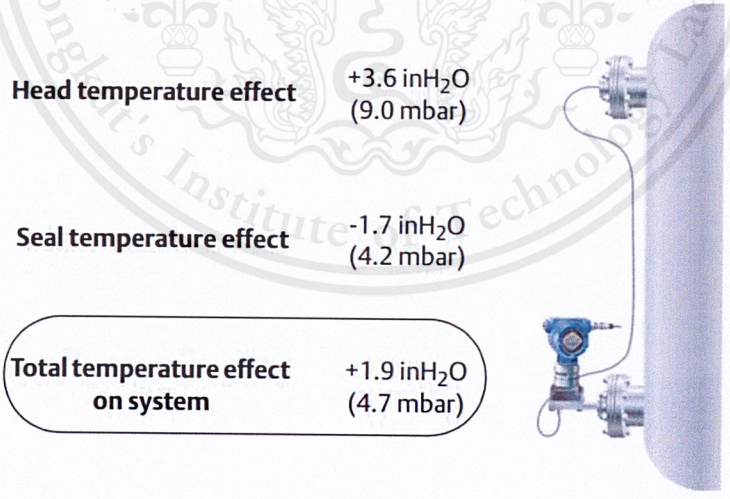


Figure 2.22: Tuned-System Assembly

2.Fill fluid selection

Fill fluid selection is very important to the safety and reliability of your measurement application. When selecting a fill fluid, the process and ambient temperatures must be within the specified temperature range of the fill fluid. Too hot

can cause the fill fluid to vaporize or yield thermal stability issues. Too cold can cause the fill fluid to gel, which slows the time response or can even render the system unresponsive.

There are different types of fill fluids exist to meet the needs of different applications. An all-purpose fill fluid can be used in most applications. However, some processes might require a fill fluid that is chemically inert to avoid reactions with oxygen. In the food and pharmaceutical industries, a hygienic fill fluid may be needed that meets various industry standards

Table 2.7: Fill Fluid Specification

Name	Temperature Range (≥ 1 Bara)	Viscosity at 25 °C (cST)	Specific gravity at 25 °C	Coefficient of thermal expansion (cc/cc/°C)
Silicone 200	-45 to 205 °C	9.5	0.934	0.00108
Tri-Therm 300	–40 to 300 °C	8.6	0.795	0.00078
Silicone 704	0 to 315 °C	39	1.07	0.00095
Silicone 705	20 to 370 °C	175	1.09	0.00077
UltraTherm 805	Up to 410 °C	1000	1.2	0.0008
SYLTHERM XLT	-105 to 145 °C	1.6	0.85	0.001198
Inert (Halocarbon)	–45 to 160 °C	6.5	1.85	0.000864
Neobee M-20	–15 to 225 °C	9.8	0.94	0.001008
Glycerin and water	–15 to 95 °C	12.5	1.13	0.000342
Propylene glycol and water	–15 to 95 °C	2.85	1.02	0.00034

- Silicone 200

Silicone 200 or Polydimethylsiloxane polymer is a general purpose fill fluid for industrial applications and is used in over half of all remote seal assemblies. This fluid has a broad temperature range to cover ambient and process conditions and has a low viscosity for good time response. Silicone fluids have a unique

combination of properties that give superior performance in a wide variety of applications. Silicones provide excellent thermal stability and low vapor pressure.

- Tri-Therm 300

Tri-Therm 300 is an advanced general use and food-grade fill fluid. The expanded operating temperature range, low viscosity, and low thermal expansion allow Tri-Therm 300 to have improved performance and a wider temperature range compared to Silicone 200. Tri-Therm 300 is a non-silicone, food grade fill fluid that is NSF HT1 registered, certifying it acceptable for use where there is possibility of incidental food contact.

- Silicone 704

Silicone 704 is a fill fluid intended for use in applications with higher operating temperatures beyond the maximum limit of Silicone 200.This specialty silicone fluid has a much higher molecular weight than Silicone 200, which increases its operating temperature. Its main limitation is its higher viscosity, so heat tracing of capillaries is suggested for many outdoor applications. The 0.03-in. (0.7 mm) ID capillary is not allowed for Silicone 704 because of its higher viscosity.

- Silicone 705

Silicone 705 is a specialty silicone fill fluid intended for use in applications with higher operating temperatures beyond the maximum limit of Silicone 704. Silicone 705 has a higher molecular weight than Silicone 704, which extends seal operating temperatures. Its primary limitation is high viscosity, so heat tracing of capillaries is often needed for acceptable response time. The 0.03-in. (0.711 mm) or 0.04-in. (1.092 mm) ID capillary are not allowed for Silicone 705 because of its higher viscosity

- UltraTherm 805

UltraTherm 805 fill fluid is a high-temperature non-silicone fluid with exceptionally low volatility, high thermal stability, and is a halogen-free, clear, colorless fluid. It is extremely resistant to degradation from heat. UltraTherm 805 is designed for applications where extreme high temperature and adverse environments are expected. Because of its high viscosity, it cannot be used in a single-filled capillary system UltraTherm 805 fill fluid is not chemically inert.

- SYLTHERM XLT

SYLTHERM XLT is a low viscosity silicone fluid used specifically for cold temperature applications.

- Inert (halocarbon)

Halocarbon 4.2 is the standard inert fluid offering with Rosemount remote seals. 4.2 fill fluid refers to viscosity in centistokes at 100 °F. Inert fill fluids are essentially non-reactive to a wide range of chemical, including halogens, oxygen, and other specialty gas applications. Other applications to consider using inert fluid include those where silicone fluids are banned due to product contamination concerns (i.e. paint manufacturing). Inert fluid has a higher vapor pressure than standard Silicone 200 and restricts applications, especially in vacuum service. Inert fluid should not be used for food grade applications.

- Neobee M-20

Neobee M-20 is the most commonly used fill fluid for hygienic applications because of its low viscosity and thermal stability. Neobee is approved under 21CFR 172.856 as a direct food additive and under 21CFR 174.5 as an indirect food additive. It is soluble in alcohol containing up to 20 percent water, has a smooth non-oily feel and unusually low viscosity, similar to Silicone 200. Neobee properties make it a suitable all purposes fill fluid. On colder applications, the response time should be evaluated due to increased viscosity.

- Glycerine and water

Glycerine is commonly used in many food, pharmaceutical, and cosmetic products. Glycerine is mixed with water in order to decrease its viscosity. Being a Generally Recognized As Safe (GRAS) substance, it may be used as a fill fluid in food, beverage, dairy, and pharmaceutical applications. Since it has a low coefficient of thermal expansion, it is also a good choice in applications requiring high performance as long as the temperature limits are not exceeded.

- Propylene glycol and water

Propylene glycol is commonly used as a raw material for paints and polyester and alkyd resins, a basic component of brake fluids, an ingredient for deicing/antifreeze fluids, and a heat transfer fluid. The food grade versions are also used as a solvent for flavors, extracts and drugs, as food antioxidants, lubricants and mold inhibitors. Being a Generally Recognized As Safe (GRAS) substance, it may be used as a fill fluid in food, beverage, dairy, and pharmaceutical applications. Since it has a

low coefficient of thermal expansion, it is also a good choice in applications requiring high performance as long as the temperature limits are not exceeded.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Foster Wheeler (Thailand) Limited is an EPC contractor for oil refiner project. EPC contractor is responsible for all activities from design, documents for procurement, construction and commissioning. This chapter discusses about designing instrument specification and preparing of documents for procurement. The author was assigned to prepare specifications for temperature instrument and pressure transmitter. The assignments are as follows:

1.Temperature Gauge Range Selection

2.Preparation of Pipe Thickness for U Length Calculation

3.Pressure Transmitter Calibration Range Selection

4.Updating Instrument Datasheet using Specification Module

5. Preparation DCS Typical Control Loop Drawing Using Microsoft Visio

6. Preparing Material Requisition Document for Pressure Transmitter and Local Indicator

7. Review Vendor Quotation

3.2 Temperature Gauge Range Selection

The normal operating range should be in the middle half scale range whenever possible. It means the range should be approximately twice the normal operating pressure. The maximum operating pressure should not exceed 75% the full-scale range.

1.	General	Item No.	KR-TG-7118	
		Service	VAC. TOW. BOTTOMS TO KR-E-320E/F	
2.	Preliminary Line Size [inch]		6"	
3.	Fluid Properties	State	LIQ	
		Type (Note A)	4	
		Description	VAC. TOW. BOTTOMS	
		Corrosion/Erosion Due To	---	
4.	PED Fluid Type/State		1	L
5.	Operating Temperature, Normal [°C]		172	
6.	Operating Pressure, Normal [kg/cm^{2}g]		26,8	
7.	Velocity [m/s]		0,60	
8.	High alarm (TAH/TAHH) [°C]		---	---
9.	Low alarm (TAL/TALL) [°C]		---	---
10.	Remarks			

Figure 3.1: Datasheet of Temperature Gauge

This process has a normal temperature, 172 °C, So, a 0 - 300 °C scale range should be selected.

3.3 Preparation of Pipe Thickness for U Length Calculation

U length should be calculated considering not only middle-third of pipe diameter height, but also pipe thickness and nozzle height. Nozzle height is provided by Piping Engineer, So, pipe thickness should be completed. There is not much procedure to find a pipe thickness size.

1.Find Pipe Specification.

In the first, find the location of temperature instrument and we can know the location of thermowell, then get a line number of that pipeline.

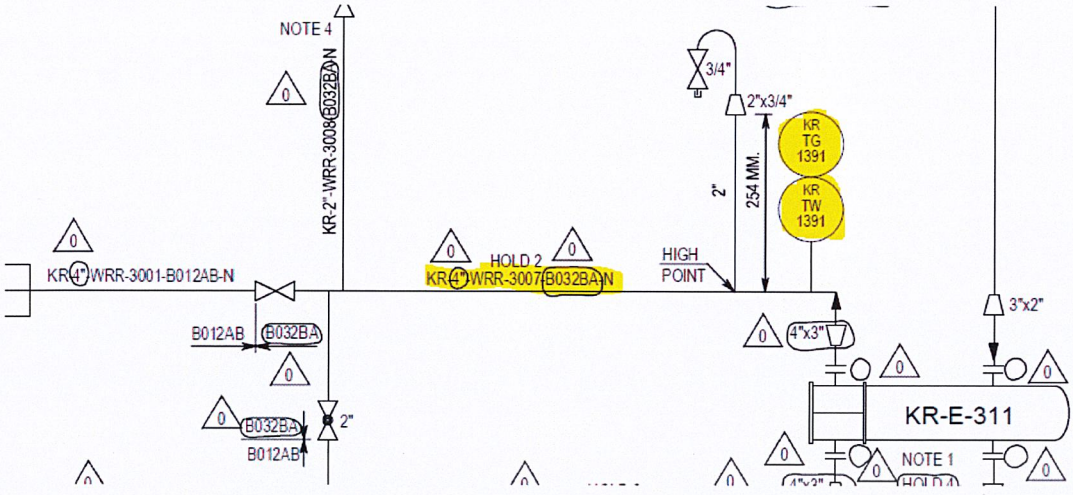


Figure 3.2: Location of Thermowell

From the figure, thermowell is located on pipeline no. KR-4”-WRR-3007-B032BA-N. A line number tells its pipe specification, So, the pipe specification of this pipeline is B032BA.

