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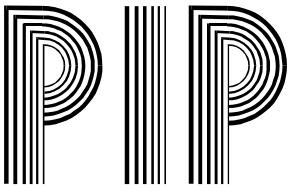

Process Industry Practices
P&ID

PIP PIC001
Piping and Instrumentation Diagram Documentation Criteria

PURPOSE AND USE OF PROCESS INDUSTRY PRACTICES

In an effort to minimize the cost of process industry facilities, this Practice has been prepared from the technical requirements in the existing standards of major industrial users, contractors, or standards organizations. By harmonizing these technical requirements into a single set of Practices, administrative, application, and engineering costs to both the purchaser and the manufacturer should be reduced. While this Practice is expected to incorporate the majority of requirements of most users, individual applications may involve requirements that will be appended to and take precedence over this Practice. Determinations concerning fitness for purpose and particular matters or application of the Practice to particular project or engineering situations should not be made solely on information contained in these materials. The use of trade names from time to time should not be viewed as an expression of preference but rather recognized as normal usage in the trade. Other brands having the same specifications are equally correct and may be substituted for those named. All practices or guidelines are intended to be consistent with applicable laws and regulations including OSHA requirements. To the extent these practices or guidelines should conflict with OSHA or other applicable laws or regulations, such laws or regulations must be followed. Consult an appropriate professional before applying or acting on any material contained in or suggested by the Practice.

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Table of Contents

1. Introduction

1.1 Purpose

This Practice provides criteria for the development of Piping and Instrumentation Diagrams (P&IDs).

1.2 Scope

This Practice addresses the format and content shown on a P&ID. The Practice is independent of time in a facility life cycle and encompasses design, construction, operations and maintenance.

This Practice covers the generation of new P&IDs and does not apply to the revision of existing P&IDs. It also applies to P&IDs provided by packaged equipment vendors.

A P&ID is a detailed graphical representation of a process including the hardware and software (e.g., piping, equipment, instrumentation) necessary to design, construct and operate the facility. Common synonyms for P&IDs include EFDs (Engineering Flow Diagrams), UFDs (Utility Flow Diagrams) and MFDs (Mechanical Flow Diagrams). This Practice applies to all diagrams that fit the definition of a P&ID.

The criteria presented in this Practice can be applied to whichever CAD system is employed for developing the P&IDs and are not vendor, hardware or software specific.

The example P&IDs included in the Appendices are not intended to recommend specific design details or requirements. Example P&IDs are included to provide an illustration of how the elements of the recommended Practice are combined into a P&ID.

2. References

Applicable requirements in the latest edition (or the edition indicated) of the following industry standards and Process Industry Practices shall be considered an integral part of this Practice. Short titles will be used herein when appropriate.

2.1 Process Industry Practices (PIP)

- PIP INEG1000 - *Insulation Design and Type Codes*
- PIP PCCIP001 - *Instrument Piping and Tubing Systems Criteria*
- PIP PCCPS001 - *Instrument and Control Systems Criteria for Packaged Equipment*
- PIP PCEDO001 - *Guidelines for Control Systems Documentation*
- PIP PCSIP001 - *Instrument Piping and Tubing Systems Specifications*
- PIP PNE00001 - *Design of ASME B31.3 Metallic Piping Systems*
- PIP PNSM0001 - *Piping Line Class Designator System*

2.2 Industry Codes and Standards

- American National Standards Institute (ANSI)
  - ANSI/FCI 70-2-1991 - *Quality Control Standard for Control Valve Seat Leakage*
- American Society of Mechanical Engineers (ASME)
  - *ASME Boiler and Pressure Vessel Code*

    Section VIII - *Pressure Vessels*
- ISA
  - ISA S5.1 - *Instrumentation Symbols and Identification* (R1992)
  - ISA S5.2 - *Binary Logic Diagrams for Process Operations* (R1981)
  - ISA S5.3 - *Graphic Symbols for Distributed Control / Shared Display Instrumentation, Logic and Computer Systems*
  - ISA S84.01 - *Application of Safety Instrumented Systems for the Process Industries*
  - ISA S91.01 - *Identification of Emergency Shutdown Systems and Controls That Are Critical to Maintaining Safety in Process Industries*
- Tubular Exchanger Manufacturers Association (TEMA)
  - TEMA Standards

2.3 Government Regulations

- Occupational Safety and Health Administration (OSHA)
  - OSHA 29 CFR 1910.119 - *Occupational Safety and Health Standards, Process Safety Management of Highly Hazardous Chemicals*

3. Definitions

For the purposes of this Practice, the following definitions apply:

Accessible: A term applied to a device or function that can be used or be seen by an operator for the purpose of performing control actions (e.g., set point changes, auto-manual transfer or on-off actions) (Reference *ISA S5.1*.)

Automated Valve: Any valve with a locally or remotely controlled actuator. Examples are throttling control valves and on/off block valves. Actuators are typically air-operated (diaphragm or piston), electric or hydraulic, some with spring return function. Manually-operated valves are sometimes also tagged as automated valves such as when a manual valve is fitted with position switches.

Auxiliary P&ID: P&ID used to show details in order to unclutter other P&IDs (e.g., lube oil system, sample systems, instrument details)

Basic Process Control System (BPCS): The Basic Process Control System is the control equipment and system that is installed to regulate normal production functions. The BPCS

may contain combinations of single loop pneumatic controllers, single loop electronic controllers, Programmable Logic Controllers (PLCs) and Distributed Control Systems (DCSs). The BPCS is required to operate the process. Examples of control functions included in the BPCS are cascade control, override control and pump start/stop. Also known as Basic Regulatory Controls. See definitions for HLCS and SIS.

Bubble: The circular symbol used to denote and identify the purpose of an instrument or function. It usually contains a tag number. Synonym for balloon. (Reference *ISA S5.1*.)

Design Pressure: The pressure used in the design of a vessel component together with the coincident design metal temperature for the purpose of determining the minimum permissible thickness or physical characteristics of the different zones of the vessel (Reference *ASME Boiler Pressure Vessel Code Section VIII, Division 1, Appendix 3*.)

Equipment Trim: Items attached to equipment as an integral component, identified as part of the equipment that is exposed to the process and whose function is local to the equipment it serves. Examples are vent and drain valves, instrument bridles, blind flanges, plugs or other miscellaneous items associated with a piece of equipment.

Fail Closed (FC): The characteristic of an automated valve that results in the valve closing as a result of specific malfunctions, including loss of signal or motive power (Reference *ISA S5.1*.)

Fail Indeterminate (FI): The characteristic of an automated valve that results in the valve moving to an unknown position as a result of specific malfunctions, including loss of signal or motive power. Some automated valves will not stay at the last position upon failure and will instead move with the process differential pressure. Additional equipment may be needed to meet the definition of FC, FO or FL. (Reference *ISA S5.1*.)

Fail Locked (FL) Last Position: The characteristic of an automated valve that results in the valve remaining in the last (locked) position as a result of specific malfunctions, including loss of signal or motive power. Automated valves may fail indeterminate without additional equipment. (Reference *ISA S5.1*.)

Fail Open (FO): The characteristic of an automated valve that results in the valve opening as a result of specific malfunctions, including loss of signal or motive power (Reference *ISA S5.1*.)

Hand Switch (HS): Any operator manipulated discrete control device, including hardwired panel switches and software points

Heat Exchanger Type: Type designation shall be shell and tube, plate and frame, spiral, etc. For shell and tube exchangers use the three letter designation describing stationary head, shell and rear end or head, in that order, per TEMA.

Higher Level Control System (HLCS): The Higher Level Control System provides sophistication above that of the BPCS. The HLCS is not necessary to operate the process. HLCS functions are typically based in process computers or higher level DCS hardware that interacts with the process by manipulating setpoints in the BPCS. Examples of control

functions in the HLCS are statistical process control and model predictive control. See definitions for BPCS and SIS.

Interlock: A system that, in response to a predetermined condition, initiates a predefined action. Typically comprised of binary (on - off) signals and logic used for process control, sequencing or protective interruption of normal process control functions. Protective interlocks are typically further defined as being either safety related or commercial (asset or production protection) related.

Line Class: A section of the Piping Material Specifications which provides a listing of piping components for specific design conditions

Logic solver: The control equipment that performs the logic function. It can be either hardwired (e.g., relays) or Programmable Electronic Systems (e.g., DCS or PLC based, including dual or triple redundant microprocessors).

Packaged Equipment: One or more pieces of equipment furnished by a vendor with supportive devices and components to perform a specific operation as a unit

Piping and Instrumentation Diagram (P&ID): A detailed graphical representation of a process including the hardware and software (e.g., piping, equipment, instrumentation) necessary to design, construct and operate the facility. Common synonyms for P&IDs include EFDs (Engineering Flow Diagrams), UFDs (Utility Flow Diagrams) and MFDs (Mechanical Flow Diagrams).

Programmable Electronic System (PES): Logic performed by programmable or configurable devices (Reference *ISA S84.01*.)

Root valve: The first valve or valves between the process and an auxiliary device (e.g., an instrument) that contacts the process and is used to isolate the device from the process. This is typically a line class valve used for shut-off and isolation. It is also commonly referred to as the primary block valve.

Safety Critical Control: A control whose failure to operate properly will directly result in a catastrophic release of toxic, reactive, flammable or explosive chemical (Reference *ISA S91.01*.)

Safety Integrity Level (SIL): One of three possible discrete integrity levels (SIL 1, SIL 2, SIL 3) of Safety Instrumented Systems. SILs are defined in terms of Probability of Failure on Demand (PFD). (Reference *ISA S84.01*.)

Safety Instrumented Systems (SIS): Systems composed of sensors, logic solvers and final control elements for the purpose of taking the process to a safe state when predetermined conditions are violated. Other terms commonly used include Emergency Shutdown System (ESD, ESS), Safety Shutdown System (SSD) and Safety Interlock System. (Reference *ISA S84.01*.) See definitions for BPCS and HLCS.

Skirt: A cylindrical supporting structure, welded to the bottom of a vertical vessel and extended to the base support

Tagged: For the purposes of labeling instrumentation and control components, a hardware device or a software point that is identified with an ISA style tag number

4. Requirements

Practice requirements are divided into five sections (General, Format, Equipment, Piping and Instruments & Controls). Reference the appropriate section for the specific area of interest.

4.1 General

Practice requirements are intended to provide a balance between the desire to show all data on P&IDs with the need to make P&IDs legible and easy to read. Most details that are available from other types of documentation (e.g., instrument loop diagrams, vessel data sheets) are not recommended for inclusion on P&IDs.

This Practice utilizes the concepts of typical details with implied components whenever appropriate to simplify P&IDs. See the cover sheet in Appendix B Page 4 for examples. Additional examples may be added as required.

4.2 Format

4.2.1 Layout

4.2.1.1 Criteria contained herein apply to reading a P&ID from the bottom or right side of the drawing. The top of a horizontal line and the left side of a vertical line is the top of a pipe. The bottom of a horizontal line and the right side of a vertical line is the bottom of a pipe. Use a note to clarify as required.

4.2.1.2 Drawing size is 22" x 34" (560 mm x 864 mm).

4.2.1.3 Layout each P&ID to avoid clutter and allow future modifications. Show no more that three pieces of major equipment per P&ID. A set of pumps in the same service is one piece of equipment for the purpose of P&ID layout per Appendix C Page 1.

4.2.1.4 Show primary flow on each P&ID from left to right.

Show flow through equipment relative to actual arrangement (e.g., cooling water supply in bottom of exchanger tube bundle and cooling water return out top).

4.2.1.5 Show primary process lines heavier than secondary and utility lines as described in Section 4.2.3.

4.2.1.6 Show off-page connector arrows for primary, secondary and instrumentation lines entering the P&ID horizontally 0.25" (6.4 mm) from the left inside borderline and exiting 0.25" (6.4 mm) horizontally from the right inside borderline per Appendix C Page 1.

Utility connectors may be shown at any convenient location on the body of the P&ID.

4.2.1.7 Show utility collection/distribution P&IDs laid out relative to Plot Plan orientation per Appendix C Page 3.

In order to depict Plot Plan orientation, utility off-page connectors for a utility connection/distribution P&ID may be positioned vertically per Appendix C Page 3.

When match lines are required on Utility P&IDs, the lines are to match the connecting drawing match lines per Appendix C Page 3.

4.2.1.8 Show service description, connector number, P&ID number and origin/destination for off-page connectors per Appendix A-3 Page 7.

Show origin/destination as an equipment number, line number, or loop number.

Show service description as name of fluid (e.g., Cracked Gas) or line description (e.g., Reactor Feed, Tower Overhead), for piping off-page connector.

Show service description as a line function (e.g., Low Level Override) or equipment to be controlled (e.g., PV-10014A/B) for instrument off-page connector.

Show service description and origin/destination text starting at left side of off-page connector symbol.

4.2.1.9 Show equipment arrangement relative to its elevation to grade (e.g., pumps at bottom of P&ID) per Appendix C Page 1.

4.2.1.10 Show control valve actuator above a horizontal line or left of a vertical line.

4.2.1.11 When a control valve identification bubble is required, show center point of bubble 0.5" (12.7 mm) above and 0.5" (12.7 mm) away from the actuator in a horizontal line or 0.5" (12.7 mm) to the left and 0.5" (12.7 mm) away from the actuator in a vertical line.

4.2.1.12 Show the center point of an instrument bubble 0.5" (12.7 mm) directly above an in-line instrument in a horizontal line or 0.5" (12.7 mm) directly left of an in-line instrument in a vertical line. Examples are restriction orifices and stand-alone thermowells.

4.2.1.13 Show pump and compressor driver piping, instrumentation and auxiliaries on a separate auxiliary P&ID.

4.2.1.14 Use typical details when they eliminate clutter without detracting from clarity. Show these details on the P&ID, on an auxiliary P&ID, or on a cover sheet.

4.2.1.15 Show the center point of a PSV (Pressure Safety Valve) identification bubble 0.5" (12.7 mm) above and 0.5" (12.7 mm) away from the safety valve.

Show the PSV in a vertical and upright position.

4.2.1.16 Show the center point of a PSE (Pressure Safety Element) identification bubble 0.5" (12.7 mm) above a horizontal line or left of a vertical line and 0.5" (12.7 mm) away from the rupture disc or equipment.

4.2.2 Symbology

4.2.2.1 Show format, equipment, piping and instrument symbols per Appendices A-1, A-2, A-3 and A-4.

Show equipment internals using a short dash/space line at a weight of 0.02" (0.5 mm).

Show a mating piping flange to an equipment nozzle at a distance of 0.06" (1.5 mm).

Show a connection to an equipment nozzle when the connection is welded per Appendix A-3 Page 6.

4.2.2.2 Show a note reference symbol per Appendix A-1 Page 2 at a weight of 0.03" (0.8 mm).

Show a note number in the symbol at a weight of 0.02" (0.5 mm).

4.2.2.3 Show normally closed manual valves using a darkened solid symbol.

When darkened in valves cannot be used because of symbol type (e.g., butterfly valve), use the abbreviation for Normally Closed (NC) directly below the valve in a horizontal line or to the right of the valve in a vertical line.

Show on-off valves in normal operating position.

Do not show control valves or relief valves normally closed.

4.2.3 Lines

4.2.3.1 Show primary process lines per Appendix A-3 Page 3 at a weight of 0.06" (1.5 mm).

4.2.3.2 Show secondary, utility, future or existing lines per Appendix A-3 Page 3 at a weight of 0.02" (0.5 mm).

4.2.3.3 Show instrument line symbols per Appendix A-4 Page 4 at a weight of 0.01" (0.3 mm).

4.2.3.4 Show packaged equipment limit lines per Appendix A-1 Page 2 at a weight of 0.03" (0.8 mm).

4.2.3.5 Show line class and insulation breaks per Appendix A-1 Page 2 at a weight of 0.02" (0.5 mm).

4.2.3.6 Minimize “dog legged” lines.

4.2.3.7 Maintain a minimum of 0.5" (12.7 mm) spacing between lines.

4.2.3.8 Show flow arrows at corners and intersecting lines, where there is a change in direction of majority of flow.

4.2.3.9 Break vertical primary process lines when crossing horizontal primary process lines.

Break secondary and utility lines for primary process lines.

Break vertical secondary and utility lines for horizontal secondary and utility lines.

Break instrument lines for all process and utility lines.

For utility collection/distribution P&IDs, break entering and exiting lines around pipe rack lines.

4.2.3.10 Maintain line break gaps at 0.13" (3.2 mm).

4.2.3.11 Avoid routing lines across equipment or text.

4.2.4 Text

4.2.4.1 Show general text and notes using a text height of 0.1" (2.5 mm) at a weight of 0.02" (0.5 mm).

General text and notes are aligned left and start in the upper left corner of the notes area per Appendix C Page 1.

4.2.4.2 Show equipment numbers using a text height of 0.16" (4 mm) at a weight of 0.03" (0.8 mm).

Show equipment numbers underlined.

Show equipment title and data using a text height of 0.1" (2.5 mm) at a weight of 0.02" (0.5 mm).

Show equipment text top/center justified.

4.2.4.3 Show line numbers per Appendix A-3 Page 1 using a text height of 0.1" (2.5 mm) at a weight of 0.02" (0.5 mm).

Place line number text 0.06" (1.5 mm) from line and lined up vertically 0.25" (6.4 mm) from off-page connector.

Show line numbers at entering off-page connectors top/left justified. Show line numbers at exiting off-page connectors top/right justified.

