

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.

This Practice is subject to revision at any time.

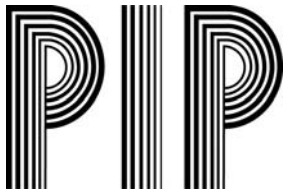
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1. Introduction

1.1 Purpose

This Practice provides requirements for designers preparing Piping and Instrumentation Diagrams (P&IDs).

1.2 Scope

This Practice describes the requirements for P&ID format and content. 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. This Practice also applies to P&IDs provided by packaged equipment vendors.

This Practice applies to all diagrams that fit the definition of a P&ID in Section 3.

The requirements provided in this Practice can be applied to any CAD system used for developing the P&IDs and are not vendor, hardware, or software specific.

The requirements provided in this Practice provide a balance between showing all data on P&IDs and making P&IDs legible and easy to read. 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 example P&IDs included in the Appendixes of this Practice are not intended to recommend specific design details or requirements. Example P&IDs are included to provide an illustration of how the elements of this Practice are combined into a P&ID.

Electronic native files for the text, symbols, and cover sheets are available to PIP Member Companies for input to members' 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 can be altered.

2. References

Applicable parts of the following Practices, industry codes and standards, and references shall be considered an integral part of this Practice. The edition in effect on the date of start of P&ID development shall be used, except as otherwise noted. Short titles are used herein where appropriate.

2.1 Process Industry Practices (PIP)

- PIP INEG1000 – *Insulation Design and Type Codes*
- PIP PCCIP001 – *Instrument Piping and Tubing Systems Criteria*
- 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 70-2-2003 – *Control Valve Seat Leakage*
- American Society of Mechanical Engineers (ASME)
 - *ASME Boiler and Pressure Vessel Code*
Section VIII – *Pressure Vessels*
- The Instrumentation, Systems, and Automation Society (ISA)
 - ISA 5.1 – *Instrumentation Symbols and Identification*
 - ISA 5.2 – *Binary Logic Diagrams for Process Operations*
 - ISA 5.3 – *Graphic Symbols for Distributed Control / Shared Display Instrumentation, Logic and Computer Systems*
 - ISA 84.01 – *Application of Safety Instrumented Systems for the 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: Term applied to a device or function that can be used or 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 5.1*)

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 a spring-return function. Manually-operated valves are sometimes tagged as automated valves (*e.g.*, if a manual valve is fitted with position switches).

auxiliary P&ID: Used to show details to unclutter other P&IDs (*e.g.*, lube oil system, sample systems, instrument details)

Basic Process Control System (BPCS): Control equipment and system installed to regulate normal production functions. It 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 also HLCS and SIS)

bubble: Circular symbol used to denote and identify the purpose of an instrument or function. The bubble usually contains a tag number. (Synonym for balloon) (Reference *ISA 5.1*)

design pressure: Pressure used in the design of a vessel component together with the coincident design metal temperature for 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)

fail closed (FC): Characteristic of an automated valve that causes the valve to close as a result of specific malfunctions, including loss of signal or motive power. (Reference *ISA 5.1*)

fail indeterminate (FI): Characteristic of an automated valve that causes the valve to move 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 instead move with the process differential pressure. Additional equipment may be needed to meet the definition of FC, FO, or FL. (Reference *ISA 5.1*)

fail locked (FL) last position: Characteristic of an automated valve that causes the valve to remain in the last (locked) position as a result of specific malfunctions, including loss of signal or motive power. Automated valves may fail indeterminately without additional equipment. (Reference *ISA 5.1*)

fail open (FO): Characteristic of an automated valve that causes the valve to open as a result of specific malfunctions, including loss of signal or motive power. (Reference *ISA 5.1*)

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, in accordance with TEMA.

Higher Level Control System (HLCS): 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 set points in the BPCS. Examples of control functions in the HLCS are statistical process control and model predictive control. (See also BPCS and SIS)

interlock: 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-related (asset or production protection).

isolation valve: A valve used for isolation of process equipment while performing activities such as purging, de-pressuring or de-inventorying. This valve is also commonly referred to as the primary block valve.

line class: Section of the Piping Material Specifications that provides a listing of piping components for specific design conditions.

logic solver: Control equipment that performs the logic function. It can be either hardwired (*e.g.*, relays) or Programmable Electronic Systems (*e.g.*, DCS-based or PLC-based, including dual-redundant 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): Detailed graphical representation of a process including the hardware and software (*i.e.*, piping, equipment, and instrumentation) necessary to design, construct and operate the facility. Common synonyms for P&IDs include Engineering Flow Diagrams (EFDs), Utility Flow Diagrams (UFDs), and Mechanical Flow Diagrams (MFDs)

Programmable Electronic System (PES): Logic performed by programmable or configurable devices (Reference *ISA 84.01*)

root valve: 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 valve is typically a line class valve used for shut-off and isolation.