2.Find Pipe Schedule

Find pipe schedule of this pipe class from Piping Material Specification Document.

SHEET 678 / 1313
DATE 30/01/2019

Piping Material Specifications

amec foster wheeler

Project	1DD5560A Cepsa- LC Fining HDT
Client	COMPAÑIA ESPAÑOLA PETROLEOS,S.A.U. CEPSA
Location	Refineria Gibraltar San Roque

B032BA

Item Name	FWIBE Code	Sch	Ext	Rate	Range High From	Range High To	Range Low From	Range Low To	Description
PIPING									
PIP PIPE	PIPKP100	080	PE	---	1/2	3/4	0	0	PIPE ASTM A106 GR.B SMLS ASME B36.10 C<=0,25% CE<=0,42% CEPSA ESP-1300-1
	PIPKP100	080	PE	---	1-1/2	2	0	0	PIPE ASTM A106 GR.B SMLS ASME B36.10 C<=0,25% CE<=0,42% CEPSA ESP-1300-1
	PIPKP100	040	BE	---	2-1/2	8	0	0	PIPE ASTM A106 GR.B SMLS ASME B36.10 C<=0,25% CE<=0,42% CEPSA ESP-1300-1
	PIPKP301	040	BE	---	10	24	0	0	PIPE API 5L GR.B ERW/X ASME B36.10 C<=0,25% CE<=0,42% CEPSA ESP-1300-1

Figure 3.3: Piping Material Specification

From Piping Material Specification Document, it is known that 4 inches pipe with pipe specification B032BA, its pipe schedule is 040 or 40

3.Find Pipe Thickness

The last step is to compare pipe schedule with a pipe chart and finally got pipe thickness. From the 040-pipe schedule and 4-in. pipe diameter can tell that pipeline no. KR-4”-WRR-3007-B032BA-N has 0.217-in. or 6.02 mm. pipe thickness

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E sales@tiogapipe.com

PIPE DIMENSIONS AND WEIGHTS

Available in commercial and nuclear

U.S./METRIC

NOMINAL PIPE SIZE	OD	SCHEDULE DESIGNATIONS			WALL THICKNESS		WEIGHT		ID	
INCH MM	INCH MM	ASME			INCH	MM	LBS/FOOT	KG/METER	INCH	MM
1/8 6	0.405 10.3	10 STD XS	40 80	10S 40S 80S	0.049 0.068 0.095	1.24 1.73 2.41	0.19 0.24 0.31	0.28 0.37 0.47	0.307 0.269 0.215	7.82 6.84 5.84
1/4 8	0.540 13.7	10 STD XS	40 80	10S 40S 80S	0.065 0.088 0.119	1.65 2.24 3.02	0.33 0.43 0.54	0.49 0.63 0.80	0.410 0.364 0.302	10.40 9.22 7.66
3/8 10	0.675 17.1	10 STD XS	40 80	10S 40S 80S	0.065 0.091 0.126	1.65 2.31 3.20	0.42 0.57 0.74	0.63 0.84 1.10	0.545 0.493 0.423	13.80 12.48 10.70
1/2 15	0.840 21.3	S 10 STD XS 160 XX	40 80	SS 10S 40S 80S	0.065 0.083 0.109 0.147 0.188 0.294	1.65 2.11 2.77 3.73 4.78 7.47	0.54 0.67 0.85 1.09 1.31 1.72	0.80 1.00 1.27 1.62 1.95 2.55	0.710 0.674 0.622 0.546 0.464 0.252	18.00 17.08 15.76 13.84 11.74 6.36
3/4 20	1.050 26.7	S 10 STD XS 160 XX	40 80	SS 10S 40S 80S	0.065 0.083 0.113 0.154 0.219 0.308	1.65 2.11 2.87 3.91 5.56 7.82	0.69 0.86 1.13 1.48 1.95 2.44	1.03 1.28 1.69 2.20 2.90 3.64	0.920 0.884 0.824 0.742 0.612 0.434	23.40 22.48 20.96 18.88 15.58 11.06
1 25	1.315 33.4	S 10 STD XS 160 XX	40 80	SS 10S 40S 80S	0.065 0.109 0.133 0.179 0.250 0.358	1.65 2.77 3.38 4.55 6.35 9.09	0.87 1.41 1.68 2.17 2.85 3.66	1.29 2.09 2.50 3.24 4.24 5.45	1.185 1.097 1.049 0.957 0.815 0.599	30.10 27.86 26.64 24.30 20.70 15.22
1-1/4 32	1.660 42.2	S 10 STD XS 160 XX	40 80	SS 10S 40S 80S	0.065 0.109 0.140 0.191 0.250 0.382	1.65 2.77 3.56 4.85 6.35 9.70	1.11 1.81 2.27 3.00 3.77 5.22	1.65 2.69 3.39 4.47 5.61 7.77	1.530 1.442 1.380 1.278 1.160 0.896	38.90 36.66 35.08 32.50 29.50 22.80
1-1/2 40	1.900 48.3	S 10 STD XS 160 XX	40 80	SS 10S 40S 80S	0.065 0.109 0.145 0.200 0.281 0.400	1.65 2.77 3.68 5.08 7.14 10.15	1.28 2.09 2.72 3.63 4.86 6.41	1.90 3.11 4.05 5.41 7.25 9.55	1.770 1.682 1.610 1.500 1.338 1.100	45.00 42.76 40.94 38.14 34.02 28.00
2 50	2.375 60.3	S 10 STD XS 160 XX	40 80	SS 10S 40S 80S	0.065 0.109 0.154 0.218 0.344 0.436	1.65 2.77 3.91 5.54 8.74 11.07	1.61 2.66 3.66 5.03 7.47 9.04	2.39 3.93 5.44 7.48 11.11 13.44	2.245 2.157 2.067 1.939 1.687 1.503	57.00 54.76 52.48 49.22 42.82 38.16
2-1/2 65	2.875 73.0	S 10 STD XS 160 XX	40 80	SS 10S 40S 80S	0.083 0.120 0.203 0.276 0.375 0.552	2.11 3.05 5.16 7.01 9.53 14.02	2.48 3.53 5.80 7.67 10.02 13.71	3.69 5.26 8.63 11.41 14.92 20.39	2.709 2.635 2.469 2.323 2.125 1.771	68.78 66.90 62.68 58.98 53.94 44.96
3 80	3.500 88.9	S 10 STD XS 160 XX	40 80	SS 10S 40S 80S	0.083 0.120 0.216 0.300 0.438 0.600	2.11 3.05 5.49 7.62 11.13 15.24	3.03 4.34 7.58 10.26 14.34 18.60	4.52 6.46 11.29 15.27 21.35 27.68	3.334 3.260 3.068 2.900 2.624 2.300	84.68 82.80 77.92 73.66 66.64 58.42
3-1/2 90	4.000 101.6	S 10 STD XS XX	40 80	SS 10S 40S 80S	0.083 0.120 0.226 0.318 0.636	2.11 3.05 5.74 8.08 16.15	3.48 4.98 9.12 12.52 22.87	5.18 7.41 13.57 18.64 34.03	3.834 3.760 3.548 3.364 2.728	97.38 95.50 90.12 85.44 69.30
4 100	4.500 114.3	S 10 STD XS 120 160 XX	40 80	SS 10S 40S 80S	0.083 0.120 0.156 0.188 0.237 0.337 0.438 0.531 0.674	2.11 3.05 3.96 4.78 6.02 8.56 11.13 13.49 17.12	3.92 5.62 7.24 8.67 10.80 15.00 19.02 22.53 27.57	5.84 8.37 10.78 12.91 16.08 22.32 28.32 33.54 41.03	4.334 4.260 4.188 4.124 4.026 3.826 3.624 3.438 3.152	110.08 108.20 106.38 104.74 102.26 97.18 92.04 87.32 80.06
4-1/2 115	5.000 127.0	STD XS XX	40 80	40S 80S	0.247 0.355 0.710	6.27 9.02 18.03	12.55 17.63 32.56	18.67 26.24 48.45	4.506 4.290 3.580	114.46 108.96 90.94