4.2.4.4 When a note contains more than one line, show line spacing between each line at 0.05" (1.3 mm).

Show spacing between notes at 0.25" (6.4 mm) beneath the last line of the preceding note maintaining top/left text justification.

4.2.4.5 Show equipment numbers, titles and data for exchangers, vessels, towers, agitators, jets, mixers, furnaces, tanks, filters and material

handling equipment within 2" (51 mm) from the top inside borderline of the P&ID, directly above the equipment and on the same horizontal plane as other equipment identification.

Show equipment numbers, titles and data for pumps, blowers and compressors within 2" (51 mm) from the bottom inside borderline of the P&ID, directly below the equipment and on the same horizontal plane as other equipment identification.

Show equipment number, title and data once for identical equipment with the same number, title and service (e.g., P-601A/B).

4.2.4.6 Show text horizontal where possible.

Show vertical text placed to the left of supporting graphics where possible. Read vertical text only from the right.

4.2.4.7 Show line numbering with the orientation of the line.

4.2.4.8 Show abbreviations per Appendix A-1 Page 1.

4.2.4.9 Show control valve failure action abbreviation 0.06" (1.5 mm) directly below control valve.

4.2.4.10 Show control valve size between the actuator and valve body symbol if the valve is not line size or easily inferred from adjoining pipe, reducers or equipment.

4.2.4.11 Show control valve seat leakage criteria (i.e., Tight Shut-Off (TSO)) between the actuator and valve body symbol.

4.2.4.12 Show the device size and set pressure for PSVs, PSEs, and Pressure Control Valves (PCVs) close to the identification bubble.

4.3 Equipment

4.3.1 Equipment General Information

4.3.1.1 Show equipment with simple outline representation. Exercise discretion so that equipment symbols do not dominate the drawing, but draw the symbols large enough for clear understanding. Do not draw equipment to scale. Show equipment relative to one another both in size and general orientation. Show equipment symbols per Appendices A-2 Page 1 through A-2 Page 9.

4.3.1.2 Show nozzles on equipment, including spares, as single lines. Show manways as double lines. Do not label process and utility nozzles. Show nozzle sizes unless the size is implied by piping connections.

4.3.1.3 Show equipment not specifically identified in this Practice with an equipment symbol that is a reasonable representation of the equipment as it will exist in the field.

4.3.1.4 Identify equipment shown on the P&ID by a classification letter and sequence number. Classifications used in this Practice are shown in Section 4.3.12.

Comment: The classifications shown in Section 4.3.12 are used on the example P&IDs contained in the Appendices for illustrative purposes only. The classifications are only one example of classifications allowed by this Practice.

4.3.1.5 Show Equipment Item Number and Title/Service as a minimum. Reference Section 4.3.13 for a complete list of equipment data for all equipment addressed in this Practice. For equipment not covered in this Practice, show equipment data as necessary.

4.3.1.6 Show internals for equipment as dashed lines as described in Section 4.2.2.1. Omit details of internals that have no significant bearing on the piping design and layout or equipment operation.

4.3.1.7 Do not show equipment elevations unless they are necessary to specify process requirements for associated equipment location or orientation relative to one another.

4.3.1.8 Show associated trim (e.g., vent and drain valves, instrument bridles) for equipment.

4.3.1.9 Show auxiliary system requirements for individual pieces of equipment (e.g., lube oil systems, seal flush systems, turbine gland leak-off piping, sample systems) on auxiliary P&IDs.

4.3.1.10 Show jacketing requirements for equipment.

4.3.1.11 Show the type of insulation (e.g., personnel protection, heat conservation) for equipment as part of the equipment data. Show insulation thickness where applicable.

4.3.2 Agitators

4.3.2.1 The term agitator applies to mechanical mixers and aerators.

4.3.2.2 Show agitators per Appendix A-2 Page 3.

4.3.3 Blowers

4.3.3.1 Show blower symbols as centrifugal or positive displacement as required.

4.3.3.2 Show blowers per Appendix A-2 Page 2.

4.3.4 Compressors

4.3.4.1 Show the compressor symbol for each stage of multistage compressors. Multi-staged compressors may be shown on multiple P&IDs.

4.3.4.2 Show compressors per Appendix A-2 Page 2.

4.3.5 Drivers

4.3.5.1 Show drivers with driven equipment using the symbols for motors, diesel engines and turbines. Equipment numbers for drivers are normally not required since equipment data for the drivers is shown as an integral part of the associated driven component. Show equipment number for driver if it drives more than one piece of equipment or if the driver number is different from the equipment it drives.

4.3.5.2 The base symbol for the pneumatic driver is the same as the electric driver. Show air inlet and discharge nozzles for the pneumatic driver.

4.3.5.3 Show drivers per Appendix A-2 Page 3.

4.3.6 Heat Exchangers

4.3.6.1 The term heat exchanger includes unfired heat exchangers, coolers, condensers, reboilers, vaporizers and heating coils. Show shell and tube exchangers following the TEMA convention (e.g., AEL, BEM) for the type utilized in the process per Appendix A-2 Page 4. Show other types (e.g., plate and frame, double pipe) per Appendix A-2 Page 5.

4.3.6.2 Orient exchanger nozzles to indicate the flow path through the exchanger.

4.3.6.3 Show the total duties for multiple exchangers utilized in series or parallel configurations for common service.

4.3.6.4 Air-cooled exchangers are generally of two basic types, forced draft or induced draft. Each type may have recirculation, multiple bundles, multiple fans, variable (automatic or manual) fan pitch, variable louvers or steam coils. Symbols may be modified to represent the type of air-cooled exchanger used.

4.3.7 Furnaces

4.3.7.1 The term furnace includes direct fired equipment, preheaters, etc. The symbol shown in Appendix A-2 Page 8 is one of many possible representations.

4.3.7.2 Show the radiant coils and convection coils for the furnace to distinguish between the respective sections.

4.3.8 Pumps

4.3.8.1 Show pumps per Appendix A-2 Page 1.

4.3.8.2 Do not show base plates unless panned and drained.

4.3.8.3 Show drains and lines to oil and/or water sumps.

4.3.8.4 Show vendor supplied instrumentation or controls (e.g., relief for a positive displacement pump, high temperature shutoff switch).

4.3.9 Packaged Equipment

4.3.9.1 The term packaged equipment includes units such as air driers, refrigeration systems, etc. Packaged equipment can be shown generically as a “black box” until vendor drawing/information becomes available.

4.3.9.2 Show packaged equipment in its entirety. Show packaged equipment limit lines per Appendix A-1 Page 2.

Comment: Vendor should provide P&IDs which depict all supplied equipment and instrumentation. Vendor drawings may be referenced in a “black box” to avoid duplication of effort in producing project P&IDs.

4.3.9.3 Assign Equipment/Item Numbers (reference Section 4.3.12) to individual equipment in the package.

4.3.10 Vessels

4.3.10.1 Show vessels as representative of actual vessel shape and orientation.

4.3.10.2 Show manways, handholes and skirts. Show other equipment (e.g., spheres) supports only if needed.

4.3.10.3 Show trays at process connection points. Number trays per the project convention. Show the top and bottom trays.

4.3.10.4 Example representations of vessels are shown in Appendix A-2 Page 9.

4.3.11 Tanks

Show tanks as representative of actual tank shape and orientation per Appendices A-2 Page 6 and A-2 Page 7.

4.3.12 Classification of Equipment

The equipment classifications listed below are used on the example P&IDs contained in the Appendices for illustrative purposes only. These equipment classifications are only one example of classifications allowed by this Practice.

CLASS	SUBJECT	DESCRIPTION
A	Mixing Equipment	Agitators, Aerators, Mechanical Mixers
B	Blowers	Centrifugal Blowers, Positive Displacement Blowers, Fans
C	Compressors	Centrifugal, Reciprocating, Screw, Vacuum
D	Mechanical Drivers	Electric and Pneumatic Motors, Diesel Engines, Steam and Gas Turbines
E	Heat Exchangers	Unfired Heat Exchangers, Condensers, Coolers, Reboilers, Vaporizers and Heating Coils, Double Pipe, Spiral, Plate & Frame, Air Coolers
F	Furnaces	Fired Heaters, Furnaces, Boilers, Kilns
P	Pumps	Horizontal and Vertical Centrifugal, Positive Displacement, Vertical Canned, Screw, Gear, Sump
R	Reactors	
T	Towers / Columns	
TK	Tanks	API atmospheric and low pressure
U	Miscellaneous Equipment	Filters, Bins, Silos
V	Drums	Separators, Driers, Accumulators

4.3.13 Equipment Data

This section lists the data to be shown on the P&ID for types of equipment. Show this information on the P&ID in relation to the appropriate equipment symbol per Section 4.2.4.5. Show units of measure (e.g., GPM, PSIG, BTU/hr) for equipment data as required. Equipment not listed should be described as appropriate to convey important data.

4.3.13.1 Agitators, Mixers

- Equipment/Item Number
- Title/Service
- Power Requirements
- Materials of Construction

4.3.13.2 Blowers

- Equipment/Item Number
- Title/Service
- Capacity (Flow & D/P)
- Power Requirements
- Materials of Construction

4.3.13.3 Compressors

- Equipment/Item Number
- Title/Service
- Capacity (Flow & D/P)
- Power Requirements
- Materials of Construction

4.3.13.4 Furnaces

- Equipment/Item Number
- Title/Service
- Duty

4.3.13.5 Heat Exchangers

- Equipment/Item Number
- Title/Service
- Duty
- Surface Area
- Shell Design Pressure @ Temperature
- Tube Design Pressure @ Temperature
- Materials of Construction (Shell/Tubes)
- Trim (Shell/Tubes)
- Insulation

4.3.13.6 Pumps

- Equipment/Item Number
- Title/Service
- Capacity (Flow & TDH)
- Power Requirements

- Materials of Construction
- Insulation

4.3.13.7 Vessels/Tanks

- Equipment/Item Number
- Title/Service
- Size, Capacity
- Design Pressure @ Temperature
- Materials of Construction
- Trim
- Insulation

4.4 Piping

4.4.1 Line Data Identification

4.4.1.1 Show the line data identification per Appendix A-3 Page 1.

Do not use suffixes as part of the sequence number.

Sequence numbers typically originate and terminate at equipment. Assign different sequence numbers to line branches that terminate at different equipment numbers or lines.

Do not change the sequence number when the line flows through a piping specialty item or a control valve or when there is a line class break.

Assign different sequence numbers to the inlet and outlet of pressure relief valves.

4.4.1.2 The size and insulation thickness fields accommodate either English or metric units.

Show insulation code changes using the point of change symbol referenced in Appendix A-1 Page 2.

4.4.1.3 Show special layout requirements (e.g., No Pockets) with a note.

4.4.2 Line Service Codes

4.4.2.1 Line service codes are listed in Appendix A-3 Page 2. Additional line service codes can be added as required.

4.4.2.2 Each line service code consists of one to three alpha characters.

4.4.3 Piping Line Symbols

4.4.3.1 Show piping for primary, secondary, utility, jacketed or double containment, and future lines per Appendix A-3 Page 3.

4.4.3.2 Show piping for existing lines depicted on new P&IDs per Appendix A-3 Page 3.

4.4.3.3 Piping for new lines depicted on existing P&IDs are not covered by this Practice.

4.4.3.4 Show piping for above ground (AG) and underground (UG) lines in the same manner. Use an AG/UG line break or a piping line class break to distinguish between above ground and underground lines.

4.4.4 Valve Symbols

4.4.4.1 Show valve symbols per Appendix A-3 Page 4. Additional valve symbols may be added as required.

4.4.4.2 Show all valve symbols as full size. Do not show reduced size valve symbols for drain and vent valving.

4.4.4.3 Do not show valve size unless the size can not be clearly identified from the P&ID.

4.4.4.4 Use the listed valve symbols for defining control valve body types. If the control valve body type is unknown, use a gate valve or rotary valve symbol as the generic symbol.

4.4.4.5 Do not show root valves where these installation details can be adequately defined on a P&ID cover sheet detail.

4.4.4.6 Show permanent hydrotest high point vent and low point drain valves. Do not show temporary hydrotest valves (valves removed after testing).

Comment: These valves are typically identified in the later stages of P&ID development and verified when an "as built" issue is made.

4.4.4.7 Do not show valve tag (commodity) numbers. Use an abbreviation or a commodity reference to distinguish between two types of a similar valve where necessary.

4.4.4.8 Use a note or symbology to specify a valve's required installation/orientation when necessary (e.g., valves with a vented ball/disc).

4.4.4.9 Do not indicate valve end connections. The exceptions are a blinded, capped or plugged valve and any design where this requirement is critical.

4.4.4.10 Show integral bypass (warm-up/pressurization) valve where applicable.

4.4.5 Piping Specialty Items

4.4.5.1 Piping specialty items are items typically not specified in piping material specifications.

4.4.5.2 Show piping specialty items per Appendix A-3 Page 5. Additional piping specialty symbols may be added as required.

4.4.5.3 Assign a tag number to each piping specialty item if it is not included in the piping material specifications. Designate the tag number as “SP-XXXX” where SP indicates a special piping item and XXXX is a four character identifier. Designate identical piping specialty items located in multiple locations with the same tag number.

4.4.5.4 Piping speciality items may be tagged as equipment or instrument items.

4.4.6 Piping Fittings

4.4.6.1 Show typical piping fittings per Appendix A-3 Page 6. Additional piping fitting symbols may be added as required.

4.4.6.2 Show all reducers on the P&ID. Do not show reducer size if it can be clearly identified from the P&ID.

4.4.6.3 Show weld connections when appropriate (e.g., at vessel nozzles).

4.4.7 Off-Page Connectors and Tie-In Symbol

4.4.7.1 Use the off-page utility connector for lines which enter/exit a P&ID from a utility distribution type P&ID. A service description and equipment number reference are not required for utilities.

4.4.7.2 Use the primary/secondary line off-page connector for utility lines when these lines are the primary system represented on the P&ID. Utility primary systems include utility headers and non-distribution type utility lines (e.g., raw water treatment lines).

4.4.7.3 Use the off-plot connector for lines that cross unit or battery limits.

4.4.7.4 Designate Tie-Ins as “T-XXXX” where T indicates a Tie-In and XXXX is a four digit sequence number per Appendix A-3 Page 7.

4.4.8 Drain Connectors

4.4.8.1 Show the closed and open drain connectors per Appendix A-3 Page 8.

4.4.8.2 The drain connector consists of a connector number, a destination line service code and a reference P&ID number. The connector number is a unique five digit number that identifies a line between two continuation P&IDs. The destination line service code is per Appendix A-3 Page 2. If a P&ID reference is not required, use the drain connectors without the connector number and reference P&ID number.

4.4.9 Notes

4.4.9.1 The notes listed in Appendix A-3 Page 9 represent typical design notes. These are shown on the cover sheets (Appendix B).

4.4.9.2 Show specific design notes on the applicable P&ID.

4.5 Instrumentation & Controls

4.5.1 Symbology

4.5.1.1 Show instrument and control symbols per Appendices A-4 Page 1 through A-4 Page 8. Reference *ISA S5.1* for additional detail.

4.5.1.2 Follow the conventions established by *ISA S5.1* for tagging and numbering of instrument and control devices. Reference Appendix A-4 Page 1.

Comment: The tagging and numbering scheme described below is used on the example P&IDs contained in the Appendices for illustrative purposes only. This example tagging and numbering scheme is only one example of tagging and numbering schemes allowed by this Practice. The tagging structure is shown in the following example:

01 FC 100 01

01 - Plant Number (does not appear on P&IDs or in a "bubble")

FC - Function Identifier (e.g., Flow Controller)

100 - Equipment (or P&ID) Number (optional)

01 - Loop Sequence Number.

4.5.1.3 Identify all measurement types by ISA symbol. If necessary, add a descriptive text label (e.g., analysis components like CO, H_2, CH_4 or unique flow measurement devices like “Mass”).

4.5.1.4 Interlock symbology is depicted as follows:

- For discrete, hardware-based interlocks, use the conventional diamond symbol per *ISA S5.1* and *ISA S5.2*.
- For PLC-based interlocks, use the diamond-in-a-box symbol per *ISA S5.1* and *ISA S5.2*.
- For DCS-based interlocks, use the DCS symbol (bubble-in-a-box). For PLCs integral to the DCS, use the PLC symbol (diamond-in-a-box).

Reference Appendix A-4 Page 2 and Section 4.5.6 for additional information.

4.5.1.5 Use directional arrows on instrumentation signal lines only when the function is not obvious (e.g., cascades, selectors, interlocks).

4.5.1.6 Instrument Function Symbols, shown in Appendix A-4 Page 3, are used to clarify the function of certain tagged instrument bubbles. The symbol is placed outside the bubble at the upper right.

4.5.1.7 Use the off-page connector per Appendix A-3 Page 7 to depict continuation of instrumentation signals from one P&ID to another.

4.5.1.8 Do not show any individual instrument bubble more than once, unless needed to clarify operation of the loop. If an instrument bubble must be shown more than once, then the succeeding occurrences are shown as dotted. An example is turbine controls shown on a different sheet than the turbine.

4.5.1.9 Show Instrument Line Symbols per Appendix A-4 Page 4.

Do not use the alternative triple cross-hatched solid line allowed by *ISA S5.1* for electrical signals.

Do not use the ISA optional binary (on - off) symbols for instrument lines.