Safety Integrity Level (SIL): One of four possible discrete integrity levels (SIL 1, SIL 2, SIL 3, and SIL 4) of Safety Instrumented Systems. SILs are defined in terms of Probability of Failure on Demand (PFD). (Reference *ISA 84.01*)

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 if predetermined conditions are violated. Other terms commonly used include Emergency Shutdown System (ESD or ESS), Safety Shutdown System (SSD), and Safety Interlock System (SIS). (Reference *ISA S84.01*) (See also BPCS and HLCS)

skirt: 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

Tight Shut-Off (TSO): Tight Shut-Off is defined in this Practice as *ANSI Class V* or *ANSI Class VI* in accordance with *ANSI/FCI 70-2*

trim: Item attached to equipment as an integral component, identified as part of the equipment that is exposed to the process, and having a function local to the equipment being served. Examples are vent and drain valves, instrument bridles, blind flanges, plugs, or other miscellaneous items associated with a piece of equipment. Typically, trim is purchased independently from the equipment.

4. Requirements

4.1 General

- 4.1.1 Most details available from other types of documentation (*e.g.*, instrument loop diagrams and vessel data sheets) should not be included on P&IDs.

- 4.1.2 This Practice uses the concepts of typical details with implied components where appropriate to simplify P&IDs. (See the cover sheet in Appendix B for examples.) Additional examples can be added as required.
- 4.1.3 While the intent of this Practice is to simplify the P&IDs through the use of implied components and cover sheets, this may not be compatible with the work processes or design software used for a project. Therefore, this Practice does not require the use of implied components. It is the responsibility of the project team to determine the compatibility of implied components with project needs and work processes (*e.g.*, safety reviews, material take-off method, integration plan, etc.).

4.2 Format

4.2.1 Layout

Comment: The layout and orientation statements specified herein are recommended as optimal, and slight deviation, although not encouraged, may be required due to space constraints.

4.2.1.1 Piping Orientation

1. The top of a horizontal line and the left side of a vertical line shall be the top of a pipe.
2. The bottom of a horizontal line and the right side of a vertical line shall be the bottom of a pipe.
3. A note shall be used to clarify the orientation as required.

4.2.1.2 Drawing size shall be 22 inches x 34 inches.

4.2.1.3 Each P&ID shall be laid out to avoid clutter and allow future modifications. No more than three pieces of major equipment shall be shown on a P&ID. A set of pumps in the same service shall be one piece of equipment for the purpose of a P&ID layout in accordance with Appendix C.

4.2.1.4 Flow Orientation

1. Primary flow shall be shown on each P&ID from left to right.
2. Flow-through equipment shall be shown 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 Primary process lines shall be shown heavier than secondary and utility lines as described in Section 4.2.3.

4.2.1.6 Connector Symbols

1. Off-page and off-plot connectors for primary, secondary, and instrumentation lines shall be shown entering the P&ID horizontally 0.25 inch from the left inside borderline and exiting 0.25 inch horizontally from the right inside borderline in accordance with Appendix C.
2. Utility connectors can be shown at any convenient location on the body of the P&ID.

4.2.1.7 Utility P&IDs

1. Utility collection/distribution P&IDs shall be laid out relative to plot plan orientation in accordance with Appendix C.
2. To depict plot plan orientation, utility off-page connectors for a utility connection/distribution P&ID may be positioned vertically in accordance with Appendix C.
3. If match lines are required on utility collection/distribution P&IDs, the lines shall match the connecting drawing match lines in accordance with Appendix C.