NOMINAL PIPE SIZE	OD	SCHEDULE DESIGNATIONS			WALL THICKNESS		WEIGHT		ID	
INCH MM	INCH MM	ASME			INCH	MM	LBS/FOOT	KG/METER	INCH	MM
S 125	5.563 141.3	S 10 STD XS 120 160 XX	40 80	SS 10S 40S 80S	0.109 0.134 0.258 0.375 0.500 0.625 0.750	2.77 3.40 6.55 9.53 12.70 15.88 19.05	6.36 7.78 14.63 20.80 27.06 32.99 38.59	9.46 11.56 21.77 30.97 40.28 49.12 57.43	5.345 5.295 5.047 4.813 4.563 4.313 4.063	135.76 134.50 128.20 122.24 115.90 109.54 103.20
6 150	6.625 168.3	S 10 STD XS 120 160 XX	40 80	SS 10S 40S 80S	0.109 0.134 0.188 0.280 0.432 0.562 0.719 0.864	2.77 3.40 4.78 7.11 10.97 14.27 18.26 21.95	7.59 9.30 12.94 18.99 28.60 36.43 45.39 53.21	11.31 13.83 19.28 28.26 42.56 54.21 67.57 79.22	6.407 6.357 6.249 6.065 5.761 5.501 5.187 4.897	162.76 161.50 158.74 154.08 146.36 139.76 131.78 124.40
7 175	7.625 193.7	STD XS XX	40 80	40S 80S	0.301 0.500 0.875	7.65 12.70 22.23	23.57 38.08 63.14	35.10 56.69 94.00	7.023 6.625 5.875	178.40 168.30 149.24
8 200	8.625 219.1	10 20 30 STD 60 XS 100 120 140 XX 160	40 80	SS 10S 40S 80S	0.109 0.148 0.250 0.277 0.322 0.406 0.500 0.594 0.719 0.812 0.875 0.906	2.77 3.76 6.35 7.04 8.18 10.31 12.70 15.09 18.26 20.62 22.23 23.01	9.92 13.41 22.38 24.72 28.58 35.67 43.43 51.00 60.77 67.82 72.49 74.76	14.78 19.97 33.32 36.82 42.55 53.09 64.64 75.92 90.44 100.93 107.93 111.27	8.407 8.329 8.125 8.071 7.981 7.813 7.625 7.437 7.187 7.001 6.875 6.813	213.56 211.58 206.40 205.02 202.74 198.48 193.70 188.92 182.58 177.86 174.64 173.08
9 225	9.625 244.5	STD XS XX	40 80	40S 80S	0.342 0.500 0.875	8.69 12.70 22.23	33.94 48.77 81.85	50.54 72.60 121.85	8.941 8.625 7.875	227.12 219.10 200.04
10 250	10.750 273.0	20 30 STD XS 80 100 120 140 160	40 60	SS 10S 40S 80S XX	0.134 0.165 0.188 0.250 0.307 0.365 0.500 0.594 0.719 0.844 1.000 1.125	3.40 4.19 4.78 6.35 7.80 9.27 12.70 15.09 18.26 21.44 25.40 28.58	15.21 18.67 21.23 28.06 34.27 40.52 54.79 64.49 77.10 89.38 104.23 115.75	22.61 27.78 31.62 41.76 51.01 60.29 81.53 95.98 114.71 133.01 155.10 172.27	10.482 10.420 10.374 10.250 10.136 10.020 9.750 9.562 9.312 9.062 8.750 8.500	266.20 264.62 263.44 260.30 257.40 254.46 247.60 242.82 236.48 230.12 222.20 215.84
11 275	11.750 298.5	STD XS XX	40 80	40S 80S	0.375 0.500 0.875	9.53 12.70 22.23	45.60 60.13 101.72	67.91 89.51 151.46	11.000 10.750 10.000	279.44 273.10 254.04
12 300	12.750 323.8	20 30 STD 40 XS 60 80 100 120 140 160	XX	SS 10S 40S 80S	0.156 0.180 0.188 0.250 0.330 0.375 0.406 0.500 0.562 0.688 0.844 1.000 1.125 1.312	3.96 4.57 4.78 6.35 8.38 9.53 10.31 12.70 14.27 17.48 21.44 25.40 28.58 33.32	21.00 24.19 25.25 33.41 43.81 49.61 53.57 65.48 73.22 88.71 107.42 125.61 139.81 160.42	31.24 35.98 37.61 49.71 65.19 73.86 79.71 97.44 108.93 132.05 159.87 186.92 208.08 238.69	12.438 12.390 12.374 12.250 12.090 12.000 11.938 11.750 11.626 11.374 11.062 10.750 10.500 10.126	315.88 314.66 314.24 311.10 307.04 304.74 303.18 298.40 295.26 288.84 280.92 273.00 266.64 257.16
14 350	14.000 355.6	10 20 STD 40 XS 60 80 100 120 140 160	30	10S 40S 80S	0.188 0.250 0.312 0.375 0.438 0.500 0.594 0.750 0.938 1.094 1.250 1.406	4.78 6.35 7.92 9.53 11.13 12.70 15.09 19.05 23.83 27.79 31.75 35.71	27.76 36.75 45.65 54.62 63.50 72.16 85.13 106.23 130.98 150.93 170.37 189.29	41.36 54.69 67.91 81.33 94.55 107.40 126.72 158.11 194.98 224.66 253.58 281.72	13.624 13.500 13.376 13.250 13.124 13.000 12.812 12.500 12.124 11.812 11.500 11.188	346.04 342.90 339.76 336.54 333.34 330.20 325.42 317.50 307.94 300.02 292.10 284.18

Figure 3.4: Pipe Chart

Pipe thickness will be calculated with nozzle height and middle-third of pipe diameter. The sum of all three values is called “U length” or “Immersion Length”, which is the exact height that thermowell will be inserted into the pipe.

3.4 Pressure Transmitter Calibration Range Selection

Pressure transmitter calibration range is based on operating value of transmitter.

Case 1 : when a process datasheet gives a normal operating value, transmitter calibration range should be 130% of normal operating value.

Case 2 : when a process datasheet gives a normal operating value or a maximum operating value or both, transmitter calibration range should be 110% of maximum operating value to cover the maximum operating value.

1.	General	Item No.		KR-PT-1126A	
		Service		KR-V-122	
2.	Preliminary Line Size		[inch]	6	
3.	Fluid Properties	State		VAP	
		Type	(Note B)	11	
		Description		NON PERM GAS	
		Corrosion/Erosion Due To		-	
4.	PED Fluid Type/State			Group 1	GAS
5.	Operating Temperature, Normal		[°C]	49	
6.	Operating Pressure	Normal	[kg/cm²g]	150.0	
		Maximum	[kg/cm²g]	-	
		Minimum	[kg/cm²g]	-	
7.	Instrument ΔP (Normal/Maximum)		[kg/cm²]	-	-
8.	High alarm (PAH/PAHH)		[kg/cm²g]	157.5	-
9.	Low alarm (PAL/PALL)		[kg/cm²g]	-	-
10.	Remarks				
11.	Revision			1	

Figure 3.5: Process Datasheet of Pressure Transmitter

From above figure, process datasheet given a 150 kg/cm3 normal operating pressure, So, 30% overdesign of normal operating pressure equals to 195 kg/cm3. To make it easier to setup transmitter, it should select 200 kg/cm^3 to be a Transmitter Calibration Range and the calculated value will be recorded in instrument datasheet.

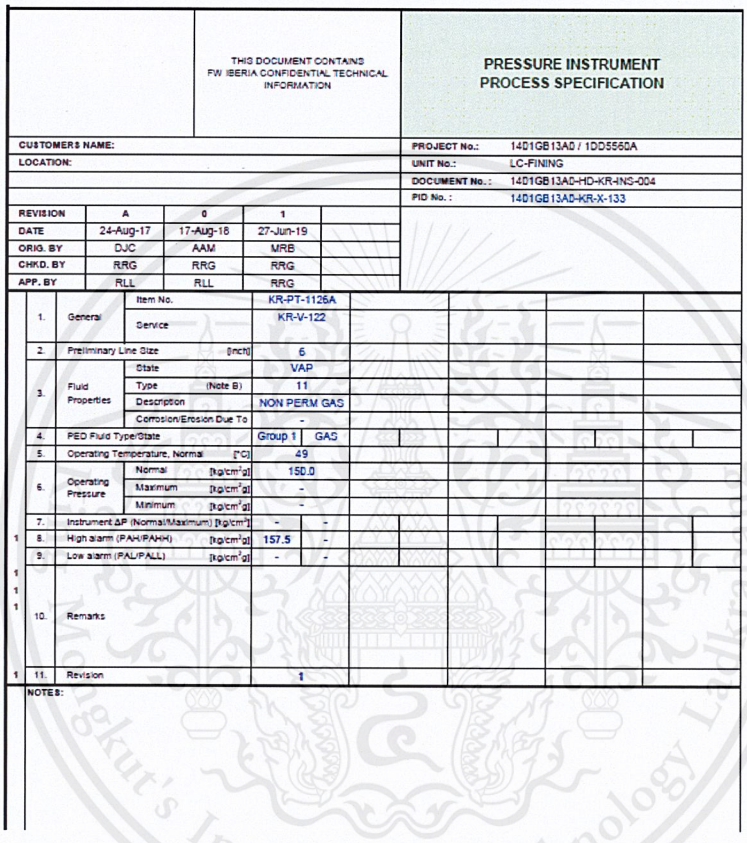
CONDICIONES PROCESO	9	Presión	Máxima		kgf/cm²-g	
	10		Normal	150	kgf/cm²-g	
	11	Presión de Diseño		165	kgf/cm²-g	
	12	Temperatura Máxima	Temperatura Diseño		°C 150	°C
	13	Punto de Congelación (Pour Point)			°C	
	14	RANGO DE CALIBRACION SCD : MIN / MAX		0	200	kgf/cm²-g
	15	ALARMAS SCD : H / HH		157.5		
	16	ALARMAS SCD : L / LL				
TRANSMISOR	17	Tipo de medida		Pressure		
	18	Señal de salida	Protocolo de comunicación	4÷20 mA, 24 vdc (2 hilos)		HART
	19	Material Cuerpo		316 SS		
	20	Material del diafragma		316L SS		
	21	Conexión Proceso		1/2" NPT		
	22	Fluido Relleno		Silicone Oil (VTA)		
	23	Conexión Eléctrica		½" NPT		
	24	Certificación eléctrica		EExd IIC T3		
	25	Protección mecánica		IP 65		
	26	Escala de medida		VTA		
	27	Rango Instrumento		VTA		
	28	Rango Calibración del Transmisor: cero / span		0	200	kgf/cm²-g
	29	Elevacion	Supresion	-	-	

Figure 3.6: Instrument Datasheet of Pressure Transmitter

3.5 Completing Instrument Datasheet using Specification Module

Instrument datasheet is a document that summarizes details about that device, including a component or a material in production. The datasheet will be used in the preparation of material requisition, a document used in the purchase of instrument. Creating an instrument datasheet will use SmartPlant Instrumentation which has the following methods

1.Study of Instrument Process Datasheet



			THIS DOCUMENT CONTAINS FW IBERIA CONFIDENTIAL TECHNICAL INFORMATION			PRESSURE INSTRUMENT PROCESS SPECIFICATION				
CUSTOMERS NAME:						PROJECT No.:	14D1GB13A0 / 1DD5560A			
LOCATION:						UNIT No.:	LC-FINING			
						DOCUMENT No.:	14D1GB13A0-HD-KR-INS-004			
						PID No. :	14D1GB13A0-KR-X-133			
REVISION		A	0	1						
DATE		24-Aug-17	17-Aug-18	27-Jun-19						
ORIG. BY		DJC	AAM	MRB						
CHKD. BY		RRG	RRG	RRG						
APP. BY		RLL	RLL	RRG						
1.	General	Item No.		KR-PT-1126A						
		Service		KR-V-122						
2.	Preliminary Line Size	[inch]		6						
3.	Fluid Properties	State		VAP						
		Type	(Note 8)	11						
		Description		NON PERM GAS						
		Corrosion/Erosion Due To		-						
4.	PED Fluid Type/State			Group 1	GAS					
5.	Operating Temperature, Normal	[°C]		49						
6.	Operating Pressure	Normal	[kg/cm²g]	150.0						
		Maximum	[kg/cm²g]	-						
		Minimum	[kg/cm²g]	-						
7.	Instrument ΔP (Normal/Maximum)	[kg/cm²]		-	-					
8.	High alarm (PAH/PAHH)	[kg/cm²g]		157.5	-					
9.	Low alarm (PAL/PALL)	[kg/cm²g]		-	-					
10.	Remarks									
11.	Revision			1						
NOTES:										

Figure 3.7: Instrument Process Datasheet

Instrument Process Datasheet is a document summarizing the performance and process characteristics of the instrument. It Contains the process information necessary for the design of the instrument in the process. This document is obtained from the Process Engineer. The information in the instrument process datasheet that relate to the preparation of the instrument datasheet includes Fluid Type, Fluid. State, Fluid Description, Operating Temperature, Operating Pressure, etc. These are basic information needed to design instrument. Different types of instrument have their own different details according to the basic requirements of instrument design.