4.5.1.10 Show device location and accessibility per Appendix A-4 Page 2.

Use an instrument bubble with horizontal double dashed lines to show instrumentation in normally inaccessible auxiliary locations.

4.5.1.11 Use FO, per *ISA S5.1*, to tag all restriction orifices. Do not use RO for restriction orifice.

The same symbol (not tag) is used for a measuring flow element (FE) orifice and a restriction orifice (FO).

4.5.1.12 Instrument symbology on the P&ID does not necessarily reflect orientation. Physical arrangement is covered by installation details or special notes.

4.5.2 Measurements

4.5.2.1 Show all transmitters to avoid misinterpretations of physical and wiring connections between the transmitter and other devices or systems.

4.5.2.2 Do not show root valves (process connections) for instruments except for special non-standard requirements. Use typical details, contained in the cover sheets (Appendix B Page 4), to identify the valve type, size, rating and materials of construction, per the applicable piping line class (reference Section 4.4.4.5).

4.5.2.3 When instrument leads or analyzer lines are piping (e.g., level bridles), then the piping and related components are shown per Piping, Section 4.4. Where instrument leads are tubing, only the tubing is shown but tubing valves, connections and fittings are not shown.

Show both leads for differential pressure type measurements. Use a single line, representing two leads, to simplify the drawing where intent is clear (e.g., only a single line is typically shown for flange tap orifice meters).

4.5.2.4 Show dip tubes, bubblers and stilling wells for both process and instrumentation. Add notes for relevant specifications, materials, dimensions, weep holes, spray heads, etc. as required.

4.5.2.5 Show flow meters with the appropriate ISA symbol. If no unique symbol exists or if a device type is unknown, then use a generic symbol and provide a text label to identify the measurement type. Reference Appendix A-4 Page 5.

Provide a tag for all in-line generic flow meter bubbles. Show a bubble with loop tag for other flow meter element symbols only if the loop association is not readily apparent. Reference Section 4.2.1.12.

Show the size of all in-line devices if not line sized or otherwise implied.

4.5.2.6 Do not show flow meter accuracies. Use of a note to indicate special meter requirements is optional.

4.5.2.7 If used, flow conditioning devices (e.g., straightening vanes) are labeled with an instrumentation tag (e.g., "FX-…") associated with the flow measurement loop.

4.5.2.8 Do not show ISO-9000 or other quality designations.

4.5.2.9 Show a symbol and tag for a thermowell if it is a stand-alone, spare or test well.

Do not show thermowell symbols or tags if a thermal measuring element is connected to it unless the loop association is not readily apparent.

If a bare element is necessary (no thermowell), then a note or text label (e.g., BARE) must be added. Text is placed outside the symbol in the lower right.

4.5.2.10 Do not show thermal or temperature measuring elements (TE) with a symbol or tag unless the loop association is not readily apparent (e.g., dual elements).

4.5.2.11 Show process connection purge and blowback requirements for all measuring devices requiring it per Appendix A-1 Page 2. Include purge media and pressure. Show detailed hardware associated with purge/blowback (e.g., rotameters) on installation details, auxiliary P&IDs, or cover sheets.

4.5.2.12 Air supplies to individual devices are not generally shown. Show air supplies to solenoids or other special applications as needed to clarify valve porting or operation (e.g., trip solenoids or pneumatic hand switches).

4.5.2.13 Do not show air or inert gas purges on enclosures.

4.5.2.14 Show analyzer sample points and return lines and connections. Label analyzer piping per Appendix A-3 Page 1. Label analyzer tubing with size and the applicable Instrument Piping and Tubing System Specification from *PIP PCSIP001*. Show sample system hardware on analyzer or other auxiliary drawings.

4.5.2.15 Show a single stream analyzer on the same P&ID as its sample point.

Show multi-stream analyzers only once with off-page connectors from/to the multiple sample points/returns. Show sample connections that supply/return samples to/from multiple analyzers only once, with continuations to/from other analyzers.

Show measured components at the upper left of each analyzer or sample point bubble as required.

4.5.2.16 Show winterization and heat tracing requirements for analyzers and instrumentation. Place the insulation type code at the lower left of the bubble.

4.5.2.17 If an indicator is integral to a transmitter, then use a single bubble and tag (e.g., LIT). If separate devices are used for the transmitter and the indicator (e.g., a remotely located indicator), then show separate bubbles and tags (e.g., LT and LI).

4.5.2.18 Show level and gauge glasses with the appropriate symbol and tag. Use a single function (one bubble and tag) regardless of the number of individual sections required to span the length. A text label or note can be used to define the number of sections.

Show separate bubbles and tags for redundant glasses or those for applications with separate taps (e.g., overlapping gauges).

4.5.2.19 Do not show the distance between level connections.

4.5.3 Valves

4.5.3.1 Show valves per Appendix A-3 Page 4. The symbols for automated valve bodies and for manual valves are identical.

Use the appropriate actuator symbols (e.g., diaphragm and piston) to distinguish automated valves from manual valves. Reference Appendix A-4 Page 6.

> *Comment:* Typically, a throttling control valve is shown with a diaphragm actuator and an on-off valve is shown with a cylinder/piston actuator, regardless of actual type.

Use the symbols shown in Appendix A-4 Page 7 for pressure and temperature regulators.

4.5.3.2 Show automated valve fail actions with text (FC/FO/FL/FI) per *ISA S5.1*. Reference Section 4.2.4.9. Using stem arrows as outlined in *ISA S5.1* is not recommended.

For multi-port automated valves, use FL and FI where appropriate. Do not use FO and FC. Use arrows to show fail position flow paths. Note that multiple arrows may be required.

Valves that have different fail actions for loss of signal and for loss of motive power require an explanatory note.

4.5.3.3 Show valve body sizes for all automated valves if not line sized or otherwise implied. Reference Section 4.2.4.10.

4.5.3.4 Do not show automated valve specifications or commodity codes.

4.5.3.5 For automated valves, identify tight shut-off requirements (defined in this Practice as *ANSI Class V* or *VI*) by using the abbreviation "TSO." Reference Section 4.2.4.11.

Comment: TSO defines the seat shut-off requirements for a new valve. Testing requirements, if any, are defined in other unit operation documents.

4.5.3.6 Do not show valve identifying tags with bubbles when the associated loop tag is readily apparent. Show an identifying tag with a bubble for split range valves, self-contained regulators or valves located on a separate P&ID from its controller. Reference Section 4.2.1.11.

4.5.3.7 Show the ranges (e.g., 0-50%, 50-100%) for split range control valves. The preferred labeling is controller percentage output since it applies to both pneumatic and electronic systems.

4.5.3.8 Do not show valve positioners unless necessary to clarify loop operation (e.g., when used with trip solenoids or pneumatic trip relays). When shown, valve positioners are normally included with the automated valve symbol and are not tagged.

4.5.3.9 If current to pneumatic converters (I/Ps) are used, show them with a bubble symbol, tag and function box only if furnished and mounted separately from the control valve, or when used with a trip solenoid valve.

4.5.3.10 Show all solenoids that actuate final control elements (e.g., trip valves and pneumatic relays).

4.5.3.11 Show solenoid valve fail actions using a directional arrow indicating the open flow path when de-energized. Note that a 4-way solenoid valve requires two directional arrows to adequately define the flow paths. Show resets (manual or remote) if included with the solenoid valve.

4.5.3.12 Identify limit switches on automated valves with a bubble and tag. The open or closed tag may be depicted with ZSO or ZSC. When both limit switches are provided, a single bubble is used with O and C modifiers outside the bubble.

Limit switches on diverter valves can be tagged as ZST and ZSD for the Through and Divert positions.

4.5.3.13 Show automated valve auxiliaries (e.g., handwheels, volume tanks, nitrogen back-up bottles). The use of typical details will reduce clutter.

Use a note to identify the need for valve travel stops.

4.5.3.14 Show setpoints on regulators.

4.5.4 Safety/Relief Devices

4.5.4.1 Show and tag relief devices and conservation vents per Appendix A-4 Page 7 (e.g., PSE and PSV). Use optional explanatory text for clarification of the type and function of the device (e.g., "Emergency Relief," "Conservation Vent," "Explosion Panel") located next to the tag. Reference Sections 4.2.1.15 and 4.2.1.16.

PSV typically refers to reclosing devices. PSE typically refers to non-reclosing devices.

Use PSE only for safety related service. Use PCV or PCE for non-safety conservation vents.

Comment: Per *ISA S5.1* (Table 1, Note 8), "The designation PSV applies to all valves intended to protect against emergency pressure conditions regardless of whether the valve construction and mode of operation place them in the category of the safety valve, relief valve or safety relief valve."

4.5.4.2 Show relief device set pressures.

4.5.4.3 Show the relief device size:

- PSVs - inlet size and outlet size
- Rupture discs - disc diameter
- Conservation vents - inlet nozzle size if there is not a pipe away or tail piece, otherwise show inlet size and outlet size
- Explosion panels - surface area or dimensions

4.5.4.4 Show the orifice size letter designation for relief valves between the inlet and outlet sizes (e.g., 3K4). Do not show the relief device sizing basis or flow capacity.

4.5.4.5 Do not show the materials of construction for relief devices.

4.5.5 Equipment Start/Stops

4.5.5.1 Do not show the local start/stop hand switch for motors without remote controls.

Show local (field) hand switches (bubble and tag) that:

- Are part of an operator control panel
- Interface with other systems (e.g., interlocks)
- Otherwise need explanation

4.5.5.2 Show all control room (DCS or panel board) hand switches with the appropriate bubble symbol and tag.

4.5.5.3 Label all hand switch positions or functions. Locate the labels outside the bubble symbol, on the upper right, using the standard text abbreviations shown in the Appendices. All others must be spelled out.

4.5.5.4 Clearly show all required feedback signals or functions (e.g., valve positions, run lights). Hardwired signals are normally shown using standard instrument line symbols. Soft-linked feedback functions can be shown outside the display bubble at the upper left.

4.5.6 Interlocks & Alarms

Interlocks are shown only symbolically on the P&ID. Functional definition is shown on auxiliary documents (e.g., binary logic diagrams, descriptive narratives, truth tables).

Comment: Interlocks are designed for a variety of functions, from simple process sequences to complex safety shutdown systems. A variety of hardware is used for implementation (e.g., DCS, PLC, relays, redundant, fault-tolerant Safety Interlock Systems).

Alarms are similarly designed in a variety of ways. Alarms come from hardware, over serial links, from DCS software and they are shown on a variety of facility documents, including P&IDs, alarm summaries, logic and loop diagrams and operating procedures.

Because of this variety, along with individual Owner interpretations of the requirements of *OSHA 1910.119* and *ISA S84.01*, many documentation aspects of interlock and alarm system design will be defined by the Owner.

4.5.6.1 Show logic functions or interlocks with the proper symbols per Section 4.5.1. Do not show binary logic gates, input/output tables or descriptive narratives.

4.5.6.2 All logic function and interlock symbols contain an identification that provides reference to a unique logic diagram, narrative, truth table or program. The reference is located within the interior of the symbol. The format of the reference is determined by the Owner. Descriptive text or a note reference may be placed outside the symbol.

If Safety Instrumented Systems (SIS) are distinguished from other interlock systems, the preferred method is to add an “S” prefix to the unique interlock identification.

Each interlock is uniquely labeled, using a serial (not parallel) tagging scheme. The “S” prefix is not used to distinguish a unique

interlock label. A valid tagging scheme is I-100, I-101, SI-200, SI-201. The scheme I-100, SI-100 is not valid.

4.5.6.3 Do not show the type of logic solver hardware or level of redundancy except through the normal use of ISA symbols and the input and output signals described in Section 4.5.1 and the Appendices.

4.5.6.4 Do not show classifications or Safety Integrity Levels (SIL) for interlocks.

4.5.6.5 Show all operator initiated interlock trip and reset hand switches.

4.5.6.6 If used, show all bypass hand switches for SIS interlocks. This includes all individual initiator and system bypass switches. Unnecessary clutter can be avoided by use of a table or reference note if large numbers of bypasses are necessary.

4.5.6.7 Show all hardwired alarms.

4.5.6.8 Show all alarms that require engineering or other review and approval based on safety or operability.

4.5.6.9 Show hardware-based diagnostic alarms. Show software-based diagnostic alarms only if safety or operationally related (e.g., defined in safety reviews). Measurement out-of-range alarms are an example of software diagnostic alarms not generally shown.

4.5.6.10 Show required alarms with tag and level (e.g., PAH), but do not show alarm trip points or settings.

For alarms based on analog measurements, the functional tag (e.g., PI) is shown inside the bubble and the alarm levels are shown outside the bubble. High alarms (e.g., H, HH) are placed at the upper right outside the bubble, while low alarms (e.g., L, LL) are placed at the lower right outside the bubble. The alarm modifier (A) is not shown.

For discrete alarm points (on/off signals), the complete functional tag and alarm level (e.g., PAH) is shown inside the bubble.

4.5.6.11 Standard *ISA S5.1* abbreviations are used for both trip and alarm functions (e.g., LSHH and LAHH).

4.5.7 DCS Points

Show a DCS point if operations manipulates the process with it or receives information from it or the point is essential to understanding the functional operation of the process controls. It is not necessary to show every point configured in a DCS. It is not necessary to include implied functions (e.g., I for indicate, R for recorder) in every DCS point tag.

Comment: It is not the intent of this section to define which DCS points to show for every supplier of a DCS or each type of system which can communicate with a DCS via a software link (e.g., analyzer data

highways, anti-surge control systems, vibration monitoring systems, Safety Instrumented Systems, PLCs, tank gauging systems).

Application of these criteria to specific systems will determine which DCS points to show. DCS points not shown may be displayed on special purpose auxiliary drawings.

4.5.7.1 Show DCS points that indicate measured process values. Include both analog and digital values obtained from hardwired inputs or via software links. Examples include flows, temperatures, pressures, compositions from analyzers and valve open/closed status.

Do not show DCS points that exist solely to transmit input signals from field hardware to other DCS points. For example, do not show a flow indicator point if the value is represented by a flow controller point on the P&ID.

4.5.7.2 Show DCS points that manipulate analog or digital output hardware devices. Examples include flow, temperature and pressure controllers, hand switches and logic points.

Do not show DCS points that exist solely to transmit control signals from other DCS points to field hardware. Examples include analog and digital output points.

4.5.7.3 Show DCS points that operations employs to manipulate the process via the BPCS. Examples include regulatory controllers and pump start/stop switches.

4.5.7.4 Show DCS points that provide operations an interface to manipulate the process through a software link to other systems. Examples include points that interface with controllers in the linked system and SIS reset hand switches.

4.5.7.5 Show DCS points that are essential to understanding the operation of the process controls. Examples include selectors in override controls or enthalpy calculators in heat duty controls.

4.5.7.6 Show DCS points that are required for regulatory compliance and mechanical integrity needs. Examples might include rolling averages for emissions monitoring or compressor runtimes.

4.5.7.7 Show DCS points that are necessary to understand the functional operation of process control schemes. Do not show points needed only for implementation (e.g., points that provide bumpless transfer, initialization, some logic functions).

4.5.7.8 Do not show Higher Level Control Systems. For example, do not show model predictive multivariable control systems.

Do not add symbols (e.g., hexagons, footballs) to indicate that a BPCS DCS point is being manipulated by a Higher Level Control System. A note may be used to reference HLCS details.

4.5.7.9 Do not show DCS points that exist solely to facilitate information transfer via a software link.

4.5.7.10 Do not show DCS points that are used solely to log, journal or time stamp events.

4.5.8 Miscellaneous

4.5.8.1 Specifically exclude the following information:

- Controller actions
- Controller and alarm setpoints
- Configuration information (e.g., controller or output actions, address information)

4.5.8.2 Show miscellaneous instrument symbols per Appendix A-4 Page 8.

4.5.8.3 Show typical details, illustrating the use of implied tags, per Appendix B Page 4.

Appendices

The Appendices of this Practice contain tables of commonly used symbols, abbreviations and other identifiers, as well as typical details and example P&IDs.

Appendix A contains symbols and text grouped by function. The symbols and text are shown the same size as would be utilized for a standard full size (22" x 34") P&ID.

Appendix B contains the same data as Appendix A, organized into cover sheets. Cover sheets are also commonly referred to as lead sheets or legend sheets.

Electronic native files for the text, symbols and cover sheets are available from PIP for input to member's CAD systems. Development of project specific cover sheets is recommended using the PIP native files as a starting point. Additions and/or deletions are allowed to meet requirements. Cover sheet borders and title blocks may be altered.

Appendix C contains example P&IDs that illustrate the text and utilize the symbols and legends on the cover sheets.

Comment: The cover sheets and P&IDs are drawn as standard full size (22" x 34") P&IDs, but reduced to standard PIP Practice 8 1/2" x 11" pages for electronic distribution purposes. It is recommended that the cover sheets and P&IDs be printed on 11" x 17" pages. This requires use of a PostScript printer driver.

Appendix A – Tables & Symbols

A-1 Format Tables & Symbols

1. Abbreviations
2. Miscellaneous Symbols

A-2 Equipment Tables & Symbols

1. Pumps
2. Compressors & Blowers
3. Drivers & Agitator/Mixer
4. TEMA Type Exchangers
5. Miscellaneous Exchangers
6. Storage Tanks
7. Storage Tanks
8. Storage Sphere and Furnace
9. Miscellaneous Vessel Details

A-3 Piping Tables & Symbols

1. Line Data Identification
2. Line Service Codes
3. Piping Line Symbols
4. Valve Symbols
5. Piping Specialty Items
6. Piping Fittings
7. Off-Page Connectors and Tie-In Symbol
8. Drain Connectors
9. Notes

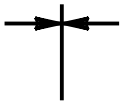
A-4 Instruments & Controls Tables & Symbols

1. Instrument Identification Letters
2. General Instrument Symbols
3. Instrument Function Symbols
4. Instrument Line Symbols
5. Primary Element Symbols (Flow)
6. Control Valve Actuator Symbols
7. Self-Actuated Devices
8. Miscellaneous Instrument Symbols.