4.2.1.8 Connector Descriptions

1. Service description, connector number, P&ID number, and origin/destination shall be shown for off-page and off-plot connectors in accordance with Appendix A-3.
 2. Origin/destination shall be shown as an equipment number, line number, or loop number.
 3. Service description for a piping off-page and off-plot connector shall be shown as name of fluid (*e.g.*, Cracked Gas) or line description (*e.g.*, Reactor Feed, Tower Overhead).
 4. Service description for an instrument off-page and off-plot connector shall be shown as a line function (*e.g.*, Low Level Override) or equipment to be controlled (*e.g.*, PV-10014A/B).
 5. Text associated with off-page and off-plot connectors on the left side of the P&ID should be left justified; text associated with off-page and off-plot connectors on the right side of a P&ID should be right justified.
- 4.2.1.9 Equipment arrangement shall be shown relative to its elevation to grade (*e.g.*, pumps at bottom of P&ID) in accordance with Appendix C.
- 4.2.1.10 A control valve actuator shall be shown above a horizontal line or left of a vertical line.
- 4.2.1.11 If a control valve identification bubble is required, the center point of the bubble shall be shown 0.5 inch above and 0.5 in away from the actuator in a horizontal line or 0.5 inch to the left and 0.5 inch away from the actuator in a vertical line.
- 4.2.1.12 The center point of an instrument bubble shall be shown 0.5 inch directly above an in-line instrument in a horizontal line or 0.5 inch directly left of an in-line instrument in a vertical line. Examples are restriction orifices and stand-alone thermowells.
- 4.2.1.13 Pump and compressor driver piping, instrumentation, and auxiliaries can be shown on a separate, auxiliary P&ID. “Primary” P&ID and auxiliary P&ID shall be cross-referenced.
- 4.2.1.14 Typical details shall be used if clutter can be eliminated without detracting from clarity. These details shall be shown on the P&ID, on an auxiliary P&ID, or on a cover sheet.

4.2.1.15 Pressure Safety Valves

1. The Pressure Safety Valve (PSV) shall be shown in a vertical and upright position.
 2. The center point of a PSV identification bubble shall be shown 0.5 inch above and 0.5 inch away from the safety valve.
- 4.2.1.16 The center point of a Pressure Safety Element (PSE) identification bubble shall be shown 0.5 inch above a horizontal line or left of a vertical line and 0.5 inch away from the PSE or equipment.

4.2.2 Symbols

- 4.2.2.1 Format, equipment, piping, and instrument symbols shall be shown in accordance with Appendixes A-1, A-2, A-3, and A-4.
- 4.2.2.2 Equipment internals shall be shown using a short dash/space line at a weight of 0.02 inch.
- 4.2.2.3 A mating piping flange to an equipment nozzle shall be shown at a distance of 0.06 inch.
- 4.2.2.4 A connection to an equipment nozzle shall be shown if the connection is welded in accordance with Appendix A-3.
- 4.2.2.5 A note reference symbol shall be shown in accordance with Appendix A-1 at a weight of 0.03 inch.
- 4.2.2.6 A note number shall be shown in the note reference symbol at a weight of 0.02 inch.
- 4.2.2.7 Normally closed manual valves shall be shown using a darkened solid symbol.
- 4.2.2.8 If darkened-in valve symbols cannot be used because of symbol type (*e.g.*, butterfly valve), the abbreviation for Normally Closed (NC) shall be used directly below the valve in a horizontal line or to the right of the valve in a vertical line.
- 4.2.2.9 On/off valves shall be shown in normal operating position.
- 4.2.2.10 Control valves or relief valves shall not be shown as NC.

4.2.3 Lines

- 4.2.3.1 Primary process lines shall be shown in accordance with Appendix A-3 at a weight of 0.06 inch.
- 4.2.3.2 Secondary, utility, future, or existing lines shall be shown in accordance with Appendix A-3 at a weight of 0.02 inch.
- 4.2.3.3 Instrument line symbols shall be shown in accordance with Appendix A-4 at a weight of 0.01 inch.
- 4.2.3.4 Packaged equipment limit lines shall be shown in accordance with Appendix A-1 at a weight of 0.03 inch.
- 4.2.3.5 Equipment outlines shall be shown in accordance with Appendix A-2 at a weight of 0.02 inch.

- 4.2.3.6 Inline piping components shall be shown in accordance with Appendix A-3 at a weight of 0.02 inch.
- 4.2.3.7 Line class and insulation breaks shall be shown in accordance with Appendix A-1 at a weight of 0.02 inch.
- 4.2.3.8 Piping and instrumentation lines on the P&ID are to be routed as directly as possible in vertical and horizontal orientation with minimal changes in direction. Avoid showing lines in non-vertical and non-horizontal routing.
- 4.2.3.9 Spacing between lines shall be maintained at a minimum of 0.5 inch.
- 4.2.3.10 Flow arrows shall be shown at corners and intersecting lines.