2.Input Data in Process Module

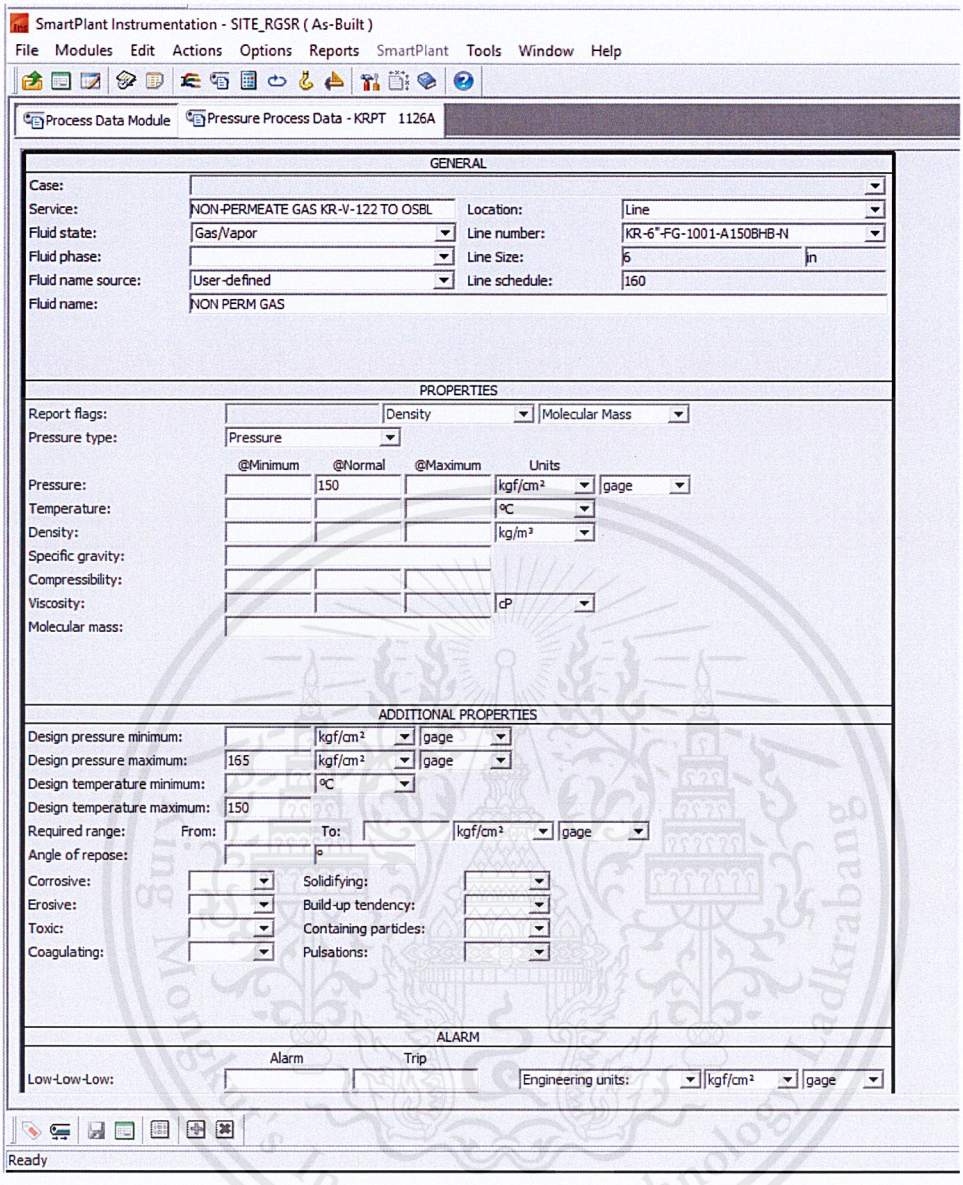
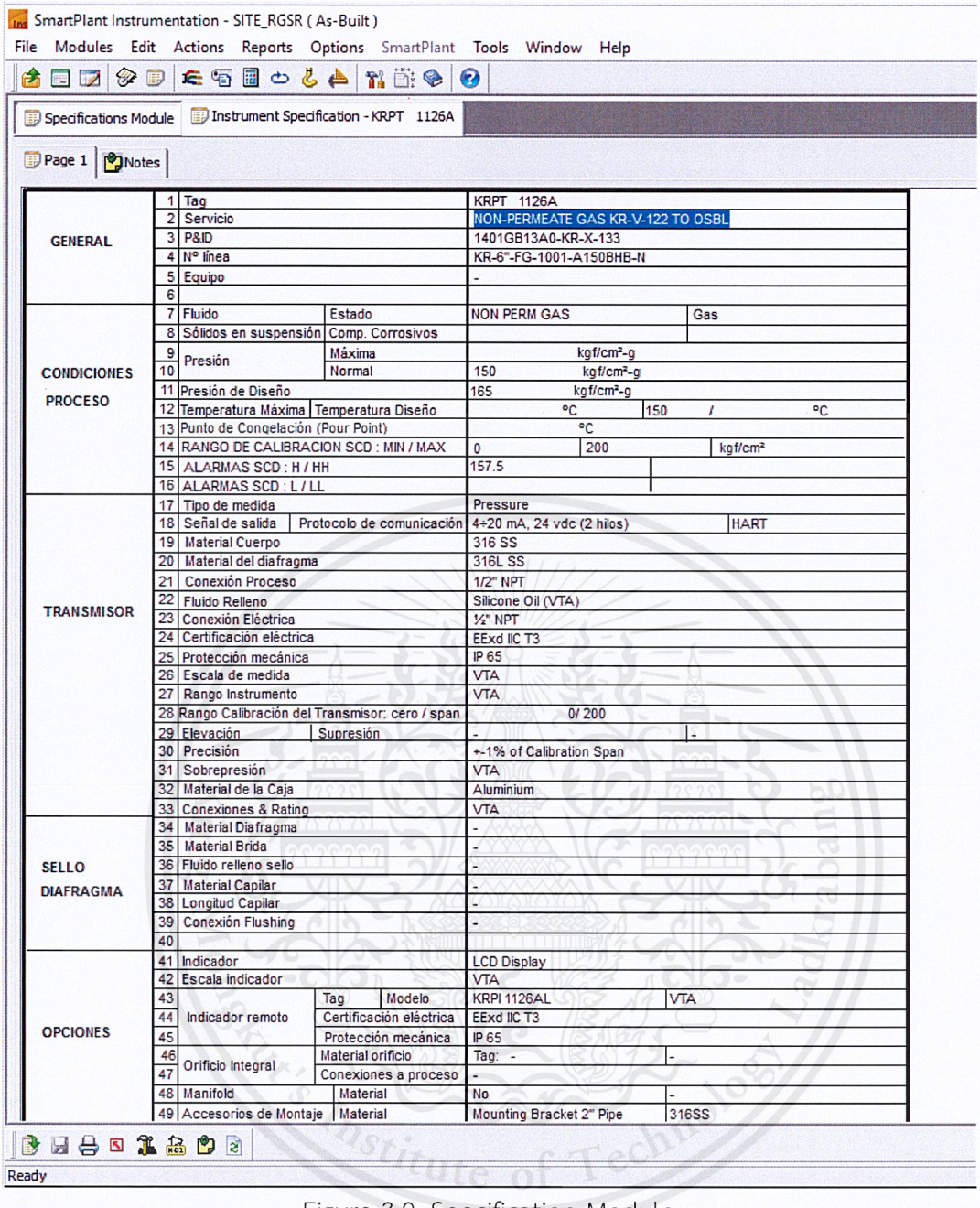


Figure 3.8: Process Data Module

The data input in process module is based on information in instrument process datasheet.

3.Input Data in Specification Module

To create an absolute datasheet, the specification module on SmartPlant Instrumentation must be filled. The Specification module is where we summarize the performance and other technical characteristics of a product, machine, component, material etc.



GENERAL	1	Tag			KRPT 1126A		
	2	Servicio			NON-PERMEATE GAS KR-V-122 TO OSBL		
	3	P&ID			1401GB13A0-KR-X-133		
	4	N° línea			KR-6"-FG-1001-A150BHB-N		
	5	Equipo			-		
	6						
CONDICIONES PROCESO	7	Fluido	Estado		NON PERM GAS	Gas	
	8	Sólidos en suspensión	Comp. Corrosivos				
	9	Presión	Máxima		kgf/cm²-g		
	10		Normal		150 kgf/cm²-g		
	11	Presión de Diseño			165 kgf/cm²-g		
	12	Temperatura Máxima	Temperatura Diseño		°C	150 /	°C
	13	Punto de Congelación (Pour Point)			°C		
	14	RANGO DE CALIBRACION SCD : MIN / MAX			0	200	kgf/cm²
	15	ALARMAS SCD : H / HH			157.5		
	16	ALARMAS SCD : L / LL					
TRANSMISOR	17	Tipo de medida			Pressure		
	18	Señal de salida	Protocolo de comunicación		4÷20 mA, 24 vdc (2 hilos)	HART	
	19	Material Cuerpo			316 SS		
	20	Material del diafragma			316L SS		
	21	Conexión Proceso			1/2" NPT		
	22	Fluido Relleno			Silicone Oil (VTA)		
	23	Conexión Eléctrica			½" NPT		
	24	Certificación eléctrica			EExd IIC T3		
	25	Protección mecánica			IP 65		
	26	Escala de medida			VTA		
	27	Rango Instrumento			VTA		
	28	Rango Calibración del Transmisor: cero / span			0/ 200		
	29	Elevación	Supresión		-	-	
	30	Precisión			+-1% of Calibration Span		
	31	Sobrepresión			VTA		
	32	Material de la Caja			Aluminium		
	33	Conexiones & Rating			VTA		
SELLO DIAFRAGMA	34	Material Diafragma			-		
	35	Material Brida			-		
	36	Fluido relleno sello			-		
	37	Material Capilar			-		
	38	Longitud Capilar			-		
	39	Conexión Flushing			-		
	40						
OPCIONES	41	Indicador			LCD Display		
	42	Escala indicador			VTA		
	43	Indicador remoto	Tag	Modelo	KRPI 1126AL	VTA	
	44		Certificación eléctrica		EExd IIC T3		
	45		Protección mecánica		IP 65		
	46	Orificio Integral	Material orificio		Tag: -	-	
	47		Conexiones a proceso		-		
	48	Manifold	Material		No	-	
	49	Accesorios de Montaje	Material		Mounting Bracket 2" Pipe	316SS	

Figure 3.9: Specification Module

3.6 Prepare DCS Typical Control Loop Drawing Using Microsoft Visio

Microsoft Visio is a program for designing, planning and drawing diagrams of works such as flow charts, organization charts or electronic circuits. By its function, Microsoft Visio is used to create the DCS Typical Control Loop Drawing Document for this project.