ABBREVIATIONS

AG	ABOVE GROUND
ATM	ATMOSPHERE
BL	BATTERY LIMIT
BTL	BOTTOM TANGENT LINE
BYP	BYPASS
CC	CHEMICAL CLEANOUT
CL	CENTERLINE
CO	CLEANOUT
CONN	CONNECTION
CSC	CAR SEAL CLOSED
CSO	CAR SEAL OPEN
CTR	CENTER
DCS	DISTRIBUTED CONTROL SYSTEM
DES	DESIGN
DIA	DIAMETER
DP	DESIGN PRESSURE
D/P	DIFFERENTIAL PRESSURE
DRN	DRAIN
DT	DESIGN TEMPERATURE
DWG	DRAWING
(E)	EXISTING
EL	ELEVATION
ESD	EMERGENCY SHUTDOWN
FOF	FACE OF FLANGE
(F)	FURNISHED
FC	FAIL CLOSED
FI	FAIL INDETERMINATE
FL	FAIL LOCKED (LAST POSITION)
FLG	FLANGE
FO	FAIL OPEN
FP	FULL PORT
FV	FULL VACUUM
GO	GEAR OPERATED
GR	GRADE
HC	HOSE CONNECTION
HDR	HEADER
HH	HAND HOLE
HOA	HAND/OFF/AUTOMATIC
HP	HIGH PRESSURE
HPT	HIGH POINT
IAS	INSTRUMENT AIR SUPPLY
ISBL	INSIDE BATTERY LIMITS
LC	LOCKED CLOSED
LO	LOCKED OPEN
LP	LOW PRESSURE
LPT	LOW POINT
MTL	MATERIAL
MAX	MAXIMUM
MIN	MINIMUM
MOV	MOTOR OPERATED VALVE
MW	MANWAY
NC	NORMALLY CLOSED
NNF	NORMALLY NO FLOW
NO	NORMALLY OPEN
NOZ	NOZZLE
O/C	OPEN/CLOSE
O/O	ON/OFF
OP	OUTPUT
OSBL	OUTSIDE BATTERY LIMITS
OVHD	OVERHEAD
PLC	PROGRAMMABLE LOGIC CONTROLLER
PRESS	PRESSURE
PV	PROCESS VARIABLE
(R)	RELOCATED
REQD	REQUIRED
RTD	RESISTANCE TEMPERATURE DETECTOR
SC	SAMPLE CONNECTION
SCH	SCHEDULE
SD	SHUTDOWN
SG	SPECIFIC GRAVITY
SIS	SAFETY INSTRUMENTED SYSTEM
SO	STEAM OUT
SP	SET POINT
SS	STAINLESS STEEL
S/S	START/STOP
STD	STANDARD
T/C	THERMOCOUPLE
TDH	TOTAL DIFFERENTIAL HEAD
TEMP	TEMPERATURE
THRD	THREADED
TL	TANGENT LINE
TSO	TIGHT SHUT-OFF
T/T	TANGENT TO TANGENT
TYP	TYPICAL
UG	UNDERGROUND
VNT	VENT
VAC	VACUUM
VB	VORTEX BREAKER
W/	WITH
W/O	WITHOUT

NOTE REFERENCE SYMBOL
(XX = NOTE NUMBER, ROTATE
ARROW AS REQUIRED)



POINT OF CHANGE
IN LINE CLASS OR
INSULATION REQUIREMENT

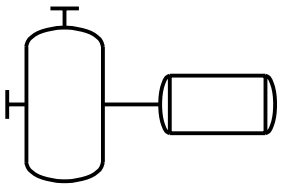
BATTERY LIMITS
(OR MATCH LINE)

PURGE CONNECTION
(XXXX = PURGE PRESSURE AND MEDIUM)

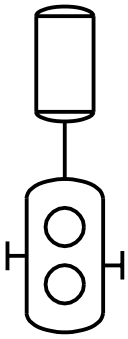
SAMPLE CONNECTION
(XX/YY = TYPE/NUMBER)

PACKAGED EQUIPMENT LIMITS

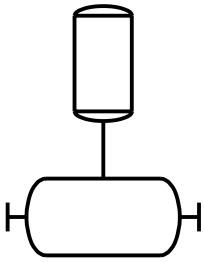
NOTE: SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS



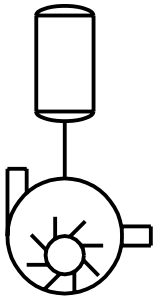
HORIZONTAL
CENTRIFUGAL PUMP



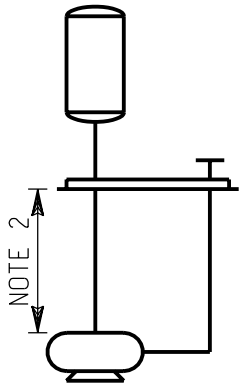
POSITIVE
DISPLACEMENT PUMP



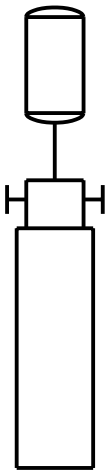
VERTICAL
INLINE PUMP



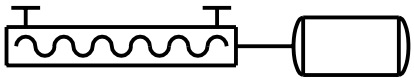
LIQUID RING
VACUUM PUMP



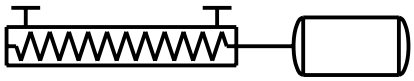
CENTRIFUGAL
SUMP PUMP



VERTICAL CAN PUMP



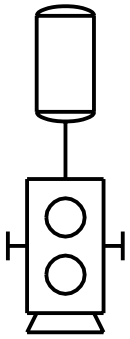
PROGRESSIVE CAVITY PUMP



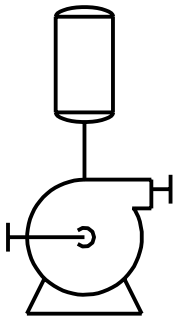
SCREW PUMP

NOTES:
1. SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" DOCUMENTS.
2. LENGTH VARIES DEPENDING UPON DEPTH OF SUMP.
3. MOTORS SHOWN HERE TO ILLUSTRATE DRIVER ORIENTATION. FOR DRIVER SYMBOLS, SEE APPENDIX A-2, p.3.

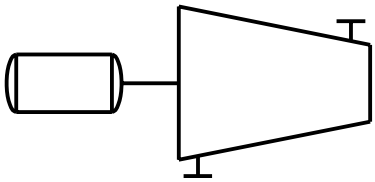
EQUIPMENT SYMBOLS
COMPRESSORS & BLOWERS



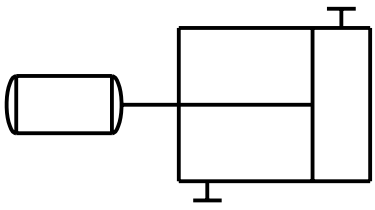
POSITIVE DISPLACEMENT BLOWER



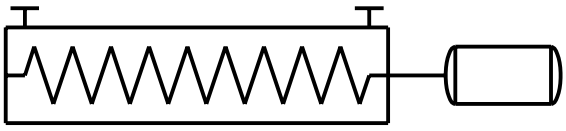
CENTRIFUGAL BLOWER



CENTRIFUGAL COMPRESSOR



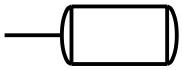
RECIPROCATING COMPRESSOR



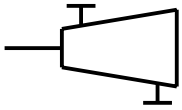
SCREW COMPRESSOR

NOTES:
1. SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" DOCUMENTS.
2. MOTORS SHOWN HERE TO ILLUSTRATE DRIVER ORIENTATION. FOR DRIVER SYMBOLS, SEE APPENDIX A-2, p.3.

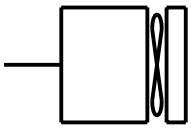
EQUIPMENT SYMBOLS
DRIVERS & AGITATOR/MIXER



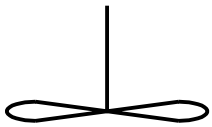
ELECTRIC MOTOR



TURBINE DRIVER



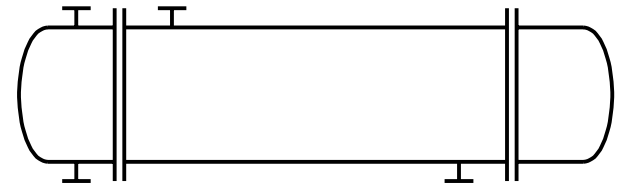
DIESEL ENGINE



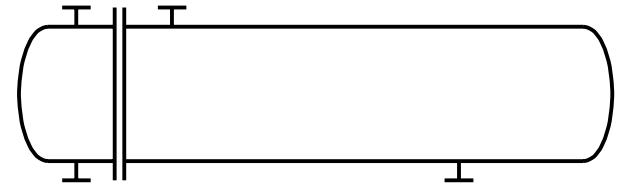
AGITATOR/MIXER

NOTE: SYMBOLS SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" DOCUMENTS.

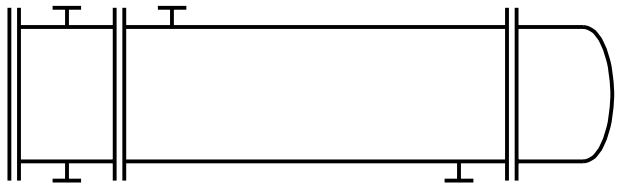
EQUIPMENT SYMBOLS
TEMA TYPE EXCHANGERS



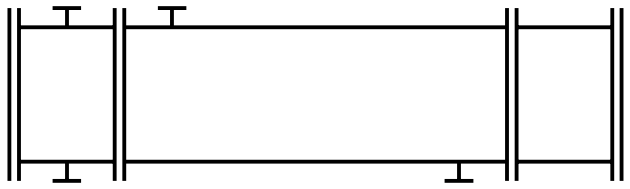
TEMA TYPE BEM



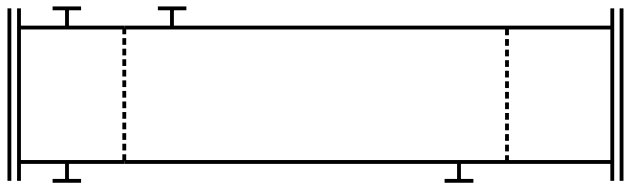
TEMA TYPE BEU



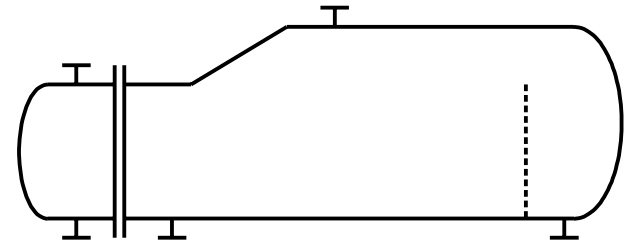
TEMA TYPE AEM



TEMA TYPE AEL



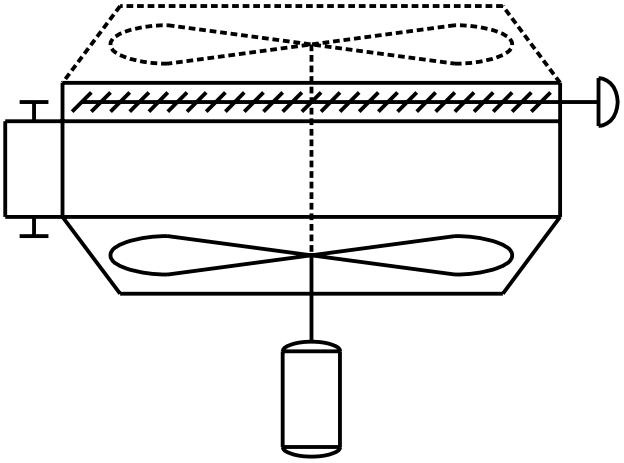
TEMA TYPE NEN



TEMA TYPE BKU

NOTES:
1. SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" DOCUMENTS.
2. CONSULT TEMA FOR TYPES OTHER THAN THOSE SHOWN.
3. EXCHANGERS SHOWN HERE REPRESENT SINGLE PASS SHELL AND EVEN NUMBER OF TUBE PASSES.

EQUIPMENT SYMBOLS
MISCELLANEOUS EXCHANGERS



AIR COOLED EXCHANGER
(LOUVERS OPTIONAL)

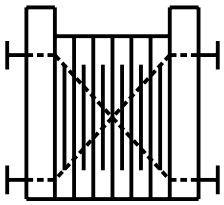
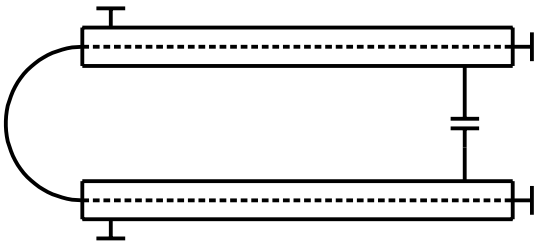
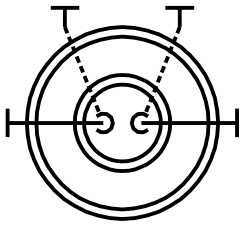


PLATE AND FRAME EXCHANGER

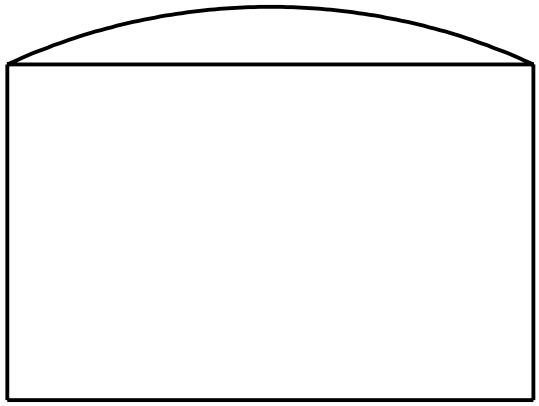


DOUBLE PIPE EXCHANGER



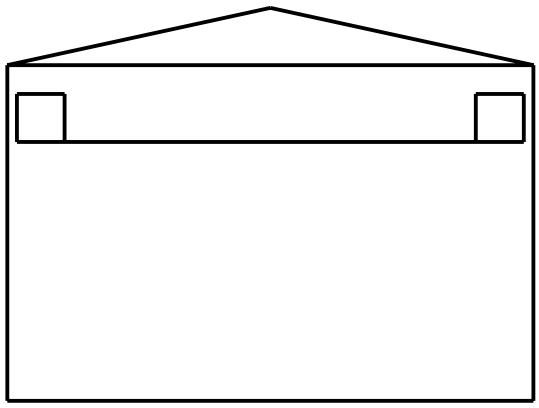
SPIRAL EXCHANGER

NOTE: SYMBOLS SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" DOCUMENTS.



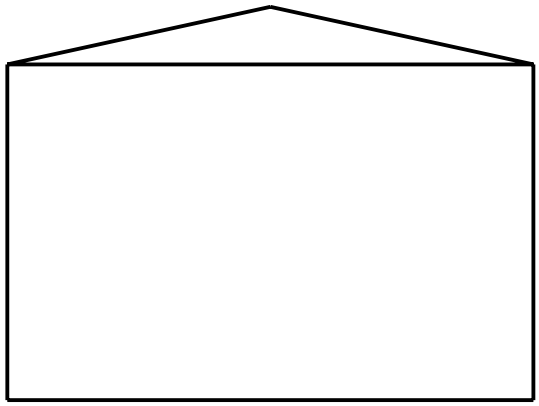
DOME ROOF TANK

OPEN TOP TANK

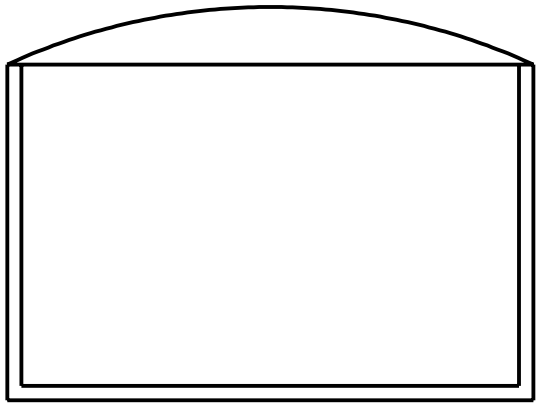


INTERNAL FLOATING ROOF TANK

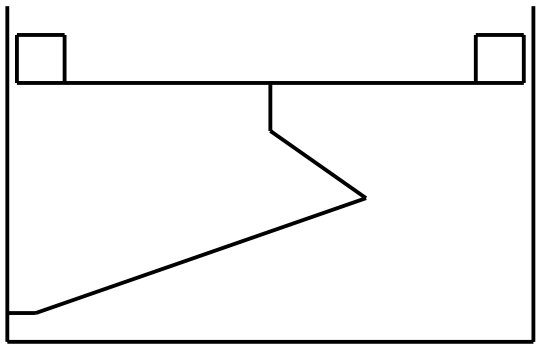
NOTE: ACTUAL SIZE WILL VARY.