4.2.3.11 Line Breaks

1. Vertical primary process lines shall be broken if crossing horizontal primary process lines.
 2. Secondary and utility lines shall be broken if crossing primary process lines.
 3. Vertical secondary and utility lines shall be broken if crossing horizontal secondary and utility lines.
 4. Instrument lines shall be broken if crossing process and utility lines.
 5. For utility collection/distribution P&IDs, entering and exiting lines shall be broken if crossing pipe rack lines.
- 4.2.3.12 Line break gaps shall be maintained at 0.13 inch.
 - 4.2.3.13 Routing lines across equipment or text shall be avoided.

4.2.4 Text

Comment: Many variables may adversely affect text legibility such as font availability and plotter/printer limitations. Text heights specified herein are recommended as optimal, and slight deviation, although not encouraged, may be required for legibility.

4.2.4.1 Drawing Notes

1. General text and drawing notes shall be shown using a text height of 0.1 inch at a weight of 0.02 inch.
2. General text and drawing notes shall be aligned left and shall start in the upper-left corner of the notes area in accordance with Appendix C.
3. If a note contains more than one line, the line spacing shall be 0.05 inch between each line.
4. Spacing between notes shall be shown at 0.25 inch beneath the last line of the preceding note maintaining a top and left text justification.

4.2.4.2 Equipment Information

1. Equipment numbers shall use a text height of 0.16 inch at a weight of 0.03 inch.
2. Equipment numbers shall be underlined.
3. Equipment title and data shall use a text height of 0.1 inch at a weight of 0.02 inch.
4. Equipment text shall be justified at the top and center.
5. Equipment numbers, titles, and data for fixed or static equipment (*i.e.*, exchangers, vessels, tanks, towers, filters, and material handling) shall be shown within 2 inches from the top inside borderline of the P&ID, directly above the equipment, and on the same horizontal plane as other equipment identification.
6. Equipment numbers, titles, and data for rotating equipment (*i.e.*, pumps, blowers, compressors, and agitators) shall be shown within 2 inches from the bottom inside borderline of the P&ID, directly below the equipment, and on the same horizontal plane as other equipment identification.
7. Equipment number, title, and data shall be shown once for identical equipment with the same number, title, and service (*e.g.*, P-601A/B).

4.2.4.3 Line Numbers

1. Line numbers shall be shown in accordance with Appendix A-3. See example shown in Appendix C.
2. Line numbers shall use a text height of 0.1 inch at a weight of 0.02 inch.
3. Line number text shall be placed 0.06 inch from the line and shall be lined up vertically 0.25 inch from the connector.
4. Line numbers at entering off-page and off-plot connectors shall be justified at the top and left.
5. Line numbers at exiting off-page and off-plot connectors shall be justified at the top and right.
6. Line numbering shall be shown with the orientation of the line.

4.2.4.4 Text Arrangement

1. Text shall be shown horizontal if possible.
2. Vertical text shall be placed to the left of supporting graphics if possible.
3. Vertical text shall be read from bottom to top.

4.2.4.5 Abbreviations shall be in accordance with Appendix A-1.

4.2.4.6 Control Valve Information

1. Control valve failure action abbreviation shall be shown at 0.06 inch directly below the control valve in horizontal lines and 0.06 inch to the right of the control valve in vertical lines. See examples shown in Appendix C.
2. If the valve size is not line size or easily inferred from adjoining pipe, reducers, or equipment, control valve size shall be shown between the actuator and valve body symbol. If necessary, control valve size can be repositioned so as not to be obscured by other items shown on actuator (*i.e.*, position switches, handwheels, etc.). See examples shown in Appendix C.
3. Control valve seat leakage criteria (*i.e.*, tight shut-off [TSO]) shall be shown between the actuator and valve body symbol. If necessary, control valve leakage criteria can be repositioned so as not to be obscured by other items shown on the actuator (*i.e.*, position switches, handwheels, etc.). See examples shown in Appendix C.

4.2.4.7 For PSVs, PSEs, and pressure control valves (PCVs), the device size and set pressure shall be shown close to the identification bubble. See examples shown in Appendix C.