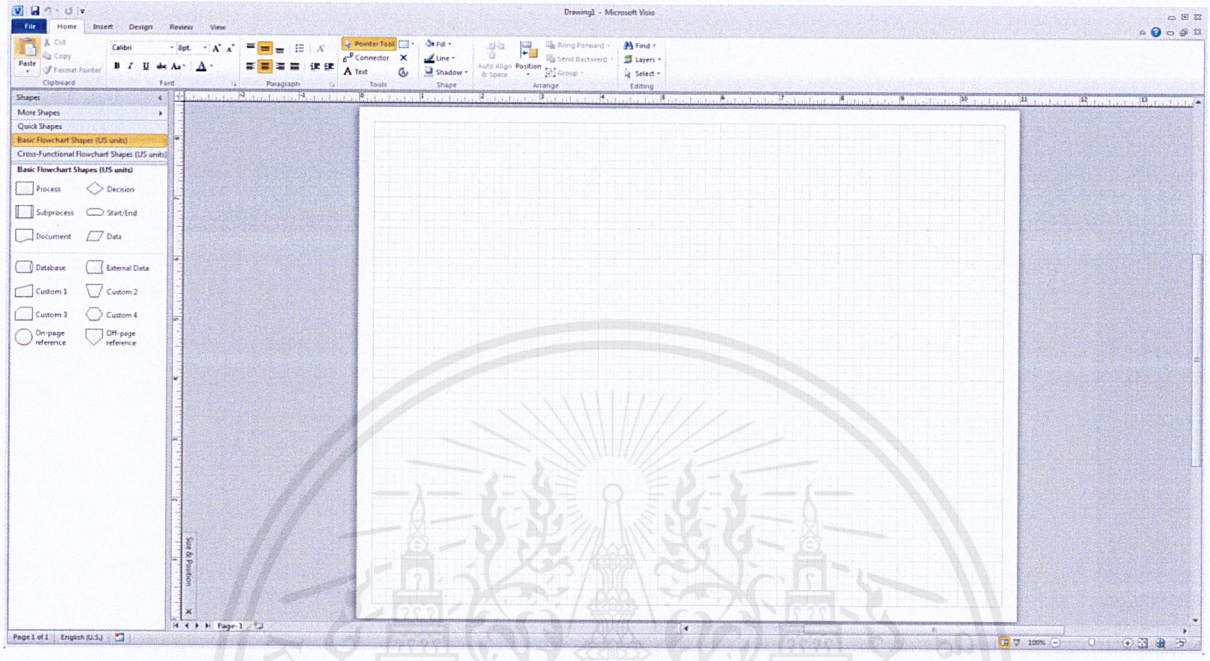


Figure 3.10: Microsoft Visio

DCS typical control loop drawing is a document showing the connection between instrument and control systems. The symbol in this drawing is as same as in P&ID but it tells about the signal used which is not show in P&ID. The symbols used in drawing are as following:

Table 3.1: Signal Symbol

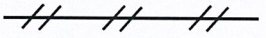
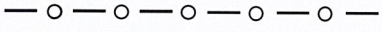
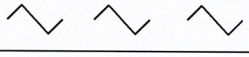
Symbol	Description
Signal	
	Electrical Signal
	Pneumatic Signal
	Software Signal
	Wireless Signal

Table 3.2: Instrument Symbol

Symbol	Description
Instrument	
	Field Instrument
	Control room instrument
	DCS Function/signal

Table 3.3: Function Symbol

Symbol	Description
Function 	
H	Low alarm
L	High alarm
√	Square root extraction
Δ	Differential
<	Less than selector
>	More than selector
X	Multiplication

Procedure of DCS Typical control Loop Drawing

1.Open the P&ID used as a reference for drawing DCS Typical Control Loop Drawing.

Open the referenced P&ID then select the loop. From the Figure, loop FC1158 is selected.

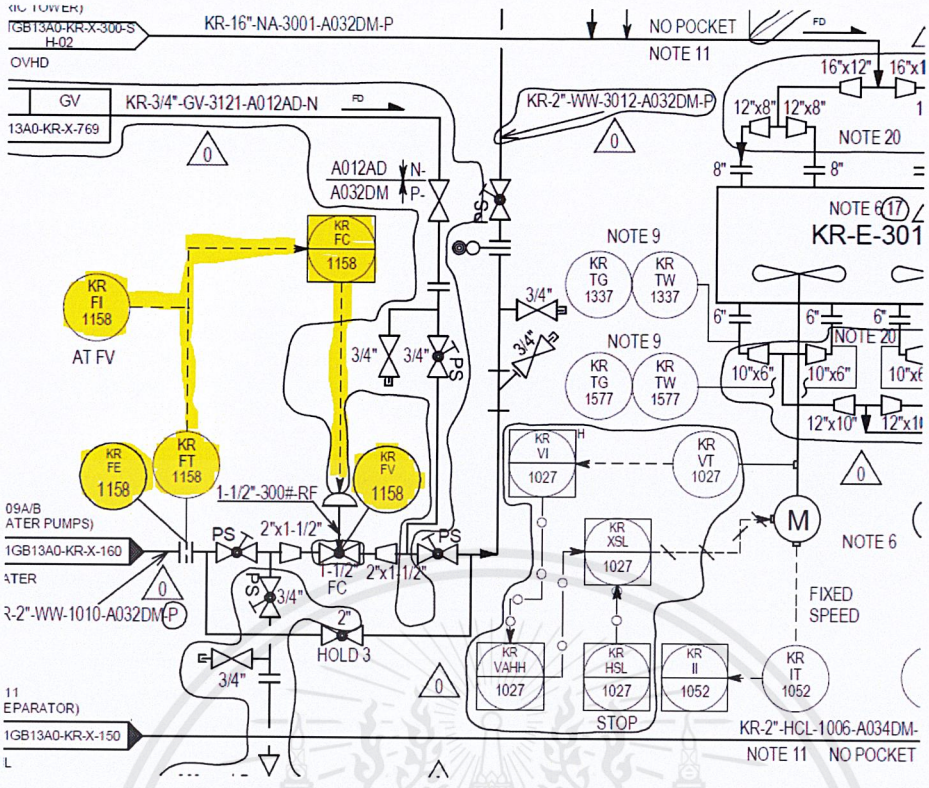


Figure 3.11: The selected control loop

2.Open Microsoft Visio

The form of drawing is divided into 5 columns, Including:

1.FIELD (INPUT)

This column is for input field instrument which is used to transmit signal to control room. Almost input field instrument are transmitters.

2.SIGNAL (INPUT)

This column shows a signal used of input field instrument. A type of signal depends on loop type and a use of signal.

3.SYSTEM

This column shows the operation of the loop. It can be understood from the symbol. If there is a complex loop, control loop cause & effect narrative document is required for better understanding of the loop, So, the loop can be drawn correctly. The symbol used in this column is almost function symbol.

4.SIGNAL (OUTPUT)

This column shows an output signal for output field instrument. Almost output field instruments are final control element.

5.FIELD (OUTPUT)

This column shows output field instrument of the loop.

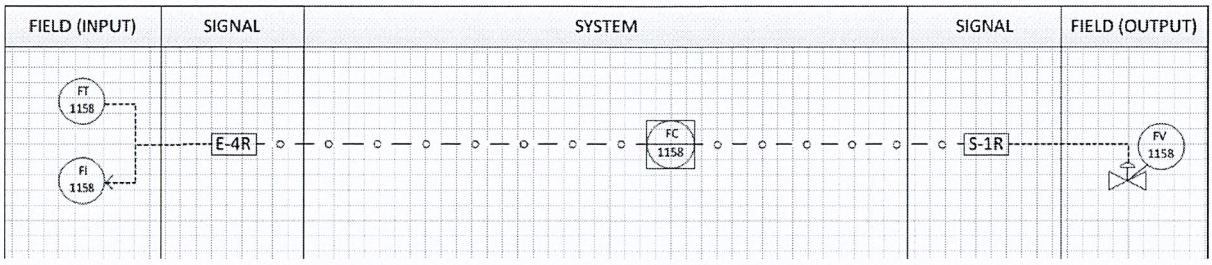


Figure 3.12: Example of DCS Control Loop Drawing

From above figure, it shows loop FC1158 in a form of DCS Typical Control Loop Drawing. This loop is flow control loop consists of FE1158 is sensing element connect with flow transmitter, FT1158 sends E-4R signal which is analogue signal to flow controller then controller sends output signal S-1R to final control element, FV1158.

3.7 Preparing Material Requisition Document for Pressure Transmitter and Local Indicator

Preparing necessary data for vendor such as transmitter body material, diaphragm material, calibration range, process connection. This document will be sent to vendor together with pressure transmitter datasheet as an overview requirement for procurement.