CONE ROOF TANK

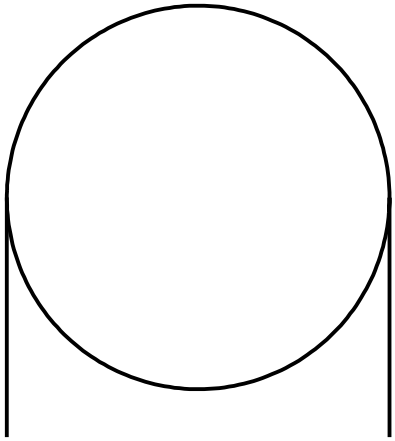


DOUBLE WALL TANK

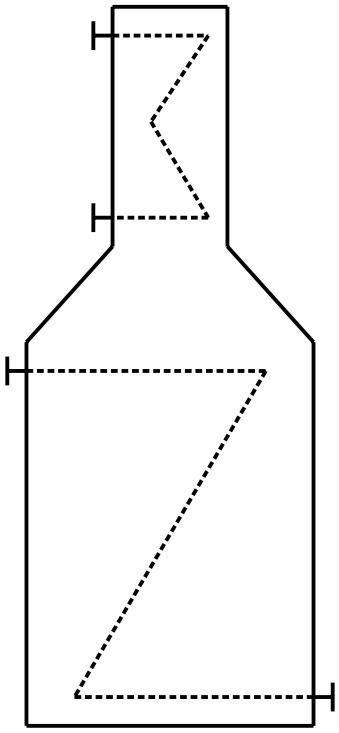


EXTERNAL FLOATING ROOF TANK

NOTE: ACTUAL SIZE WILL VARY.

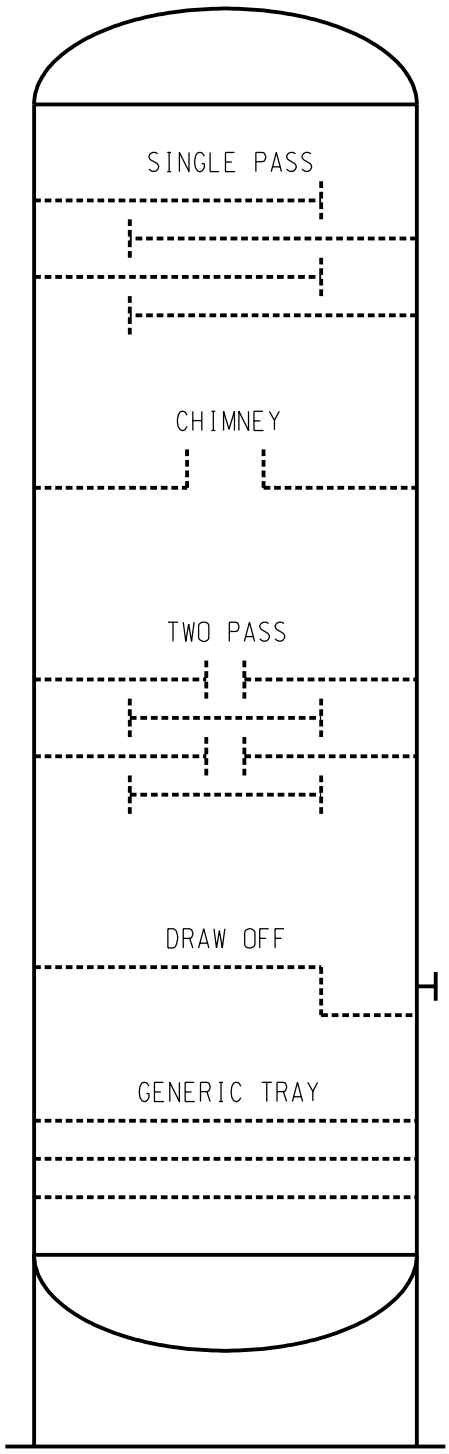


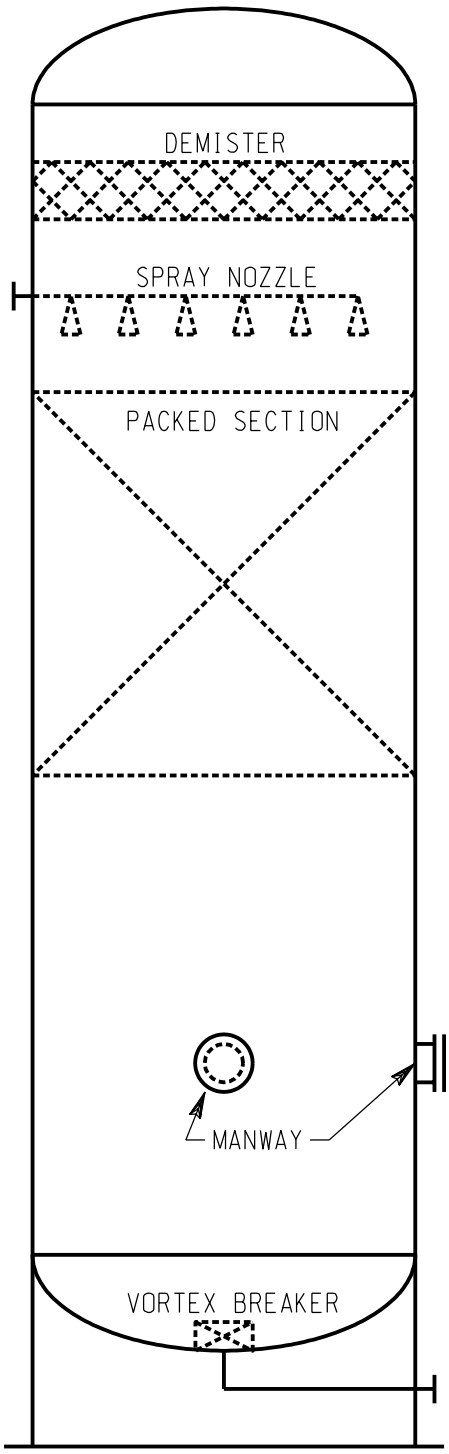
SPHERE



FURNACE

NOTE: ACTUAL SIZE WILL VARY.





NOTE: ACTUAL SIZE WILL VARY.

UNIT/AREA (NUMERIC)	SERVICE (ALPHA)	SEQUENCE (NUMERIC)	SIZE (NUMERIC)	LINE CLASS (NOTE 1)
XX	XXX	XXXXX	XXXX	XXXXXXXXXX

INSUL. TYPE (NOTE 2)	THICKNESS (NUMERIC)	OPTIONAL (USER DEFINED)
XXXX	XXXX	XXXX

NOTES:
1. DEFINED BY PIP PNSM0001; PIPING LINE CLASS DESIGNATOR SYSTEM. FOR INSTRUMENT PIPING AND TUBING SPECIFICATION, SEE PIP PCSIP001.
2. DEFINED BY PIP INEG1000; INSULATION DESIGN AND TYPE CODES.

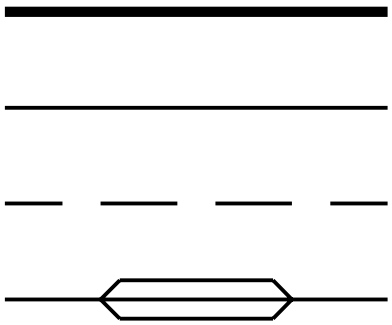
AV	ATMOSPHERIC VENT
BA	BREATHING AIR
BD	BLOWDOWN
BFW	BOILER FEED WATER
BRR	BRINE RETURN
BRS	BRINE SUPPLY
CC	CONTAMINABLE CONDENSATE
CF	COLD FLARE
CHS	CHEMICAL SEWER
CV	COLD VENT
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
DMW	DEMINERALIZED WATER
DR	DRAIN
DS	DILUTION STEAM
DW	DRINKING WATER
ER	ETHYLENE REFRIGERANT
FF	FLUSHING FLUID
FG	FUEL GAS
FO	FUEL OIL
FW	FIRE WATER
GLR	GLYCOL RETURN
GLS	GLYCOL SUPPLY
H	HYDROGEN
HS	HIGH PRESSURE STEAM
IA	INSTRUMENT AIR
IS	INTERMEDIATE PRESSURE STEAM
LNG	LIQUIFIED NATURAL GAS
LO	LUBE OIL
LPG	LIQUIFIED PETROLEUM GAS
LS	LOW PRESSURE STEAM
ME	METHANOL
MR	MIXED REFRIGERANT
MS	MEDIUM PRESSURE STEAM
N	NITROGEN
NA	CAUSTIC
NAS	CAUSTIC SEWER
NG	NATURAL GAS
NH	AMMONIA
OWS	OILY WATER SEWER
OX	OXYGEN
P	GENERAL PROCESS
PA	PLANT AIR
PC	PROCESS CONDENSATE
PR	PROPYLENE REFRIGERANT
PW	PROCESS WATER
QO	QUENCH OIL
RS	RECOVERED SLOPS
RV	RELIEF VENT
RW	RAW WATER
SC	STEAM CONDENSATE
SG	SYNTHESIS GAS
SO	SEAL OIL
SS	SANITARY SEWER
STS	STORM SEWER
SW	SERVICE WATER
SWR	SEA WATER RETURN
SWS	SEA WATER SUPPLY
TWR	TEMPERED WATER RETURN
TWS	TEMPERED WATER SUPPLY
VC	VACUUM CONDENSATE
VE	VACUUM EXHAUST
WF	WARM FLARE
WO	WASH OIL
WW	WASTE WATER

PRIMARY (AG & UG)

SECONDARY / UTILITY (AG & UG)

FUTURE OR EXISTING ON NEW P&IDs

JACKETED OR DOUBLE CONTAINMENT



VALVE SYMBOLS


GATE (OR GENERIC)


CHECK


STOP CHECK


GLOBE


BUTTERFLY


NEEDLE


BALL


GENERIC ROTARY (1/4 TURN)


PLUG

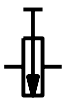

DIAPHRAGM


3-WAY


4-WAY


PINCH


ANGLE


KNIFE

NOTE: SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS


Y-TYPE STRAINER


EJECTOR/EDUCTOR


CONE STRAINER

REMOVABLE SPOOL


T-TYPE STRAINER

DESUPERHEATER


DUPLEX STRAINER


FLEXIBLE HOSE


BASKET STRAINER


EXPANSION JOINT


TEMPORARY STRAINER


DAMPER


FILTER


BREATHER

DETONATION ARRESTOR


VENT COVER

FLAME ARRESTOR


IN-LINE MIXER

STEAM TRAP


DIVERTER VALVE


EXHAUST HEAD


ROTARY VALVE

IN-LINE SILENCER


EXCESS FLOW VALVE

VENT SILENCER


PULSATION DAMPENER

NOTE: SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS


FLANGE

WELDED CONNECTION


CAP


CONCENTRIC (OR GENERIC) REDUCER


ECCENTRIC REDUCER


HOSE CONNECTION


SPACER


BLANK


OPEN FIGURE 8 BLIND

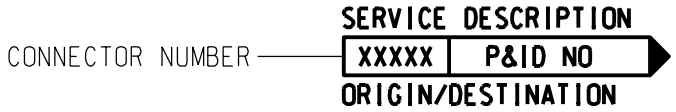

CLOSED FIGURE 8 BLIND


PLUG

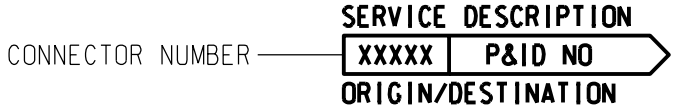
BLIND FLANGE

NOTE: SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS

A. OFF-PLOT CONNECTOR



B. PRIMARY/SECONDARY LINES AND INSTRUMENT SIGNAL CONNECTOR

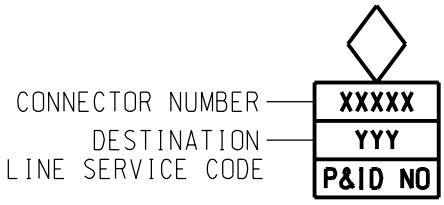


C. UTILITY CONNECTOR

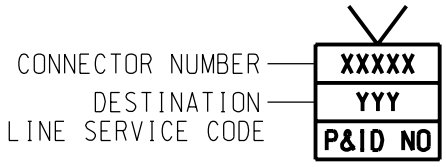
D. TIE-IN SYMBOL

NOTE: SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS

CLOSED DRAIN



OPEN DRAIN



CLOSED DRAIN (NO P&ID)

OPEN DRAIN (NO P&ID)

NOTE: SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS

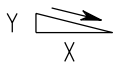
NOTES

1. FOR GENERAL PIPING REQUIREMENTS, SEE DESIGN SPECIFICATION PIP PNE00001. FOR INSTRUMENT PIPING AND TUBING SYSTEMS CRITERIA, SEE PIP PCCIP001.

2. ALL SINGLE VALVED CONNECTIONS TO ATMOSPHERE IN PROCESS SERVICE WILL BE PLUGGED, CAPPED OR BLIND FLANGED.

3. ALL VENTS AND DRAINS ARE 3/4" UNLESS OTHERWISE NOTED.

4. DEFINITIONS:

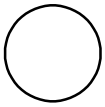
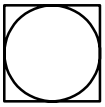
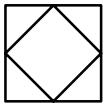
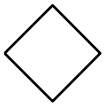
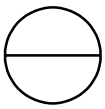
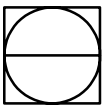
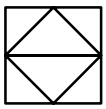
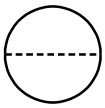
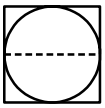
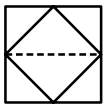
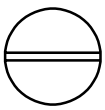
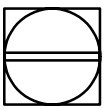
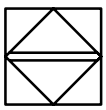
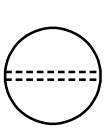
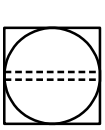
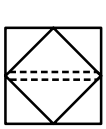
GRAVITY FLOW	ELEVATIONS DOWNSTREAM NEVER EXCEED INLET ELEVATIONS. LINE MAY CONTAIN POCKETS.
	SLOPED LINE: NO POCKETS PERMITTED.
FREE DRAINING TO XXXX	NO POCKETS PERMITTED.
NO POCKETS	NO POCKETS IN LINE.

5. CLOSED PRESSURE RELIEF VALVE DISCHARGE LEADS SHALL BE FREE DRAINING FROM THE PRESSURE RELIEF VALVE TO THE TOP OF THE DISCHARGE HEADER.

6. 3/8" WEEP HOLES ARE PROVIDED AT LOW POINTS OF VENT, PRESSURE RELIEF VALVE AND RUPTURE DISK DISCHARGE LINES TO ATMOSPHERE.

7. REDUCERS IN PRESSURE RELIEF VALVE INLET OR OUTLET PIPING SHALL BE INSTALLED IMMEDIATELY ADJACENT TO THE PRESSURE RELIEF VALVES.

FIRST LETTER			SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, FLAME, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	USER'S CHOICE (TYPICALLY CONDUCTIVITY - ELECTRICAL)			CONTROL	CLOSED
D	USER'S CHOICE (TYPICALLY DENSITY OR SPECIFIC GRAVITY)	DIFFERENTIAL			DIVERT
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO (FRACTION)			
G	USER'S CHOICE OR GAUGING (DIMENSIONAL)		GLASS, VIEWING DEVICE		
H	HAND				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	USER'S CHOICE (TYPICALLY MOISTURE OR HUMIDITY)	MOMENTARY			MIDDLE, INTERMEDIATE
N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE, RESTRICTION		OPEN
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY OR HEAT DUTY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	THROUGH
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, UNCLASSIFIED FINAL CONTROL ELEMENT	

LOCATION/ACCESSIBILITY	DISCRETE INSTRUMENTS	SHARED DISPLAY AND CONTROL (DCS)	PLC	DISCRETE HARDWARE INTERLOCK
FIELD MOUNTED 1. FIELD OR LOCALLY MOUNTED. 2. ACCESSIBLE TO AN OPERATOR AT DEVICE.				
PRIMARY LOCATION NORMALLY ACCESSIBLE TO AN OPERATOR 1. CENTRAL OR MAIN CONTROL ROOM. 2. FRONT OF MAIN PANEL OR CONSOLE MOUNTED. 3. VISIBLE ON VIDEO DISPLAY. 4. ACCESSIBLE TO AN OPERATOR AT DEVICE OR CONSOLE.				
PRIMARY LOCATION NORMALLY INACCESSIBLE TO AN OPERATOR 1. CENTRAL OR MAIN CONTROL ROOM. 2. REAR OF PANEL OR CABINET MOUNTED. 3. NOT VISIBLE ON VIDEO DISPLAY. 4. NOT NORMALLY ACCESSIBLE TO AN OPERATOR AT DEVICE OR CONSOLE.				
AUXILIARY LOCATION NORMALLY ACCESSIBLE TO AN OPERATOR 1. SECONDARY OR LOCAL CONTROL ROOM. 2. FIELD OR LOCAL CONTROL PANEL. 3. FRONT OF SECONDARY OR LOCAL PANEL MOUNTED. 4. VISIBLE ON VIDEO DISPLAY. 5. ACCESSIBLE TO AN OPERATOR AT DEVICE OR CONSOLE.				
AUXILIARY LOCATION NORMALLY INACCESSIBLE TO AN OPERATOR 1. SECONDARY OR LOCAL CONTROL ROOM. 2. FIELD OR LOCAL CONTROL PANEL. 3. REAR OF SECONDARY OR LOCAL PANEL OR CABINET MOUNTED. 4. NOT VISIBLE ON VIDEO DISPLAY. 5. NOT NORMALLY ACCESSIBLE TO AN OPERATOR AT DEVICE OR CONSOLE.				