4.3 Equipment

4.3.1 General

4.3.1.1 Equipment Symbols

1. Equipment symbols shall be shown in accordance with Appendix A-2.
2. Equipment shall be shown with simple outline representation.
3. Discretion shall be exercised for equipment symbols to not dominate the drawing, but the symbols shall be drawn large enough for clear understanding.
4. Equipment shall not be drawn to scale.
5. Equipment shall be shown relative to associated equipment both in size and general orientation.

4.3.1.2 Nozzles

1. Nozzles, including spares, shall be shown on equipment as single lines.
2. Manways shall be shown as double lines.
3. Process and utility nozzles may be labeled.
4. Nozzle sizes shall be shown, unless the size is implied by piping connections.

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

4.3.1.4 Equipment shall be identified 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 Appendix C for illustrative purposes only. The classifications are only one example of classifications allowed by this Practice.

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

4.3.1.6 Internals for equipment shall be shown as dashed lines as described in Section 4.2.2.2. Details of internals that have no significant bearing on the piping design and layout or equipment operation shall be omitted.

4.3.1.7 Equipment elevations shall not be shown unless the elevations are necessary to specify process requirements for associated equipment location or orientation relative to one another.

4.3.1.8 Associated trim (*e.g.*, vent and drain valves, instrument bridles) for equipment shall be shown.

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

4.3.1.10 Jacketing and tracing requirements for equipment shall be shown.

4.3.1.11 The type of insulation (*e.g.*, personnel protection, heat conservation) for equipment shall be shown as part of the equipment data. Insulation thickness shall be shown where applicable.

4.3.2 Agitators

4.3.2.1 The term agitator shall apply to mechanical mixers and aerators.

4.3.2.2 Agitators shall be shown in accordance with Appendix A-2.

4.3.3 Blowers

4.3.3.1 Blower symbols shall be shown as centrifugal or positive displacement as required.

4.3.3.2 Blowers shall be shown in accordance with Appendix A-2.

4.3.4 Compressors

4.3.4.1 The compressor symbol shall be shown for each stage of multistage compressors.

4.3.4.2 Multistaged compressors can be shown on multiple P&IDs.

4.3.4.3 Compressors shall be shown in accordance with Appendix A-2.

4.3.5 Drivers

4.3.5.1 Drivers shall be shown with the driven equipment and shall use the symbols for motors, diesel engines, and turbines.

- 4.3.5.2 Equipment numbers for drivers are normally not required because equipment data for the drivers is shown as an integral part of the associated driven component.
- 4.3.5.3 Equipment number shall be shown for driver if it drives more than one piece of equipment or if the driver number is different from the equipment it drives.
- 4.3.5.4 The base symbol for the pneumatic driver is the same as the electric driver. Air inlet and discharge nozzles shall be shown for the pneumatic driver.
- 4.3.5.5 Drivers shall be shown in accordance with Appendix A-2.

4.3.6 Heat Exchangers

- 4.3.6.1 The term heat exchanger includes unfired heat exchangers, coolers, condensers, reboilers, vaporizers and heating coils.
- 4.3.6.2 Shell and tube exchangers shall be shown following the TEMA convention (*e.g.*, AEL, BEM) for the type utilized in the process in accordance with Appendix A-2.
- 4.3.6.3 Other types (*e.g.*, plate and frame, double pipe) shall be shown in accordance with Appendix A-2.
- 4.3.6.4 Exchanger nozzles shall be oriented to indicate the flow path through the exchanger.
- 4.3.6.5 The total duties shall be shown for multiple exchangers utilized in series or parallel configurations for common service.
- 4.3.6.6 Air-cooled exchangers shall include two basic types, forced draft or induced draft. Each type can have recirculation, multiple bundles, multiple fans, variable (automatic or manual) fan pitch, variable louvers, or steam coils. Symbols can 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 is one of many possible representations.
- 4.3.7.2 The radiant coils and convection coils for the furnace shall be shown to distinguish between the respective sections.

4.3.8 Pumps

- 4.3.8.1 Pumps shall be shown in accordance with Appendix A-2.
- 4.3.8.2 Base plates shall not be shown unless panned and drained.
- 4.3.8.3 Drains and lines to oil and/or water sumps shall be shown.
- 4.3.8.4 Vendor-supplied instrumentation or controls (*e.g.*, relief for a positive displacement pump, high temperature shutoff switch) shall be shown.
- 4.3.8.5 External piping and instrumentation for pump seals shall be shown.