LISTA DE INSTRUMENTOS

CEPSA LUBRICANTS PROJECT

PROYECTO: 1406OB13A9

Plano nº

Rev. 9

P_&_ID_Drawing	Instrument_Name	Instrument_Type_Description	DIP Signal	Body Material	Diaphragm Material	Process Connection	Calib_Range Min(kg/cm2)	Calib_Range Max (kg/cm2)	Connection & Rating	Diaphragm Seal Material	Flange Material for Diaphragm Seal	Status	Requisition Number
1401OB13A2-KR-k-021	XPT_0001	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	VTA	0	240.35	2" 4D1000RA1LDC	316L SS	316L SS	Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-020	XPT_0002A	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-050	XPT_0002	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	VTA	0	3.81	2" 4D0001F	316L SS	316L SS	Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-010	XPR_0005	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-010	XPT_0003	Transmisor de Presión SCD	4-20 mA HART	3A750	3A750	VTA	0	204.47	2" 4D0002RA1LDC	3A755	3A755	Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-020	XPT_0010C	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	1/2" NPT	0	68.03	VTA			Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-006	XPT_0010D	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	1/2" NPT	0	53.3	VTA			Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-006	XPR_0011	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-004	XPT_0011	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	1/2" NPT	0	6.48	VTA			Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-010	XPR_0012A	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-010	XPR_0012B	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-010	XPT_0012	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	VTA	0	4.4	2" 4D0001F	316L SS	316L SS	Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-007	XPR_0013A	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-007	XPT_0013	Transmisor de Presión SCD	4-20 mA HART		316L SS	VTA	0	9.842	2" 4D0001F			Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-002	XPR_0013B	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-007	XPR_0013A	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-007	XPT_0002	Transmisor de Presión SCD	4-20 mA HART		316L SS	VTA	0	9.842	2" 4D0001F			Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-007	XPR_0002B	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-015	XPR_0005	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-010	XPT_0002	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	VTA	0	13.42	2" 4D0001F	316L SS	316 SS	Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-163-244.1	XPR_0706L	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-163-244.1	XPT_0706	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	1/2" NPT	0	1.142	VTA			Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-004	XPR_0716A	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-004	XPR_0716B	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-004	XPT_0716	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	1/2" NPT	0	0.032	VTA			Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-136	XPR_1021L	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-126	XPT_1021	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	VTA	0	3.81	2" 4D0001F	316L SS	316 SS	Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-136	XPR_1027A	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-136	XPT_1027A	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	VTA	0	3.81	2" 4D0001F	316L SS	316 SS	Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-139-244.1	XPT_1039A	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	VTA	0	211.42	2" 4D0001F1	316L SS	316 SS	Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-139-244.1	XPT_1039B	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	VTA	0	211.42	2" 4D0001F1	316L SS	316 SS	Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-118	XPR_1071A	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-118	XPT_1071	Transmisor de Presión SCD	4-20 mA HART	32155	32155	VTA	0	28.71	2" 4D0001F1	32155	32155	Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-121	XPR_1092L	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-121	XPT_1092	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	1/2" NPT	0	4.1	VTA			Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-123	XPR_1093L	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-123	XPT_1093	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	1/2" NPT	0	5.12	VTA			Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-126	XPR_1126L	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-126	XPT_1126A	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	1/2" NPT	0	32.65	VTA			Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-131	XPR_1115L	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-131	XPT_1115	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	3/4" Flange 1500#RF	0	169.73	VTA			Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-132	XPR_1123L	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-132	XPT_1123	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	3/4" Flange 1500#RF	0	107.35	VTA			Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-133	XPR_1125AL	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-133	XPT_1125A	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	3/4" Flange 1500#RF	0	195	VTA			Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-135	XPR_1125L	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-135	XPT_1125	Transmisor de Presión SCD	4-20 mA HART	316 SS	316L SS	1/2" NPT	0	29.1	VTA			Se añade en el proyecto	RM-1401OB13A2-2206-310
1401OB13A2-KR-k-135	XPR_1125BL	Indicación de Presión Local										Se añade en el proyecto	RM-1401OB13A2-2206-310

Figure 3.13: Material Requisition Document

3.8 Review Vendor Quotation

Review vendor quotation is a procedure after sending material requisition. Vendor will send back a quotation document, this document is contained instrument specification and model code of vendor. Our job is to check if the specifications that vendor respond back is follow specification in material requisition document or not.

Tag No	Instrument Type	Transmitter Model Code	Manifold Model Code
KRFT 0604	DP Flow Transmitter	3051CD2A02A1AH2S6BCK8L4M5Q4Q8C1C4P1HR7	0304RT32F11DFL4

Figure 3.14: Example of Model Code

Review vender quotation is to use an information in Model Decodifition Document which is attached together with quotation document compare to instrument datasheet. If any information is not following our requirement, it should respond to vendor to discuss about the details whether it must be changed or not.

Model	Description
3051CD2A02A1AH2S6BCK8L4M5Q4Q8C1C4P1HR7 / 0304RT32F11DFL4	
3051C	Transmitter Type: Pressure Transmitter
D	Measurement Type: Differential Pressure
2	Pressure Range: CD: 250 inH2O (623 mbar) CG: -250 to 250inH2O(-623 to 623 mbar) CA: 150 psia (10.34 bar)
A	Output: 4-20 mA with Digital Signal Based on HART Protocol
0	Materials of Construction: Alternate Process Connection
2	Isolating Diaphragm: 316L SST
A	O-Ring: Glass-filled PTFE
1	Sensor Fill Fluid: Silicone Oil
A	Housing/Conduit: Polyurethane-covered Aluminum 1/2-14 NPT
H2	Alternate Process Connection: Traditional Flange 316 SST, Drain/Vent SST
S6	Assembly: Assemble to Model 304 Manifold
BC	Mounting Bracket: Mounting Bracket for 2 in. Pipe Mounting, All SST
K8	Product Certification: ATEX Flameproof, Intrinsic Safety and Type N
L4	Bolting Material: Austenitic 316 SST
M5	Meter Type: LCD Display
Q4	Certificate: Calibration Certificate
Q8	Certification: Material Traceability Certification per EN 10204-3.1
C1	Configuration: Custom Software Configuration
C4	Alarm Level: Analog output Levels Compliant with NAMUR NE43, High Alarm
P1	Testing: Hydrostatic Testing with Certificate
HR7	HART Revision: Configured for HART Revision 7
Assemble to	
0304	Product Description: Conventional Manifold
R	Manufacturer: Rosemount Inc.
T	Manifold Style: Traditional (Flange x Flange or Flange x NPT)
3	Manifold Type: 3-Valve
2	Materials of Construction: 316 SST Body, 316 SST Bonnet, 316 SST Stem, 316 SST Tip
F	Process Connection Style: Flanged
1	Packing Material: PTFE
1	Bolts: For Assembly to 2051/3051 with Traditional Flange
DF	Adaptors: 1/2-14 NPT flange adapters
L4	Bolting Material: Austenitic 316 SST

Figure 3.15: Model Decodification

CHAPTER 4

RESULT

4.1 Introduction

From the process throughout the period of co-operative education. This chapter is presented about the result of following assignments:

1.Temperature Gauge Range Selection

2.instrument Datasheet

3.DCS Typical Control Loop Drawing

4.Preparing Material Requisition Document

5.Review Vendor Quotation

4.2 Temperature Gauge Range Selection

The temperature gauge range is recorded in temperature gauge datasheet, a document for procurement of temperature instrument.

GENERAL	1	Tag			KRTG 7118	
	2	Servicio			VACUUM TOWER BOTTOMS INLET TEMP TO KR-E-320E/F	
	3	No. Linea		P&ID	KR-6"-RUC-3151-A060FA-V	1401GB13A0-KR-X-330
	4	Equipo			-	
	5					
CONDICIONES PROCESO	6	Fluido		Estado	VAC. TOW. BOTTOMS	Liquido
	7	Sólidos en suspensión		Comp. corrosivos		
	8	Temperatura		Operación	172 °C	
	9			Máxima	°C	
	10					
	11					
	12					
CABEZA DE CONEXIÓN	13	Tipo			Dial	
	14	Material			Shockproof Aluminium Dial and Anti-corrosion Painted	
	15	Conexión Eléctrica			-	
	16	Clasificación Eléctrica			Eexd IIC T6	
	17	Protección mecánica			IP 65	
	18					
	19					
	20					
VAINA	21	Conexión a Proceso			1-1/2" 600#RF	
	22	Tipo de Construcción			Forged Bar	
	23	Material Brida			AISI 316	
	24	Material Vaina			AISI 316	
	25	Conexión Interna			½" NPT-H	
	26	Longitud de inmersión ("U")			259 mm	
	27	Longitud total			VTA mm	
	28	Estándar			STD IF-001	
	29					
	30					
TERMÓMETRO	31	Tipo			Bimetallic	
	32	Escala de medida			0 - 300 °C	
	33	Diámetro esfera		Color del dial	125	White Background and Black Numbers
	34	Materiales: Caja		Sonda	AISI 316	AISI 316
	35	Posición			Adjustable	
	36	Diámetro exterior			6 mm	
	37	Longitud inmersión			-	
	38	Protección intemperie			IP 65	
	39	Precisión			± 1% of full scale	
	40	SISTEMA RELLENO	Tipo relleno			
	41		Compensación			
	42		Longitud capilar			
	43		Material capilar			
	44		Material revestimiento			
	45		Diámetro bulbo			
	46		Longitud bulbo			
	47		Tipo bulbo			
	48		Conexión bulbo			
	49					
	50					
DATOS FABRICANTE	51	Fabricante		Nº serie	*	
	52	Modelo			*	
	53	Nº Requisición		Código SAP	RM-1401GB13A0-2206-620	
	54					

Notas de Proceso:
NOTE
May contain less than 500wppm catalyst or coke fines, size up to 2 mm.

FLUID TYPE
4(Liquids whose pour points are above the minimum design (or lowest

Notas de Instrumentos:
See notes

Figure 4.1: Temperature Gauge Datasheet

4.3 Instrument Datasheet

The author was assigned to creating pressure transmitter datasheet of all pressure transmitters in oil refinery project. The detail in datasheet is designed according to the process and general requirement in chapter 3.