NOTE:
1. MULTIPLE LOCATIONS OF THE SAME TYPE CAN BE DISTINGUISHED BY ADDING A TEXT LABEL OR NOTE.
2. SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS

	SUMMING		HIGH SELECT
	AVERAGING		LOW SELECT
	DIFFERENCE		HIGH LIMIT
	MULTIPLYING		LOW LIMIT
	DIVIDING		BIAS
	SQUARE ROOT		UNSPECIFIED FUNCTION
	EXPONENTIAL		USER DEFINED

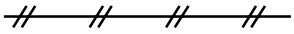
CONVERSION INPUT/OUTPUT **

A	ANALOG	I	CURRENT
B	BINARY	O	ELECTROMAGNETIC, SONIC
D	DIGITAL	P	PNEUMATIC
E	VOLTAGE	R	RESISTANCE (ELECTRICAL)
H	HYDRAULIC		

NOTE: SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS

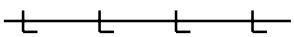
INSTRUMENT SUPPLY OR CONNECTION TO PROCESS

PNEUMATIC SIGNAL

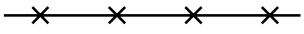


ELECTRIC SIGNAL

HYDRAULIC SIGNAL

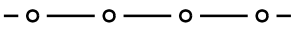


CAPILLARY TUBE

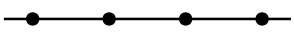


ELECTROMAGNETIC, SONIC, OPTICAL, OR NUCLEAR SIGNAL

SOFTWARE OR DATA LINK

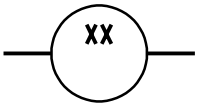


MECHANICAL LINK

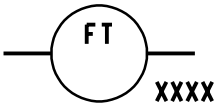


NOTE: SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS

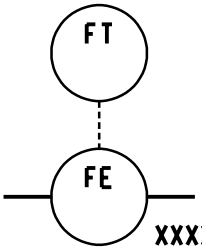
PRIMARY ELEMENT SYMBOLS (FLOW)



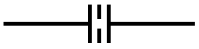
GENERAL SYMBOL
IN-LINE ELEMENT
XX = FS, FG, FE, FT



IN-LINE FLOW ELEMENT
WITH INTEGRAL TRANSMITTER
XXXX = MASS, CORIOLIS,
THERMAL, INT. ORIFICE ...



IN-LINE FLOW ELEMENT
WITH SEPARATE TRANSMITTER
XXXX = MASS, CORIOLIS,
THERMAL...



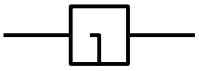
ORIFICE

MAGNETIC

TURBINE OR PROPELLER

ULTRASONIC

VORTEX



PITOT TUBE

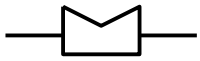
AVERAGING PITOT TUBE

FLOW NOZZLE

VENTURI

WEDGE METER

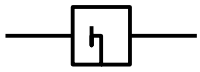
FLUME



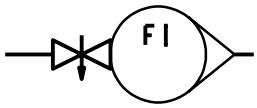
WEIR

POSITIVE
DISPLACEMENT

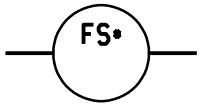
ORIFICE IN QUICK
CHANGE FITTING



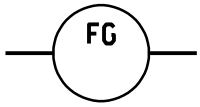
TARGET



ROTAMETER (OR PURGE)
(SHOWN WITH OPTIONAL
INTEGRAL VALVE)

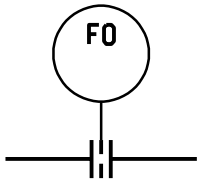


FLOW SWITCH
* = H/L



FLOW GLASS

FLOW CONDITIONING DEVICES
(e.g., STRAIGHTENING VANES)



RESTRICTION ORIFICE

NOTE:
1. SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS
2. FLOW ASSUMED LEFT TO RIGHT AS SHOWN.

CONTROL VALVE ACTUATOR SYMBOLS (NOTE 2)

MANUAL OPERATOR

MOTOR OPERATED

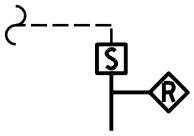
DIAPHRAGM

ELECTRO-HYDRAULIC

PRESSURE BALANCED
DIAPHRAGM

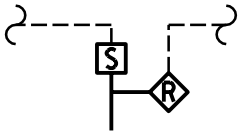
SINGLE SOLENOID

HANDWHEEL - USED
WITH ANY ACTUATOR

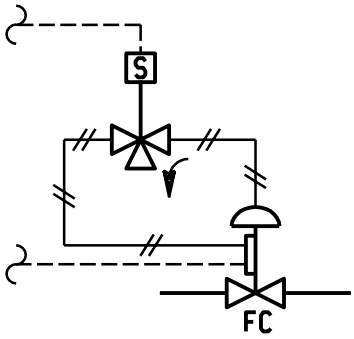


SINGLE SOLENOID
WITH MANUAL RESET

CYLINDER/PISTON



SINGLE SOLENOID
WITH REMOTE RESET



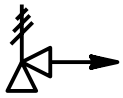
TYPICAL CONTROL VALVE
WITH POSITIONER AND
SOLENOID

NOTE:
1. SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS
2. SEE PIPING APPENDIX A-3, p.4 FOR TYPICAL VALVE SYMBOLS. BY ADDING AN ACTUATOR TO THE BASIC VALVE SYMBOL, THE VALVE BECOMES A CONTROL VALVE.

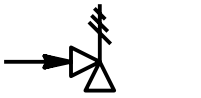
SELF-ACTUATED DEVICES

RUPTURE DISC OR SAFETY HEAD FOR PRESSURE RELIEF (EXPLOSION PANEL)

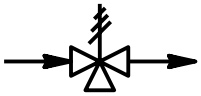
RUPTURE DISC OR SAFETY HEAD FOR VACUUM RELIEF (EXPLOSION PANEL)



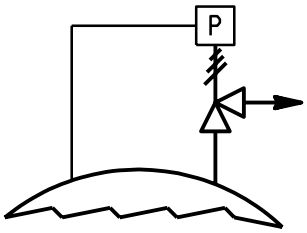
PRESSURE RELIEF OR SAFETY VALVE



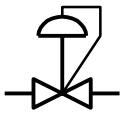
VACUUM RELIEF VALVE



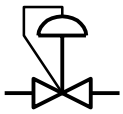
PRESSURE AND VACUUM RELIEF VALVE OR CONSERVATION VENT



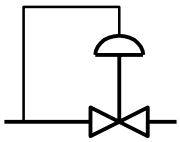
PILOT OPERATED RELIEF VALVE WITH REMOTE SENSOR (USE APPROPRIATE RELIEF VALVE SYMBOL)



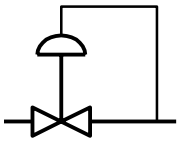
PRESSURE REDUCING REGULATOR (SELF-CONTAINED)



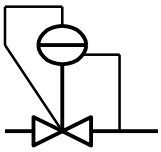
BACK PRESSURE REGULATOR (SELF-CONTAINED)



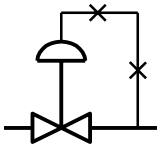
BACK PRESSURE REGULATOR W/ EXTERNAL TAP



PRESSURE REDUCING REGULATOR W/ EXTERNAL TAP



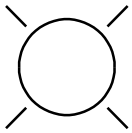
DIFFERENTIAL PRESSURE REDUCING REGULATOR



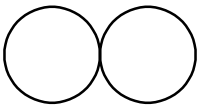
TEMPERATURE REGULATOR FILLED SYSTEM TYPE

NOTE:
1. SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS
2. FLOW ASSUMED LEFT TO RIGHT AS SHOWN.

CHEMICAL SEAL/DIAPHRAGM



PILOT LIGHT OR GAUGE GLASS ILLUMINATOR



DUAL FUNCTION OR INSTRUMENTS
SHARING COMMON HOUSING

UNDEFINED INTERLOCK LOGIC

INSTRUMENT WITH LONG TAG NUMBER

NOTE: SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS

Appendix B – Cover Sheets

- Symbols & Nomenclature - Typical Piping
- Symbols & Nomenclature - Typical Instrumentation
- Symbols & Nomenclature - Typical Equipment
- Typical Details with Implied Components

ABBREVIATIONS

AG	ABOVE GROUND
ATM	ATMOSPHERE
BL	BATTERY LIMIT
BTL	BOTTOM TANGENT LINE
BYP	BYPASS
CC	CHEMICAL CLEANOUT
CL	CENTERLINE
CO	CLEANOUT
CONN	CONNECTION
CSC	CAR SEAL CLOSED
CSO	CAR SEAL OPEN
CTR	CENTER
DCS	DISTRIBUTED CONTROL SYSTEM
DES	DESIGN
DIA	DIAMETER
DP	DESIGN PRESSURE
D/P	DIFFERENTIAL PRESSURE
DRN	DRAIN
DT	DESIGN TEMPERATURE
DWG	DRAWING
(E)	EXISTING
EL	ELEVATION
ESD	EMERGENCY SHUTDOWN
FOF	FACE OF FLANGE
(F)	FURNISHED
FC	FAIL CLOSED
FI	FAIL INDETERMINATE
FL	FAIL LOCKED (LAST POSITION)
FLG	FLANGE
FO	FAIL OPEN
FP	FULL PORT
FV	FULL VACUUM
GO	GEAR OPERATED
GR	GRADE
HC	HOSE CONNECTION
HDR	HEADER
HH	HAND HOLE
HOA	HAND/OFF/AUTOMATIC
HP	HIGH PRESSURE
HPT	HIGH POINT
IAS	INSTRUMENT AIR SUPPLY
ISBL	INSIDE BATTERY LIMITS
LC	LOCKED CLOSED
LO	LOCKED OPEN
LP	LOW PRESSURE
LPT	LOW POINT
MAX	MAXIMUM
MIN	MINIMUM
MOV	MOTOR OPERATED VALVE
MTL	MATERIAL
MW	MANWAY
NC	NORMALLY CLOSED
NNF	NORMALLY NO FLOW
NO	NORMALLY OPEN
NOZ	NOZZLE
O/C	OPEN/CLOSE
O/O	ON/OFF
OP	OUTPUT
OSBL	OUTSIDE BATTERY LIMITS
OVHD	OVERHEAD
PLC	PROGRAMMABLE LOGIC CONTROLLER
PRESS	PRESSURE
PV	PROCESS VARIABLE
(R)	RELOCATED
REQD	REQUIRED
RTD	RESISTANCE TEMP. DETECTOR
SC	SAMPLE CONNECTION
SCH	SCHEDULE
SD	SHUTDOWN
SG	SPECIFIC GRAVITY
SIS	SAFETY INSTRUMENTED SYSTEM
SO	STEAM OUT
SP	SET POINT
SS	STAINLESS STEEL
S/S	START/STOP
STD	STANDARD
T/C	THERMOCOUPLE
TDH	TOTAL DIFFERENTIAL HEAD
TEMP	TEMPERATURE
THRD	THREADED
TL	TANGENT LINE
TSO	TIGHT SHUT-OFF
T/T	TANGENT TO TANGENT
TYP	TYPICAL
UG	UNDERGROUND
VNT	VENT
VAC	VACUUM
VB	VORTEX BREAKER
W/	WITH
W/O	WITHOUT

VALVE SYMBOLS ⑧ ⑨

PIPING FITTINGS

PIPING SPECIALTY ITEMS ⑧

INSULATION TYPE CODES

AC	ACOUSTIC CONTROL INSULATION
CC	COLD SERVICE INSULATION
CJ	CHILLED FLUID JACKETED
CP	CONDENSATION CONTROL
CT	CHILLED FLUID TRACED
ET	ELECTRIC TRACED
FP	FIRE PROTECTION INSULATION
HC	HEAT CONSERVATION INSULATION
HJ	HOT FLUID JACKETING
HT	HOT FLUID TRACED
PF	PREVENTION FROM FREEZING INSULATION
PP	PERSONNEL PROTECTION INSULATION
PS	PROCESS STABILITY INSULATION
SJ	STEAM JACKETED
ST	STEAM TRACED

PIPING LINE SYMBOLS

LINE DATA IDENTIFICATION

OFF-PAGE & DRAIN CONNECTORS

LINE SERVICE CODES

AV	ATMOSPHERIC VENT
BA	BREATHING AIR
BD	BLOWDOWN
BFW	BOILER FEED WATER
BRR	BRINE RETURN
BRS	BRINE SUPPLY
CC	CONTAMINABLE CONDENSATE
CF	COLD FLARE
CHS	CHEMICAL SEWER
CV	COLD VENT
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
DMW	DEMINERALIZED WATER
DR	DRAIN
DS	DILUTION STEAM
DW	DRINKING WATER
ER	ETHYLENE REFRIGERANT
FF	FLUSHING FLUID
FG	FUEL GAS
FO	FUEL OIL
FW	FIRE WATER
GLR	GLYCOL RETURN
GLS	GLYCOL SUPPLY
H	HYDROGEN
HS	HIGH PRESSURE STEAM
IA	INSTRUMENT AIR
IS	INTERMEDIATE PRESSURE STEAM
LNG	LIQUIFIED NATURAL GAS
LO	LUBE OIL
LPG	LIQUIFIED PETROLEUM GAS
LS	LOW PRESSURE STEAM
ME	METHANOL
MR	MIXED REFRIGERANT
MS	MEDIUM PRESSURE STEAM
N	NITROGEN
NA	CAUSTIC
NAS	CAUSTIC SEWER
NG	NATURAL GAS
NH	AMMONIA
OWS	OILY WATER SEWER
OX	OXYGEN
P	GENERAL PROCESS
PA	PLANT AIR
PC	PROCESS CONDENSATE
PR	PROPYLENE REFRIGERANT
PW	PROCESS WATER
QO	QUENCH OIL
RS	RECOVERED SLOPS
RV	RELIEF VENT
RW	RAW WATER
SC	STEAM CONDENSATE
SG	SYNTHESIS GAS
SO	SEAL OIL
SS	SANITARY SEWER
STS	STORM SEWER
SW	SERVICE WATER
SWR	SEA WATER RETURN
SWS	SEA WATER SUPPLY
TWR	TEMPERED WATER RETURN
TWS	TEMPERED WATER SUPPLY
VC	VACUUM CONDENSATE
VE	VACUUM EXHAUST
WF	WARM FLARE
WO	WASH OIL
WW	WASTE WATER

MISCELLANEOUS

NOTES:

1. FOR GENERAL PIPING REQUIREMENTS, SEE DESIGN SPECIFICATION PIP PNE00001. FOR INSTRUMENT PIPING AND TUBING SYSTEMS CRITERIA, SEE PIP PCCIP001.
2. ALL SINGLE VALVED CONNECTIONS TO ATMOSPHERE IN PROCESS SERVICE WILL BE PLUGGED, CAPPED OR BLIND FLANGED.
3. ALL VENTS AND DRAINS ARE 3/4" UNLESS OTHERWISE NOTED.
4. DEFINITIONS:

GRAVITY FLOW	ELEVATIONS DOWNSTREAM NEVER EXCEED INLET ELEVATIONS. LINE MAY CONTAIN POCKETS.
 Y X	SLOPED LINE: NO POCKETS PERMITTED.
FREE DRAINING TO XXXX	NO POCKETS PERMITTED.
NO POCKETS	NO POCKETS IN LINE.

5. CLOSED PRESSURE RELIEF VALVE DISCHARGE LEADS SHALL BE FREE DRAINING FROM THE PRESSURE RELIEF VALVE TO THE TOP OF THE DISCHARGE HEADER.
6. 3/8" WEEP HOLES ARE PROVIDED AT LOW POINTS OF VENT, PRESSURE RELIEF VALVE AND RUPTURE DISK DISCHARGE LINES TO ATMOSPHERE.
7. REDUCERS IN PRESSURE RELIEF VALVE INLET OR OUTLET PIPING SHALL BE INSTALLED IMMEDIATELY ADJACENT TO THE PRESSURE RELIEF VALVES.
8. FLOW ASSUMED LEFT TO RIGHT AS SHOWN.
9. VALVES WHICH ARE NORMALLY CLOSED ARE SO INDICATED BY "DARKENED IN" SYMBOL.
   EXAMPLE:

    NORMALLY CLOSED GATE VALVE

   NORMALLY CLOSED BUTTERFLY VALVES ARE INDICATED BY THE ABBREVIATION "NC".
10. DEFINED BY PIP PNSM0001: PIPING LINE CLASS DESIGNATOR SYSTEM. FOR INSTRUMENT PIPING AND TUBING SPECIFICATION, SEE PIP PCSIP001.
11. DEFINED BY PIP INEG1000: INSULATION DESIGN AND TYPE CODES.
12. ON P&ID'S WHICH SHOW UTILITY COLLECTION/DISTRIBUTION SYSTEMS, AN ADDITIONAL NOTE INDICATING USER OR AREA MAY BE PLACED ADJACENT TO THE UTILITY CONNECTOR. SEE APPENDIX C, p.3.