4.3.9 Packaged Equipment

- 4.3.9.1 The term packaged equipment includes units such as air driers, refrigeration systems, etc.
- 4.3.9.2 Packaged equipment limit lines shall be shown in accordance with Appendix A-1.
- 4.3.9.3 Packaged equipment shall be shown in its entirety.

Comment: To satisfy this requirement and avoid duplication of effort in producing P&IDs, vendor drawings, in PIP format, can be referenced in an empty box drawn with package equipment lines.

- 4.3.9.4 Equipment/Item Numbers (reference Section 4.3.12) shall be assigned to individual equipment in the package.

4.3.10 Vessels

- 4.3.10.1 Vessels shall be shown as representing the actual vessel shape and orientation. Example representations of vessels are shown in Appendix A-2.
- 4.3.10.2 Manways, handholes, and skirts shall be shown.
- 4.3.10.3 Other equipment (*e.g.*, spheres) supports shall be shown only if needed.
- 4.3.10.4 Trays and tray numbers shall be shown at process connection points.
- 4.3.10.5 Trays shall be numbered in accordance with the project convention.
- 4.3.10.6 The top and bottom trays shall be shown.

4.3.11 Tanks

Tanks shall be shown as representing the actual tank shape and orientation in accordance with Appendix A-2.

4.3.12 Classification of Equipment

The equipment classifications listed in Table 1 are used on the example P&IDs contained in Appendix C for illustrative purposes only. These equipment classifications are only one example of classifications allowed by this Practice.

Table 1: Equipment Classifications

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	Vessels	Separators, Driers, Accumulators, Drums

4.3.13 Equipment Data

The following equipment information shall be shown on the P&ID in relation to the appropriate equipment symbol and in accordance with Section 4.2.4.2:

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 and D/P)
- Power Requirements
- Materials of Construction

4.3.13.3 Compressors

- Equipment/Item Number
- Title/Service
- Capacity (Flow and 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 and TDH)
- Power Requirements
- Materials of Construction
- Insulation/Tracing

4.3.13.7 Vessels/Tanks

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

4.3.13.8 Units of measure (*e.g.*, GPM, PSIG, BTU/hr) for equipment data shall be shown as required.

4.3.13.9 Equipment not listed shall be described as appropriate to convey important data.

4.4 Piping

4.4.1 Line Data Identification

- 4.4.1.1 The line data identification shall be shown in accordance with Appendix A-3.
- 4.4.1.2 Unit symbols (*e.g.*, “” for inches) shall be included with line sizes.
- 4.4.1.3 A leading zero shall be used if calling out piping in decimal format.
- 4.4.1.4 Additional characters can be added to the size tag (*i.e.*, user is not limited to “XXXX”).
- 4.4.1.5 Suffixes shall not be used as part of the sequence number.
- 4.4.1.6 Sequence numbers shall typically originate and terminate at equipment.
- 4.4.1.7 Different sequence numbers shall be assigned to line branches that terminate at different equipment numbers or lines.
- 4.4.1.8 The sequence number shall not be changed if the line flows through a piping specialty item or a control valve.
- 4.4.1.9 The sequence number may be changed if there is a line class break.
- 4.4.1.10 Different sequence numbers shall be assigned to the inlet and outlet of pressure relief valves.
- 4.4.1.11 The size and insulation thickness fields accommodate either English or metric units.
- 4.4.1.12 Insulation code changes shall be shown using the point of change symbol referenced in Appendix A-1.
- 4.4.1.13 Special layout requirements (*e.g.*, No Pockets) shall be shown with a note.

4.4.2 Line Service Codes

- 4.4.2.1 Line service codes are listed in Appendix A-3.

Comment: Additional line service codes can be added as required.

- 4.4.2.2 Each line service code shall consist of one to three alpha characters.

4.4.3 Piping Line Symbols

- 4.4.3.1 Piping shall be shown for primary, secondary, utility, jacketed or double containment, and future lines in accordance with Appendix A-3. For future lines, the dashed symbol shall be used and the line shall be labeled as “future.”
- 4.4.3.2 Piping for existing lines depicted on new P&IDs shall be shown in accordance with Appendix A-3. The dashed symbol shall be used for existing lines and the line shall be labeled as “existing.”

Comment: Piping for new lines depicted on existing P&IDs is not covered by this Practice.

- 4.4.3.3 Piping for above ground (AG) and underground (UG) lines shall be shown in the same manner.