GENERAL	1	Tag			KRPT 1126A			
	2	Servicio			NON-PERMEATE GAS KR-V-122 TO OSBL			
	3	P&ID			1401GB13A0-KR-X-133			
	4	N° línea			KR-6"-FG-1001-A150BHB-N			
	5	Equipo			-			
	6							
CONDICIONES PROCESO	7	Fluido	Estado		NON PERM GAS	Gas		
	8	Sólidos en suspensión	Comp. Corrosivos					
	9	Presión	Máxima		kgf/cm²-g			
	10		Normal		150 kgf/cm²-g			
	11	Presión de Diseño			165 kgf/cm²-g			
	12	Temperatura Máxima Temperatura Diseño			°C 150 °C			
	13	Punto de Congelación (Pour Point)			°C			
	14	RANGO DE CALIBRACION SCD : MIN / MAX			0	200	kgf/cm²-g	
	15	ALARMAS SCD : H / HH			157.5			
	16	ALARMAS SCD : L / LL						
TRANSMISOR	17	Tipo de medida			Pressure			
	18	Señal de salida	Protocolo de comunicación		4÷20 mA, 24 vdc (2 hilos)	HART		
	19	Material Cuerpo			316 SS			
	20	Material del diafragma			316L SS			
	21	Conexión Proceso			1/2" NPT			
	22	Fluido Relleno			Silicone Oil (VTA)			
	23	Conexión Eléctrica			½" NPT			
	24	Certificación eléctrica			EExd IIC T3			
	25	Protección mecánica			IP 65			
	26	Escala de medida			VTA			
	27	Rango Instrumento			VTA			
	28	Rango Calibración del Transmisor: cero / span			0	200	kgf/cm²-g	
	29	Elevación	Supresión		-	-		
	30	Precisión			+-1% of Calibration Span			
	31	Sobrepresión			VTA			
	32	Material de la Caja			Aluminium			
	33	Conexiones & Rating			VTA			
SELLO DIAFRAGMA	34	Material Diafragma			-			
	35	Material Brida			-			
	36	Fluido relleno sello			-			
	37	Material Capilar			-			
	38	Longitud Capilar			-			
	39	Conexión Flushing			-			
	40							
OPCIONES	41	Indicador			LCD Display			
	42	Escala indicador			VTA			
	43	Indicador remoto	Tag	Modelo	KRPI 1126AL	VTA		
	44		Certificación eléctrica		EExd IIC T3			
	45		Protección mecánica		IP 65			
	46	Orificio Integral	Material orificio		Tag: -	-		
	47		Conexiones a proceso		-			
	48	Manifold	Material		No	-		
	49	Accesorios de Montaje	Material		Mounting Bracket 2" Pipe	316SS		
	50	Etiqueta de identificación			304SS tag plate stamped tag for individual device			
DATOS FABRICANTE	51	Fabricante	N° serie		*			
	52	Modelo			*			
	53	Rev. del dispositivo	Rev. del fichero DD					
	54	N° Requisición	Código SAP		RM-1401GB13A0-2206-310			
Notas Proceso: FLUID TYPE 11 (Wet Gas)					Notas Instrumentación: See notes			

Figure 4.2: Pressure Transmitter Datasheet

Figure above is an example of pressure transmitter datasheet which is divided into 7 sections, consists of:

1.General

GENERAL	1	Tag	KRPT 1126A
	2	Servicio	NON-PERMEATE GAS KR-V-122 TO OSBL
	3	P&ID	1401GB13A0-KR-X-133
	4	N° línea	KR-6"-FG-1001-A150BHB-N
	5	Equipo	-
	6		

Figure 4.3: General section in Pressure Transmitter Datasheet

This section is about general information of transmitter, including Tag number, Service, P&ID, Line No. and Equipment. The detail in this section is from P&ID.

2. Process condition

CONDICIONES PROCESO	7	Fluido	Estado	NON PERM GAS		Gas
	8	Sólidos en suspensión	Comp. Corrosivos			
	9	Presión	Máxima	kgf/cm²-g		
	10		Normal	150	kgf/cm²-g	
	11	Presión de Diseño		165	kgf/cm²-g	
	12	Temperatura Máxima Temperatura Diseño		°C	150	°C
	13	Punto de Congelación (Pour Point)		°C		
	14	RANGO DE CALIBRACION SCD : MIN / MAX		0	200	kgf/cm²-g
	15	ALARMAS SCD : H / HH		157.5		
	16	ALARMAS SCD : L / LL				

Figure 4.4: Process condition section in Pressure Transmitter Datasheet

This section is about process data of transmitter. The detail can be separated into 3 groups by the designer.

1. Designed by Piping Engineer: The details designed by Piping Engineer are Design Pressure and Design Temperature.

- Design Pressure depends on the material of pipeline. This pressure is the maximum pressure that pipeline can withstand.
- Design Temperature depends on the material of pipeline. This temperature is the maximum temperature that pipeline can withstand.

2. Designed by Process Engineer: The detail designed by Process Engineer are Fluid, Fluid State, Pressure Value, Maximum Temperature and Alarm.

- Fluid and Fluid State are the fluid name and its state respectively.
- Pressure Value is the operating pressure of the process. This value must not exceed design pressure value.
- Maximum Temperature is temperature operating temperature of the process. This value must not exceed design temperature value.
- Alarm is a signal sending to control room when instrument measuring an over value (Alarm High) or a less value (Alarm Low) of operating value.

3. Designed by Instrument Engineer : The detail designed by Process Engineer is DCS Calibration Range. This value will be converted into electric signal and sending to control room in order to be monitoring or controlling.

3. Transmitter

TRANSMISOR	17	Tipo de medida		Pressure		
	18	Señal de salida	Protocolo de comunicación	4÷20 mA, 24 vdc (2 hilos)		HART
	19	Material Cuerpo		316 SS		
	20	Material del diafragma		316L SS		
	21	Conexión Proceso		1/2" NPT		
	22	Fluido Relleno		Silicone Oil (VTA)		
	23	Conexión Eléctrica		½" NPT		
	24	Certificación eléctrica		EExd IIC T3		
	25	Protección mecánica		IP 65		
	26	Escala de medida		VTA		
	27	Rango Instrumento		VTA		
	28	Rango Calibración del Transmisor: cero / span		0	200	kgf/cm²-g
	29	Elevación	Supresión	-	-	
	30	Precisión		+-1% of Calibration Span		
	31	Sobrepresión		VTA		
	32	Material de la Caja		Aluminium		
	33	Conexiones & Rating		VTA		

Figure 4.5: Transmitter section in Pressure Transmitter Datasheet

This section is a responsible of Instrument Engineer. The detail is all about transmitter and mostly based on instrument specification which is the most suitable for the process. The engineer should be circumspect for designing instrument.

The detail including:

- Line No. 17: Measure Type is a type of media that transmitter measure. Pressure transmitter can measure both pressure and differential pressure. This pressure transmitter is used for pressure measuring.

- Line No. 18: Output Signal / Communication of Protocol: Output signal of transmitter is 4-20 mA via HART protocol, Power supply used is 24 V. direct current.

- Line No. 19: Body Material of transmitter is 316 SS.

- Line No. 20: Diaphragm Material is 316L SS.

- Line No. 21: Process Connection, a connection point between transmitter and process line, is ½" NPT.

- Line No. 22: Fill Fluid is Silicone Oil. (VTA stands for Vender to Advised. If this fluid is not suitable for process condition (high temperature or high pressure), vender can advise for more suitable choice.)

- Line No. 23: Electrical Connection, a connection point between electrical wiring and transmitter size, is ½" NPT.

- Line No. 24: Electrical Certification is electrical protection for transmitter. It depends on the area where transmitter is located. EExd IIC T3 consists of (1) EExd is Explosion Proof for transmitter, (2) IIC is gas group, (3) T3 is temperature classification.

- Line No. 25: Mechanical Protection or Ingress Protection is IP 65.

- Line No. 26&27: Measurement Scale and Instrument Range are vender to advised.

- Line No. 28: Transmitter calibration Range is as same as DCS Calibration Range.

- Line No. 29: Elevation / Suppression is no required.

- Line No. 30: Precision is +/- 1 % of full scale range as project specification.

- Line No. 31: Overpressure is vender to advised.

- Line No. 32: Housing Material is Aluminium.

- Line No. 33: Connection & Rating is for diaphragm seal used.

4. Diaphragm Seal

SELLO DIAFRAGMA	34	Material Diafragma	-
	35	Material Brida	-
	36	Fluido relleno sello	-
	37	Material Capilar	-
	38	Longitud Capilar	-
	39	Conexión Flushing	-
	40		

Figure 4.6: Diaphragm seal section in Pressure Transmitter Datasheet

This section is for diaphragm seal specification, consists of Diaphragm seal material, Flange material, Diaphragm real filled fluid, Capillary material, Capillary length and Flushing Connection respectively.

Generally, almost of diaphragm seal material components are required 316 Stainless Steel as minimum. The filled fluid is Silicone Oil as minimum. Flushing Connection is the connection of flushing ring which is used for diaphragm seal in order to prevent the clogging of the instrument connection. In diaphragm seal application always require flushing ring.

5. Options

OPCIONES	41	Indicador			LCD Display	
	42	Escala indicador			VTA	
	43	Indicador remoto	Tag	Modelo	KRPI 1126AL	VTA
	44		Certificación eléctrica		EExd IIC T3	
	45		Protección mecánica		IP 65	
	46	Orificio Integral	Material orificio		Tag: -	-
	47		Conexiones a proceso		-	
	48	Manifold	Material		No	-
	49	Accesorios de Montaje	Material		Mounting Bracket 2" Pipe	316SS
	50	Etiqueta de identificación			304SS tag plate stamped tag for individual device	

Figure 4.7: Options section in Pressure Transmitter Datasheet

This section is for additional options for pressure transmitter. The additional options consist of:

- Line No. 41-42: Indicator, herein, indicator is to select the type of transmitter display, in this oil refinery project uses LCD Display for pressure transmitter. Indicator Scale is selected by vendor advise.

- Line No. 43-45: Remote Indicator is the pressure transmitter indicator that is remoted from the pressure transmitter according to the ambient conditions, accessibility to read the indicator, or hazardous atmospheres. The electrical certification and mechanical protection is as same as the transmitter itself.

- Line No. 46-47: Integral Orifice is used for small pipe mounting and when Differential Pressure Transmitter has to be directly mounted on the orifice. In this project there is none of any pressure transmitter uses integral orifice.

- Line No. 48: No manifold required.

- Line No. 49: Mounting Bracket required, and its material is 316 Stainless Steel.

- Line No. 50: 304 Stainless Steel tag identification required.

6. Manufactory Data

This manufactory data will be input after the order is made.

DATOS FABRICANTE	51	Fabricante	N° serie	*	
	52	Modelo		*	
	53	Rev. del dispositivo	Rev. del fichero DD		
	54	N° Requisición	Código SAP	RM-1401GB13A0-2206-310	

Figure 4.8: Manufactory data section in Pressure Transmitter Datasheet

7. Note

In note section is for more information for the pressure transmitter, including process note and instrumentation note.

Notas Proceso:	Notas Instrumentación:
FLUID TYPE 11 (Wet Gas)	See notes

Figure 4.9: Note section in Pressure Transmitter Datasheet

4.4 DCS Typical Control Loop Drawing

This document is sent to DCS System Vendor instead of P&IDs. The document shows the drawing of the loop, not only for control loop but also any loop that uses DCS system for their communication.