REFERENCE DRAWINGS

1	06/98							

SCALE	FILENAME	DRAWN
NONE	PIPB1.DGN	REM

PROCESS INDUSTRY PRACTICES
PIPING AND INSTRUMENTATION DIAGRAM

PIP
PRACTICE REF PIC001

SYMBOLS AND NOMENCLATURE
TYPICAL PIPING COVER SHEET
APPENDIX B, PAGE 1

PROJECT	PLANT	DRAWING NUMBER	REV NO
		PIP-00-001	1

INSTRUMENT LINE SYMBOLS

- INSTRUMENT SUPPLY OR CONNECTION TO PROCESS
- PNEUMATIC SIGNAL
- ELECTRIC SIGNAL
- HYDRAULIC SIGNAL
- CAPILLARY TUBE
- ELECTROMAGNETIC, SONIC, OPTICAL, OR NUCLEAR SIGNAL
- SOFTWARE OR DATA LINK
- MECHANICAL LINK

MISCELLANEOUS SYMBOLS

- CHEMICAL SEAL/DIAPHRAGM
- PILOT LIGHT OR GAUGE GLASS ILLUMINATOR
- DUAL FUNCTION OR INSTRUMENTS SHARING COMMON HOUSING
- UNDEFINED INTERLOCK LOGIC
- FC 1230-99 — INSTRUMENT WITH LONG TAG NUMBER

CONTROL VALVE ACTUATOR SYMBOLS (4)

- MANUAL OPERATOR
- DIAPHRAGM
- PRESSURE BALANCED DIAPHRAGM
- HANDWHEEL - USED WITH ANY ACTUATOR
- CYLINDER/PISTON
- M — MOTOR OPERATED
- E/H — ELECTRO-HYDRAULIC
- S — SINGLE SOLENOID
- S, R — SINGLE SOLENOID WITH REMOTE RESET
- S, R — SINGLE SOLENOID WITH MANUAL RESET
- S, FC — TYPICAL CONTROL VALVE WITH POSITIONER AND SOLENOID

PRIMARY ELEMENT SYMBOLS (FLOW) (2)

- XX — GENERAL SYMBOL IN-LINE ELEMENT XX = FS, FG, FE, FT
- FT, XXXX — IN-LINE FLOW ELEMENT WITH INTEGRAL TRANSMITTER XXXX = MASS, CORIOLIS, THERMAL, INT, ORIFICE ...
- FT / FE, XXXX — IN-LINE FLOW ELEMENT WITH SEPARATE TRANSMITTER XXXX = MASS, CORIOLIS, THERMAL...
- ORIFICE
- M — MAGNETIC
- TURBINE OR PROPELLER
- ULTRASONIC
- VORTEX
- PITOT TUBE
- AVERAGING PITOT TUBE
- FLOW NOZZLE
- VENTURI
- WEDGE METER
- FLUME
- WEIR
- POSITIVE DISPLACEMENT
- ORIFICE IN QUICK CHANGE FITTING
- TARGET
- FI — ROTAMETER (OR PURGE) (SHOWN WITH OPTIONAL INTEGRAL VALVE)
- FS* — FLOW SWITCH * = H/L
- FG — FLOW GLASS
- FLOW CONDITIONING DEVICES (e.g., STRAIGHTENING VANES)
- FO — RESTRICTION ORIFICE

INSTRUMENT FUNCTION SYMBOLS

Σ	SUMMING	>	HIGH SELECT
Σ/n	AVERAGING	<	LOW SELECT
Δ	DIFFERENCE	>|	HIGH LIMIT
x	MULTIPLYING	<|	LOW LIMIT
÷	DIVIDING	±	BIAS
√	SQUARE ROOT	f(x)	UNSPECIFIED FUNCTION
x^n	EXPONENTIAL		USER DEFINED
/	CONVERSION INPUT/OUTPUT		

/ A ANALOG, B BINARY, D DIGITAL, E VOLTAGE, H HYDRAULIC, I CURRENT, O ELECTROMAGNETIC, SONIC, P PNEUMATIC, R RESISTANCE (ELECTRICAL)

SELF-ACTUATED DEVICES (2)

- RUPTURE DISC OR SAFETY HEAD FOR PRESSURE RELIEF (EXPLOSION PANEL)
- RUPTURE DISC OR SAFETY HEAD FOR VACUUM RELIEF (EXPLOSION PANEL)
- PRESSURE RELIEF OR SAFETY VALVE
- VACUUM RELIEF VALVE
- PRESSURE AND VACUUM RELIEF VALVE OR CONSERVATION VENT
- P — PILOT OPERATED RELIEF VALVE WITH REMOTE SENSOR (USE APPROPRIATE RELIEF VALVE SYMBOL)
- PRESSURE REDUCING REGULATOR (SELF-CONTAINED)
- BACK PRESSURE REGULATOR (SELF-CONTAINED)
- BACK PRESSURE REGULATOR W/ EXTERNAL TAP
- PRESSURE REDUCING REGULATOR W/ EXTERNAL TAP
- DIFFERENTIAL PRESSURE REDUCING REGULATOR
- TEMPERATURE REGULATOR FILLED SYSTEM TYPE

GENERAL INSTRUMENT SYMBOLS (3)

LOCATION/ACCESSIBILITY	DISCRETE INSTRUMENTS	SHARED DISPLAY AND CONTROL (DCS)	PLC	DISCRETE HARDWARE INTERLOCK
FIELD MOUNTED 1.FIELD OR LOCALLY MOUNTED. 2.ACCESSIBLE TO AN OPERATOR AT DEVICE.	○	▢	◇	◇
PRIMARY LOCATION NORMALLY ACCESSIBLE TO AN OPERATOR 1.CENTRAL OR MAIN CONTROL ROOM. 2.FRONT OF MAIN PANEL OR CONSOLE MOUNTED. 3.VISIBLE ON VIDEO DISPLAY. 4.ACCESSIBLE TO AN OPERATOR AT DEVICE OR CONSOLE.	⊖	▢	◇	
PRIMARY LOCATION NORMALLY INACCESSIBLE TO AN OPERATOR 1.CENTRAL OR MAIN CONTROL ROOM. 2.REAR OF PANEL OR CABINET MOUNTED. 3.NOT VISIBLE ON VIDEO DISPLAY. 4.NOT NORMALLY ACCESSIBLE TO AN OPERATOR AT DEVICE OR CONSOLE.	⊖	▢	◇	
AUXILIARY LOCATION NORMALLY ACCESSIBLE TO AN OPERATOR 1.SECONDARY OR LOCAL CONTROL ROOM. 2.FIELD OR LOCAL CONTROL PANEL. 3.FRONT OF SECONDARY OR LOCAL PANEL MOUNTED. 4.VISIBLE ON VIDEO DISPLAY. 5.ACCESSIBLE TO AN OPERATOR AT DEVICE OR CONSOLE.	⊖	▢	◇	
AUXILIARY LOCATION NORMALLY INACCESSIBLE TO AN OPERATOR 1.SECONDARY OR LOCAL CONTROL ROOM. 2.FIELD OR LOCAL CONTROL PANEL. 3.REAR OF SECONDARY OR LOCAL PANEL OR CABINET MOUNTED. 4.NOT VISIBLE ON VIDEO DISPLAY. 5.NOT NORMALLY ACCESSIBLE TO AN OPERATOR AT DEVICE OR CONSOLE.	⊖	▢	◇	

INSTRUMENT IDENTIFICATION LETTERS

	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, FLAME, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	USER'S CHOICE (TYPICALLY CONDUCTIVITY - ELECTRICAL)			CONTROL	CLOSED
D	USER'S CHOICE (TYPICALLY DENSITY OR SPECIFIC GRAVITY)	DIFFERENTIAL			DIVERT
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO (FRACTION)			
G	USER'S CHOICE OR GAUGING (DIMENSIONAL)		GLASS, VIEWING DEVICE		
H	HAND				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	USER'S CHOICE (TYPICALLY MOISTURE OR HUMIDITY)	MOMENTARY			MIDDLE, INTERMEDIATE
N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE, RESTRICTION		OPEN
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY OR HEAT DUTY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	THROUGH
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, UNCLASSIFIED FINAL CONTROL ELEMENT	

NOTES:

1. REFERENCE ISA S5.1, S5.2 & S5.3.
2. FLOW ASSUMED LEFT TO RIGHT AS SHOWN.
3. MULTIPLE LOCATIONS OF THE SAME TYPE CAN BE DISTINGUISHED BY ADDING A TEXT LABEL OR NOTE.
4. FOR VALVE SYMBOLS, SEE APPENDIX B, p.1.

REFERENCE DRAWINGS

REV	DATE
1	06/98

SCALE	FILENAME	DRAWN
NONE	PIP02.DGN	REM

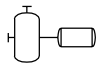
PROCESS INDUSTRY PRACTICES
PIPING AND INSTRUMENTATION DIAGRAM

PIP
PRACTICE REF PIC001

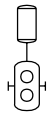
SYMBOLS AND NOMENCLATURE
TYPICAL INSTRUMENTATION COVER SHEET
APPENDIX B, PAGE 2

PROJECT	PLANT	DRAWING NUMBER	REV NO
		PIP-00-002	1

PUMPS (1)

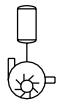


HORIZONTAL CENTRIFUGAL PUMP

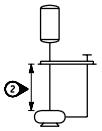


POSITIVE DISPLACEMENT PUMP

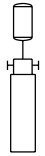
VERTICAL INLINE PUMP



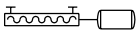
LIQUID RING VACUUM PUMP



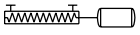
CENTRIFUGAL SUMP PUMP



VERTICAL CAN PUMP

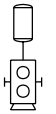


PROGRESSIVE CAVITY PUMP

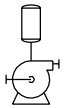


SCREW PUMP

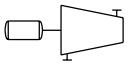
COMPRESSORS & BLOWERS (1)



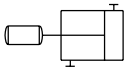
POSITIVE DISPLACEMENT BLOWER



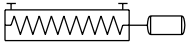
CENTRIFUGAL BLOWER



CENTRIFUGAL COMPRESSOR



RECIPROCATING COMPRESSOR



SCREW COMPRESSOR

DRIVERS

ELECTRIC MOTOR

TURBINE DRIVER

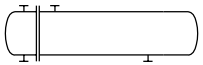
DIESEL ENGINE

MISCELLANEOUS

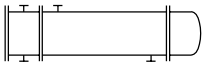
AGITATOR/MIXER

HEAT EXCHANGERS (3) (4)

TEMA TYPE BEM

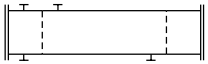


TEMA TYPE BEU

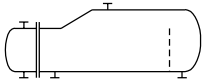


TEMA TYPE AEM

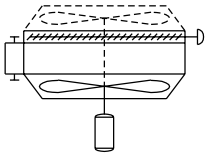
TEMA TYPE AEL



TEMA TYPE NEN

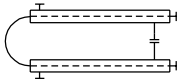


TEMA TYPE BKU



AIR COOLED EXCHANGER (LOUVERS OPTIONAL)

PLATE AND FRAME EXCHANGER



DOUBLE PIPE EXCHANGER

SPIRAL EXCHANGER

NOTES:

1. MOTORS ARE SHOWN HERE TO ILLUSTRATE DRIVER ORIENTATION.
2. LENGTH VARIES DEPENDING UPON DEPTH OF SUMP.
3. CONSULT TEMA FOR TYPES OTHER THAN THOSE SHOWN.
4. EXCHANGERS SHOWN HERE REPRESENT SINGLE PASS SHELL AND EVEN NUMBER OF TUBE PASSES.

REFERENCE DRAWINGS

1	06/98		
SCALE	FILENAME		DRAWN
NONE	PIP03.DGN		GAM

PROCESS INDUSTRY PRACTICES
PIPING AND INSTRUMENTATION DIAGRAM

PIP
PRACTICE REF PIC001

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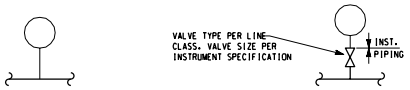
TYPICAL EQUIPMENT COVER SHEET
APPENDIX B, PAGE 3

PROJECT	PLANT	DRAWING NUMBER	REV NO
		PIP-00-003	1

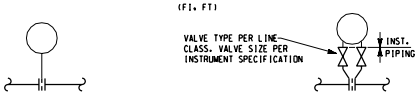
FIELD MOUNTED PRESSURE INSTRUMENT

(PI, PT, PS)



ORIFICE FLANGE - MOUNTED FLOW INSTRUMENT

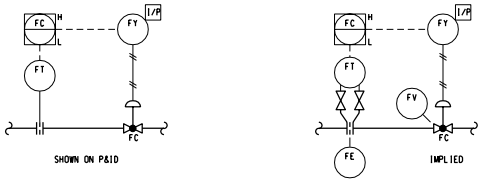
(FI, FT)



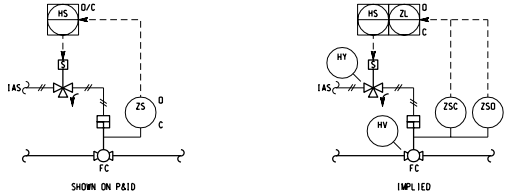
LEVEL OR D/P INSTRUMENT

(PDI, PDT, LC, LG, LT, LS)

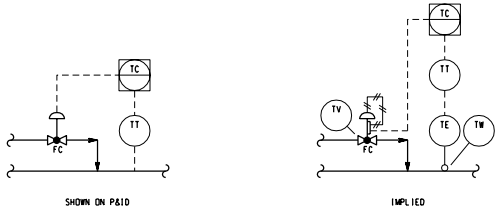
TYPICAL FLOW LOOP WITH SEPARATE I/P



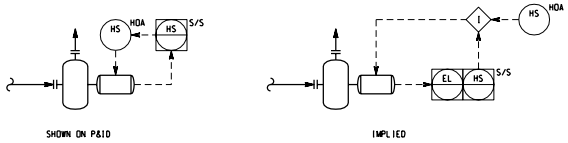
TYPICAL VALVE DETAIL



TYPICAL TEMPERATURE LOOP WITH VALVE POSITIONER



TYPICAL PUMP MOTOR CONTROLS



NOTES:

1. FOR NOTES, SYMBOLS AND ABBREVIATIONS, SEE "SYMBOLS AND NOMENCLATURE", PIP-00-001 THROUGH 003.

REFERENCE DRAWINGS

1	06/98		
SCALE	FILENAME		DRAWN
NONE	PIP84.DGN		GAM

PROCESS INDUSTRY PRACTICES
PIPING AND INSTRUMENTATION DIAGRAM

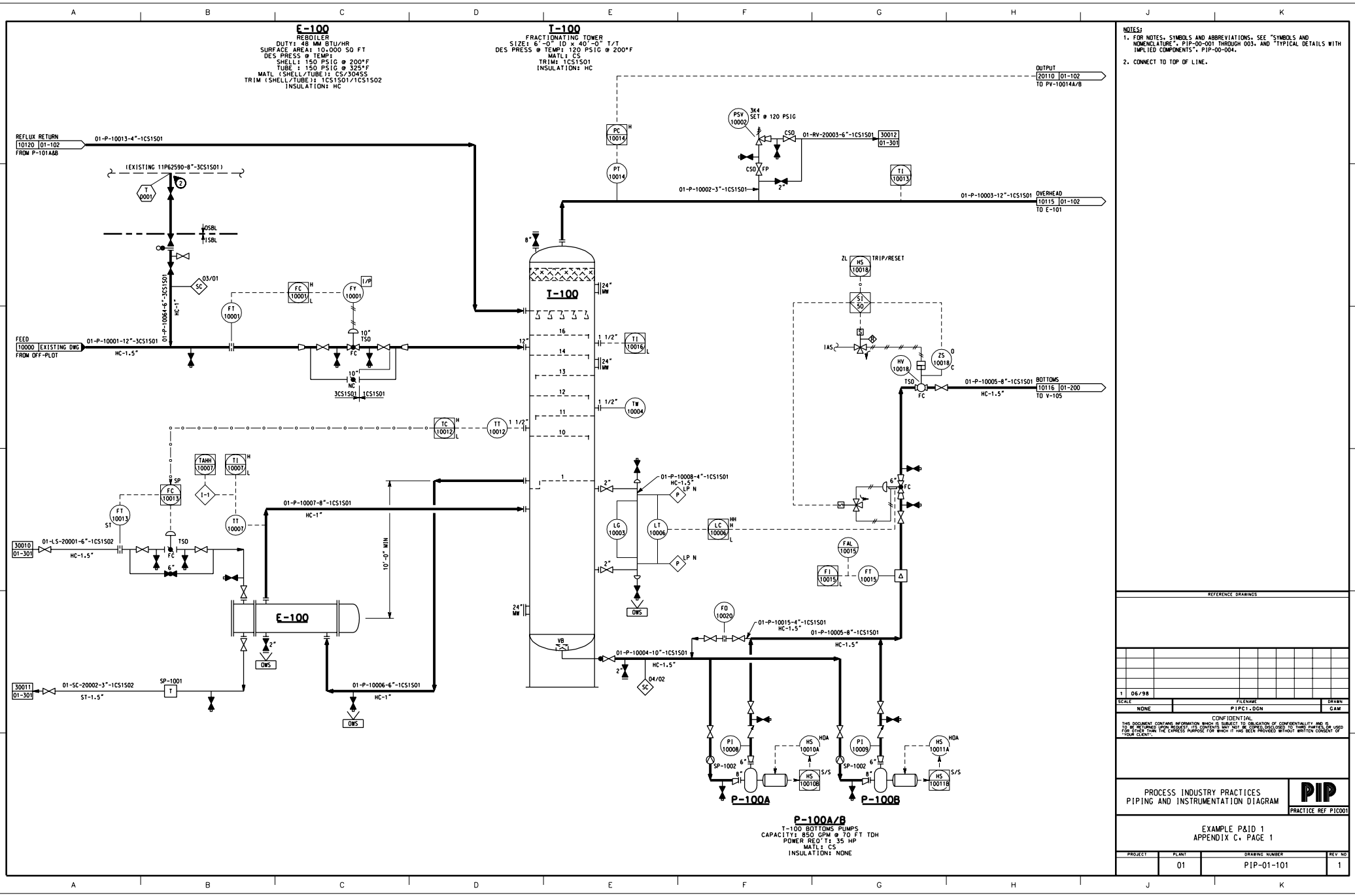
PIP
PRACTICE REF PIC001

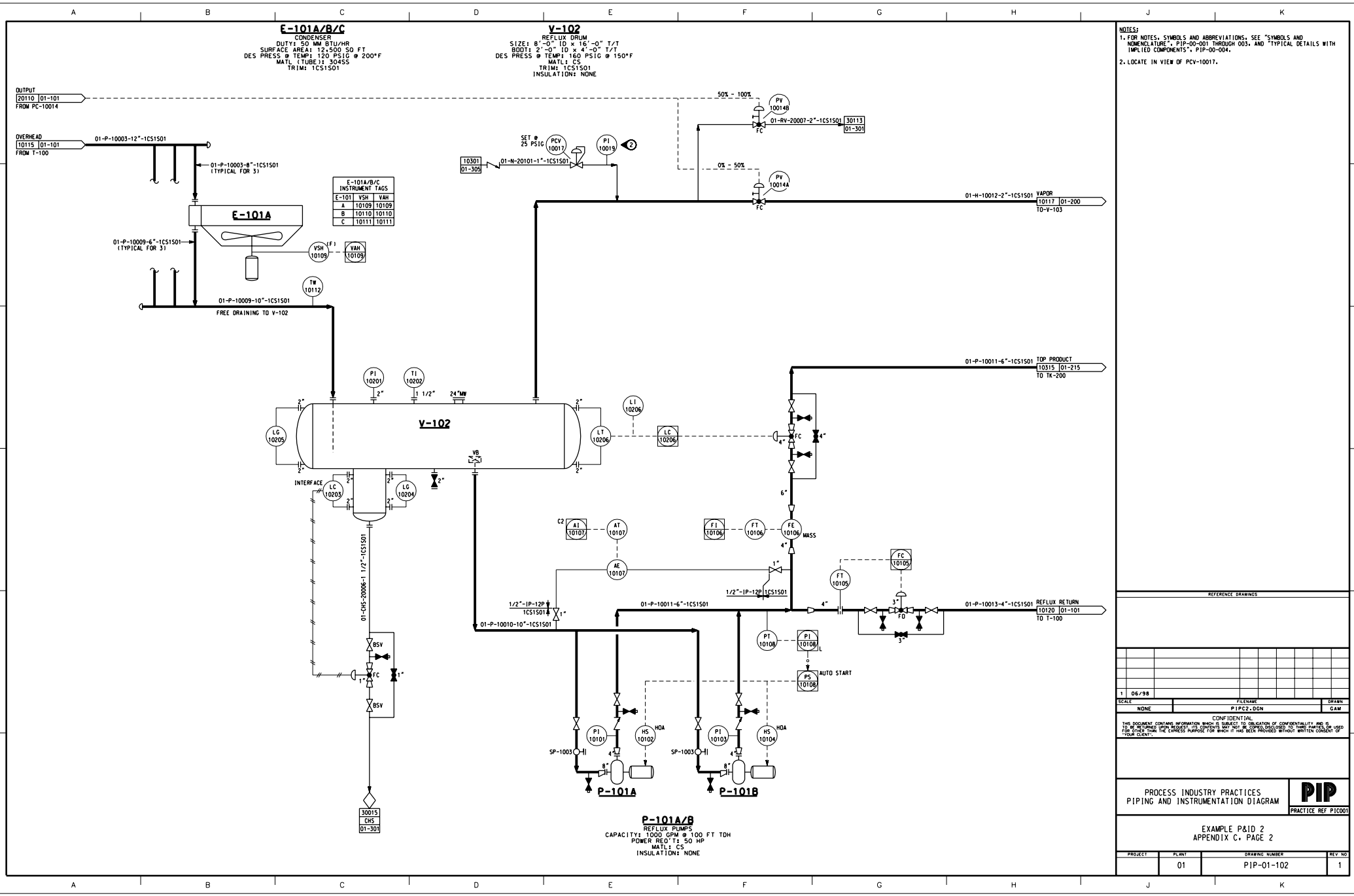
TYPICAL DETAILS WITH IMPLIED COMPONENTS
APPENDIX B, PAGE 4

PROJECT	PLANT	DRAWING NUMBER	REV NO
		PIP-00-004	1

Appendix C – Example P&IDs

1. Example P&ID 1
2. Example P&ID 2
3. Example Utility P&ID


E-100
REBOILER
DUTY: 48 MM BTU/HR
SURFACE AREA: 10,000 SQ FT
DES PRESS @ TEMP:
SHELL: 150 PSIG @ 200°F
TUBE : 150 PSIG @ 325°F
MATL (SHELL/TUBE): CS/304SS
TRIM (SHELL/TUBE): 1CS1SO1/1CS1SO2
INSULATION: HC
T-100
FRACTIONATING TOWER
SIZE: 6'-0" ID x 40'-0" T/T
DES PRESS @ TEMP: 120 PSIG @ 200°F
MATL: CS
TRIM: 1CS1SO1
INSULATION: HC
NOTES:
1. FOR NOTES, SYMBOLS AND ABBREVIATIONS, SEE "SYMBOLS AND NOMENCLATURE", PIP-00-001 THROUGH 003, AND "TYPICAL DETAILS WITH IMPLIED COMPONENTS", PIP-00-004.
2. CONNECT TO TOP OF LINE.
REFLUX RETURN
10120 01-102
FROM P-101A&B
01-P-10013-4"-1CS1SO1
OUTPUT
20110 01-102
TO PV-10014A/B
PC 10014
PT 10014
PSV 10002
3K4
SET @ 120 PSIG
CSO
01-RV-20003-6"-1CS1SO1
30012
01-301
CSO
FP
TI 10013
01-P-10002-3"-1CS1SO1
01-P-10003-12"-1CS1SO1
OVERHEAD
10115 01-102
TO E-101
(EXISTING 11P62590-8"-3CS1SO1)
T 0001
OSBL
ISBL
SC
03/01
01-P-10064-6"-3CS1SO1
HC-1"
FC 10001
FY 10001
I/P
FT 10001
FEED
10000 EXISTING DWG
FROM OFF-PLOT
01-P-10001-12"-3CS1SO1
HC-1.5"
10" TSO
FC
10" NC
3CS1SO1 1CS1SO1
12"
T-100
24" MW
16
14
13
12
11
10
1
TI 10016
TW 10004
TC 10012
TT 10012
1 1/2"
ZL
HS 10018
TRIP/RESET
SJ 50
IAS
HV 10018
ZS 10018
TSO
FC
01-P-10005-8"-1CS1SO1
HC-1.5"
BOTTOMS
10116 01-200
TO V-105
TAHH 10007
TI 10007
SP
FC 10013
I-1
FT 10013
ST
TT 10007
01-P-10007-8"-1CS1SO1
HC-1"
30010
01-301
01-LS-20001-6"-1CS1SO2
HC-1.5"
TSD
FC
6"
MIN "0"-0"
E-100
2"
DWS
30011
01-301
01-SC-20002-3"-1CS1SO2
ST-1.5"
SP-1001
T
01-P-10006-6"-1CS1SO1
HC-1"
DWS
01-P-10008-4"-1CS1SO1
HC-1.5
LP N
P
LG 10003
LT 10006
LC 10006
HH
H
L
LP N
P
2"
DWS
FAL 10015
FI 10015
FT 10015
FO 10020
01-P-10015-4"-1CS1SO1
HC-1.5"
01-P-10005-8"-1CS1SO1
HC-1.5"
01-P-10004-10"-1CS1SO1
HC-1.5"
2"
SC
04/02
VB
PI 10008
PI 10009
HS 10010A
HS 10010B
HS 10011A
HS 10011B
HOA
S/S
SP-1002
6"
8"
P-100A
P-100B
P-100A/B
T-100 BOTTOMS PUMPS
CAPACITY: 850 GPM @ 70 FT TDH
POWER REQ'T: 35 HP
MATL: CS
INSULATION: NONE
REFERENCE DRAWINGS
1 06/98
SCALE
NONE
FILENAME
P1PC1.DGN
DRAWN
GAM
CONFIDENTIAL
THIS DOCUMENT CONTAINS INFORMATION WHICH IS SUBJECT TO OBLIGATION OF CONFIDENTIALITY AND IS TO BE RETURNED UPON REQUEST. ITS CONTENTS MAY NOT BE COPIED, DISCLOSED TO THIRD PARTIES, OR USED FOR OTHER THAN THE EXPRESS PURPOSE FOR WHICH IT HAS BEEN PROVIDED WITHOUT WRITTEN CONSENT OF "YOUR CLIENT".
PROCESS INDUSTRY PRACTICES
PIPING AND INSTRUMENTATION DIAGRAM
PIP
PRACTICE REF PIC001
EXAMPLE P&ID 1
APPENDIX C, PAGE 1
PROJECT
PLANT
01
DRAWING NUMBER
PIP-01-101
REV NO
1


E-101A/B/C
CONDENSER
DUTY: 50 MM BTU/HR
SURFACE AREA: 12,500 SQ FT
DES PRESS @ TEMP: 120 PSIG @ 200°F
MATL (TUBE): 304SS
TRIM: 1CS1S01
V-102
REFLUX DRUM
SIZE: 8'-0" ID x 16'-0" T/T
BODY: 2'-0" ID x 4'-0" T/T
DES PRESS @ TEMP: 160 PSIG @ 150°F
MATL: CS
TRIM: 1CS1S01
INSULATION: NONE
OUTPUT
20110 01-101
FROM PC-10014
OVERHEAD
10115 01-101
FROM T-100
01-P-10003-12"-1CS1S01
01-P-10003-8"-1CS1S01
(TYPICAL FOR 3)
E-101A
E-101A/B/C INSTRUMENT TAGS
E-101 VSH VAH
A 10109 10109
B 10110 10110
C 10111 10111
01-P-10009-6"-1CS1S01
(TYPICAL FOR 3)
VSH 10109
VAH 10109
TW 10112
01-P-10009-10"-1CS1S01
FREE DRAINING TO V-102
50% - 100%
PV 10014B
01-RV-20007-2"-1CS1S01
30113 01-301
SET @ 25 PSIG
PCV 10017
PI 10019
10301 01-305
01-N-20101-1"-1CS1S01
0% - 50%
PV 10014A
01-H-10012-2"-1CS1S01
VAPOR
10117 01-200
TO V-103
PI 10201
TI 10202
24"MW
V-102
LG 10205
LT 10206
LI 10206
LC 10206
VB
INTERFACE
LC 10203
LG 10204
01-CHS-20008-1 1/2"-1CS1S01
01-P-10011-6"-1CS1S01
TOP PRODUCT
10315 01-215
TO TK-200
C2
AI 10107
AT 10107
AE 10107
FI 10106
FT 10106
FE 10106
MASS
FC 10105
FT 10105
1/2"-IP-12P 1CS1S01
01-P-10010-10"-1CS1S01
01-P-10013-4"-1CS1S01
REFLUX RETURN
10120 01-101
TO T-100
PT 10108
PI 10108
PS 10108
AUTO START
BSV
FC
BSV
30015
CHS
01-301
PI 10101
HS 10102
HOA
SP-1003
P-101A
PI 10103
HS 10104
HOA
SP-1003
P-101B
P-101A/B
REFLUX PUMPS
CAPACITY: 1000 GPM @ 100 FT TDH
POWER REQ'T: 50 HP
MATL: CS
INSULATION: NONE
NOTES:
1. FOR NOTES, SYMBOLS AND ABBREVIATIONS, SEE "SYMBOLS AND NOMENCLATURE", PIP-00-001 THROUGH 003, AND "TYPICAL DETAILS WITH IMPLIED COMPONENTS", PIP-00-004.
2. LOCATE IN VIEW OF PCV-10017.
REFERENCE DRAWINGS
1 06/98
SCALE NONE
FILENAME PIPC2.DGN
DRAWN GAM
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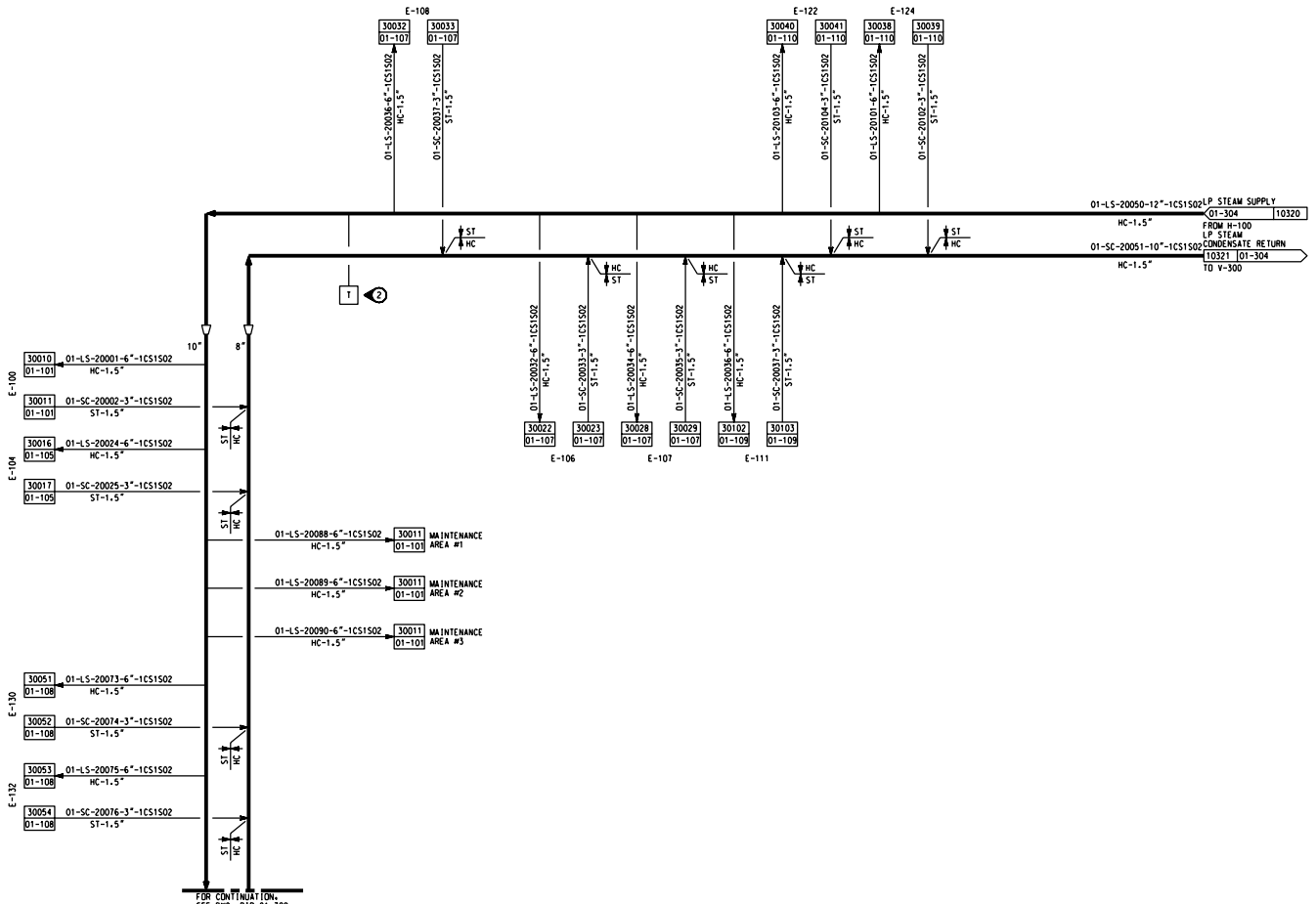
PROCESS INDUSTRY PRACTICES
PIPING AND INSTRUMENTATION DIAGRAM
PIP
PRACTICE REF PIC001
EXAMPLE P&ID 2
APPENDIX C, PAGE 2
PROJECT
PLANT 01
DRAWING NUMBER PIP-01-102
REV NO 1



NOTES:

1. FOR NOTES, SYMBOLS AND ABBREVIATIONS, SEE "SYMBOLS AND NOMENCLATURE", PIP-00-001 THROUGH 003, AND "TYPICAL DETAILS WITH IMPLIED COMPONENTS", PIP-00-004.
2. SEE AUXILIARY P&ID PIP-01-401.

REFERENCE DRAWINGS

1	06/98		
SCALE	FILENAME		DRAWN
NONE	PIPC3.DGN		GAM

PROCESS INDUSTRY PRACTICES
PIPING AND INSTRUMENTATION DIAGRAM

PIP
PRACTICE REF PIC001

EXAMPLE UTILITY P&ID
APPENDIX C, PAGE 3

PROJECT	PLANT	DRAWING NUMBER	REV NO
	01	PIP-01-301	1