- 4.4.3.4 An AG/UG line break or a piping line class break shall be used to distinguish between AG and UG lines.
- 4.4.3.5 Dashed lines can also be used to identify proposed, funded or duplicate equipment.

4.4.4 Valve Symbols

- 4.4.4.1 Valve symbols shall be shown in accordance with Appendix A-3.
- 4.4.4.2 Additional valve symbols can be added as required.
- 4.4.4.3 All valve symbols shall be shown full size.
- 4.4.4.4 Reduced size valve symbols shall not be shown for drain and vent valving.
- 4.4.4.5 Valve size shall not be shown unless the size cannot be clearly identified from the P&ID.
- 4.4.4.6 The listed valve symbols shall be used for defining control valve body types.
- 4.4.4.7 If the control valve body type is unknown, a gate valve or rotary valve symbol shall be used as the generic symbol.
- 4.4.4.8 Permanent hydrotest high-point vent and low-point drain valves shall be shown.

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

- 4.4.4.9 Temporary hydrotest valves (valves removed after testing) shall not be shown.
- 4.4.4.10 Valve tag (commodity) numbers shall not be shown.

Comment: To distinguish between two types of valves allowed by the same pipe specification or for non-spec valves, an abbreviation or commodity reference may be used.

- 4.4.4.11 A note or symbol shall be used to specify required installation/ orientation for a valve if necessary (*e.g.*, valves with a vented ball/disc).
- 4.4.4.12 Valve end connections shall not be indicated, with the exception of a blinded, capped, or plugged valve, and any design in which this requirement is critical.
- 4.4.4.13 Integral bypass (warm-up/pressurization) valves shall be shown where applicable.

4.4.5 Piping Specialty Items

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

- 4.4.5.1 Piping specialty items shall be shown in accordance with Appendix A-3. Additional piping specialty symbols can be added as required.

- 4.4.5.2 A tag number shall be assigned to each piping specialty item if it is not included in the piping material specifications.
- 4.4.5.3 The tag number shall be designated as “SP-XXXX” in which SP indicates a special piping item and XXXX is a four-character maximum identifier.
- 4.4.5.4 Identical piping specialty items located in multiple locations may be designated with the same tag number.
- 4.4.5.5 Piping specialty items can be tagged as equipment or instrument items.

4.4.6 Piping Fittings

- 4.4.6.1 Typical piping fittings shall be shown in accordance with Appendix A-3. Additional piping fitting symbols can be added as required.
- 4.4.6.2 All reducers shall be shown on the P&ID.
- 4.4.6.3 Reducer size shall not be shown if it can be clearly identified from the P&ID.
- 4.4.6.4 Weld connections shall be shown if appropriate (*e.g.*, at vessel nozzles).

4.4.7 Connectors and Tie-in Symbols

- 4.4.7.1 All connectors and tie-ins shall be shown as in Appendix A-3.
 - Comment:* The connector number shall be a number unique to a set of connectors for a line traveling between two P&IDs.
- 4.4.7.2 The off-page connector shall be used for lines that continue to/from another P&ID showing the same unit or system.
- 4.4.7.3 The utility or drain connector shall be used for lines that enter/exit a P&ID from a utility distribution type P&ID.
 - Comment:* A service description and equipment number reference are not required for utilities.
- 4.4.7.4 The off-page connector shall be used for utility lines if these lines are the primary system represented on the P&ID.
 - Comment:* Utility primary systems include utility headers and non-distribution type utility lines (*e.g.*, raw water treatment lines).
- 4.4.7.5 The off-plot connector shall be used for lines that cross unit or battery limits.

4.4.9 Notes

- 4.4.9.1 The notes listed in Appendix A-3 shall represent typical design notes and are shown on the cover sheets of Appendix B.
- 4.4.9.2 Specific design notes shall be shown on the applicable P&ID.

4.5 Instrumentation and Controls

4.5.1 Symbols

- 4.5.1.1 Instrument and control symbols shall be shown in accordance with Appendix A-4. (Reference *ISA-5.1* for additional details)
- 4.5.1.2 The conventions established by *ISA-5.1* shall be followed for tagging and numbering of instrument and control devices. (Reference Appendix A-4)

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

01 FC 100 01

01 – Plant Number (shall 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.

Breaks in the instrument bubble may be used to accommodate longer tag numbers.