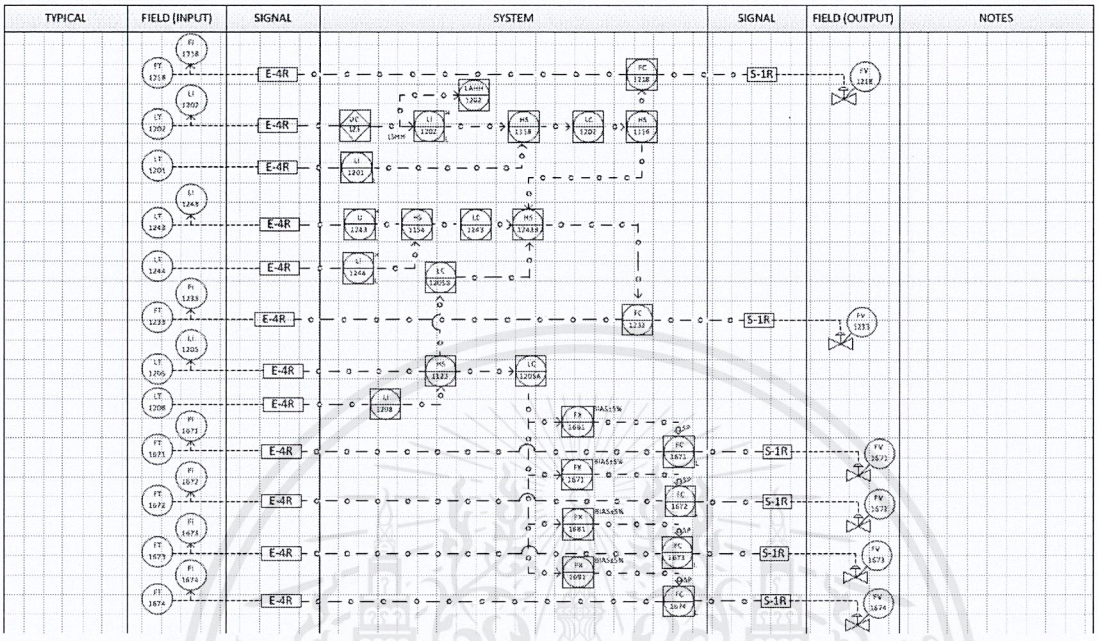
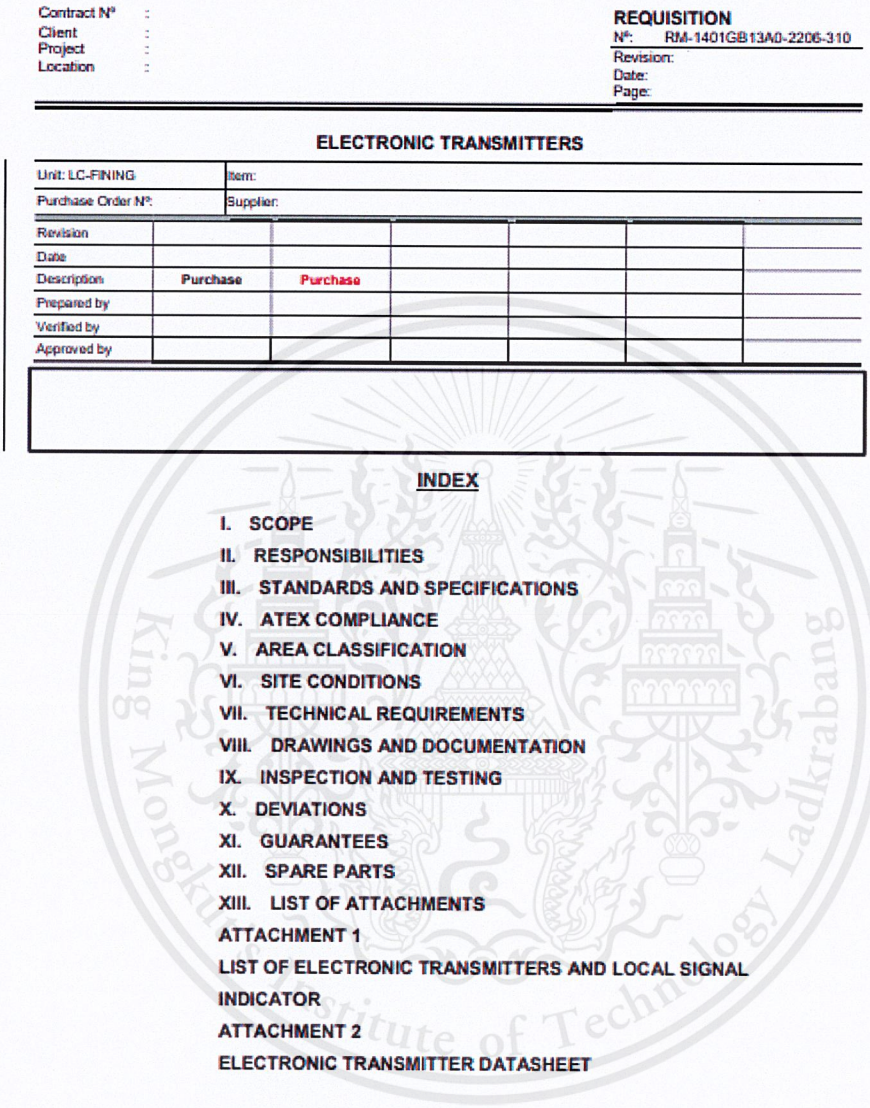


Figure 4.10: Example of DCS Typical Control Loop Document

4.5 Preparing Material Requisition Document

The prepared document is attached with material requisition in a form of list of pressure transmitter and local indicator. The Instrument datasheet is also attached in material requisition.



Contract N° :
Client :
Project :
Location :

REQUISITION
N°: RM-1401GB13A0-2206-310
Revision:
Date:
Page:

ELECTRONIC TRANSMITTERS

Unit: LC-FINING	Item:					
Purchase Order N°:	Supplier:					
Revision						
Date						
Description	Purchase	Purchase				
Prepared by						
Verified by						
Approved by						

INDEX

Figure 4.11: The cover page of Material Requisition Document

4.6 Review Vendor Quotation

Vender Quotation Review is to review the specifications of instruments that have been requested to the vendor to confirm the understanding of engineers and vendors in the same direction.

According to section 3.8, there are many specifications that are not following the requirements. Those specifications will be marked for green and added note for vendor. Almost marked specifications are about specific details for diaphragm seal system such as Seal Type, Capillary Type (diameter of capillary tube which is must be suitable with fill fluid property), Manifold Packing (The boiling point of manifold coating must be suitable with process condition), Protection Type (Vendor offers Intrinsic Safety protection type instead of Explosion proof protection type, this must be verified by vendor).

				Manifold			Seals						
Tag No	Instrument Type	Fluid	Fluid Phase	Material	Process Connection	Packing	Seal Type	Capillary Type	Capillary Length	Process Connection & Rating	Seal Diaphragm Material	Fill fluid	Des Tempe of fil
KRFT 0601	DP Flow Transmitter	TRANSPORT OIL	Liquid	N.A.	N.A.	N.A.	GRAYLOC	D.I. 1.092 mm	6 m	Flanged 3" 2500# GRAYLOC	SS 316	DC 704	0 to
KRFT 0603	DP Flow Transmitter	TRANSPORT OIL	Liquid	N.A.	N.A.	N.A.	GRAYLOC	D.I. 1.092 mm	6 m	Flanged 3/4" 2500# GRAYLOC	SS 316	(To be defined)	(To be
KRFT 0604	DP Flow Transmitter	COOLING OIL	Liquid	316 SST	1/2" NPT with flange adapter	PTFE	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.
KRFT 0605	DP Flow Transmitter	COOLING OIL	Liquid	N.A.	N.A.	N.A.	PFW	D.I. 1.092 mm	6 m	Flanged 3" 600# RF	SS 316	DC 704	0 to
KRFT 0606	DP Flow Transmitter	SLOP OIL	Liquid	N.A.	N.A.	N.A.	FFW	D.I. 1.092 mm	6 m	Flanged 3" 300# RF	SS 316	Thermal range expander/Silicone 705	-45 to
KRFT 0607	DP Flow Transmitter	SLOP OIL	Liquid	N.A.	N.A.	N.A.	FFW	D.I. 1.092 mm	6 m	Flanged 3" 300# RF	SS 316	Thermal range expander/Silicone 705	-45 to
KRFT 0608	DP Flow Transmitter	COOLING OIL	Liquid	316 SST	1/2" NPT with flange adapter	PTFE	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.

... | Pressure Transmitter | Indicator | Operational Spares | Commissioning spares | Item Details | Clarification-Deviation

Figure 4.12: Example of vendor quotation

CHAPTER 5

CONCLUSION

4.1 CONCLUSION

From all assigned works of the author to work as an instrument engineer at Foster Wheeler (Thailand) Limited. In order to accomplish the assigned work, the author studied about Engineering Procurement and Management for oil refinery of the project, how to design suitable specific specification of instrument for the process.

All assigned works are document work, instrument datasheet is made for summarize specification of instrument and to be an attached document with material requisition document to require instrument in oil refinery project, DCS Typical Control Loop Drawing will be sent to DCS System vendor and the step after sending material requisition, review vendor quotation is to recheck the instrument specification and discuss with vendor in case of there is any specification not as same as the requirement according to material requisition.

4.2 TROUBLE AND TROUBLE SHOOTING

1. Make a lot of mistake: this problem is solved by pay many attentions to work and if there is any question, should not keep it for long time and ask the mentor.

2. **The schedule is delay:** It is probably a communicate problem with another department. This problem will not exist if each department has an explicit communication.

4.3 SUGGESTION

The suggestion is for a student who interesting in the co-operative education in next semester, English Skill is important and basic knowledge for Microsoft Excel.

REFERENCES

[1] Appleton, “APPLETON : GUIDE FOR USE ELECTRICAL PRODUCTS IN HAZARDOUS LOCATIONS.”, Emerson.

[2] Appleton, “APPLETON 2014 NEC CODE REVIEW”, Emerson.

[2] Emerson, “Material Selection and Compatibility Considerations for Rosemount™ Pressure Transmitters”

[3] Henry Hardee, (2019, January 24), “Diaphragm Seal Overview: Basic Principle and Applications” Retrieved December 11, 2019, from https://blog.wika.us/knowhow/diaphragm-seal-overview-basic-principle-and-applications/

[4] Sealexcel, (2017, February 1), “Understanding Manifold Valves: Definition, Types And Advantages” Retrieved December 11, 2019, from https://sealexcel.com/blog/understanding-manifold-valves-definition-types-and-advantages/

[5] Peter Woolf, “Chemical Engineering Process Dynamics and Controls Open Textbook I.” University of Michigan, Engineering Faculty, Chemical Department.

[7] Béla G. Lipták, “Instrument Engineers' Handbook, Fourth Edition, Volume 1: Process Measurement and Analysis”

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