- 4.5.1.3 All measurement types shall be identified by an ISA symbol.
- 4.5.1.4 If necessary, a descriptive text label may be added (*e.g.*, analysis components like CO, H₂, CH₄, or unique flow measurement devices like “Mass”).
- 4.5.1.5 Interlock symbols shall be depicted as follows:
 - a. For discrete, hardware-based interlocks, the conventional diamond symbol shall be used in accordance with *ISA-5.1* and *ISA-5.2*.
 - b. For PLC-based interlocks, the diamond-in-a-box symbol shall be used in accordance with *ISA-5.1* and *ISA-5.2*.
 - c. For DCS-based interlocks, the DCS symbol (bubble-in-a-box) shall be used.
 - d. For PLCs integral to the DCS, the PLC symbol (diamond-in-a-box) shall be used.

Comment: Reference Appendix A-4 and Section 4.5.6 for additional information.

- 4.5.1.6 Directional arrows on instrumentation signal lines shall be used only if the function is not obvious (*e.g.*, cascades, selectors, interlocks).
- 4.5.1.7 Instrument function symbols, shown in Appendix A-4, shall be used to clarify the function of certain tagged instrument bubbles. The symbol shall be placed outside the bubble at the upper right.

- 4.5.1.8 The off-page connector shall be used in accordance with Appendix A-3 to depict continuation of instrumentation signals from one P&ID to another.
- 4.5.1.9 An individual instrument bubble shall not be shown more than once, unless needed to clarify operation of the loop.
- 4.5.1.10 If it is necessary to show an instrument bubble more than once, the succeeding occurrences shall be shown as dotted (*e.g.*, turbine controls shown on a different sheet than the turbine).
- 4.5.1.11 Instrument Line Symbols shall be shown in accordance with Appendix A-4.
- 4.5.1.12 The alternative triple cross-hatched solid line allowed by *ISA-5.1* shall not be used for electrical signals.
- 4.5.1.13 The ISA optional binary (on-off) symbols shall not be used for instrument lines.
- 4.5.1.14 Device location and accessibility shall be shown in accordance with Appendix A-4.
- 4.5.1.15 An instrument bubble with horizontal double dashed lines shall be used to show instrumentation in normally inaccessible auxiliary locations.
- 4.5.1.16 FO shall be used to tag all restriction orifices in accordance with *ISA-5.1*.
- 4.5.1.17 RO shall not be used for restriction orifices.
- 4.5.1.18 The same symbol (not tag) shall be used for a measuring flow element (FE) orifice and a restriction orifice (FO).
- 4.5.1.19 Instrument symbols on the P&ID do not necessarily reflect orientation.
- 4.5.1.20 Physical arrangement shall be covered by installation details or special notes.

4.5.2 Measurements

- 4.5.2.1 All transmitters shall be shown to avoid misinterpretations of physical and wiring connections between the transmitter and other devices or systems.

4.5.2.2 Isolation and Root Valves

1. Isolation valves shall be shown where an instrument is mounted on a vessel or other piece of equipment.
2. Root valves shall not be shown where these installation details can be adequately defined on a P&ID cover sheet.
3. Typical details, contained in the cover sheets (Appendix B), shall be used to identify the valve type, size, rating, and materials of construction in accordance with the applicable piping line class.

4.5.2.3 Instrument Leads

1. If instrument leads or analyzer lines are piping (*e.g.*, level bridles), the piping and related components shall be shown in accordance with Section 4.4.
2. If instrument leads are tubing, only the tubing shall be shown. Tubing valves, connections, and fittings shall not be shown.
3. Both leads for differential pressure type measurements shall be shown.
4. A single line, representing two leads, shall be used to simplify the drawing if intent is clear (*e.g.*, only a single line shall be typically shown for flange tap orifice meters).

4.5.2.4 Dip Tubes, Bubblers, and Stilling Wells

1. Dip tubes, bubblers, and stilling wells shall be shown for both process and instrumentation.
2. Notes shall be added as required for relevant specifications, materials, dimensions, weep holes, spray heads, etc.

4.5.2.5 Flow Meters

1. Flow meters shall be shown with the appropriate ISA symbol.
2. If no unique symbol exists or if a device type is unknown, a generic symbol shall be used and a text label shall be provided to identify the measurement type. (Reference Appendix A-4)
3. A tag shall be provided for all in-line generic flow meter bubbles.
4. A bubble shall be shown with a loop tag for other flow meter element symbols only if the loop association is not readily apparent. (Reference Section 4.2.1.12)
5. The size of all in-line devices shall be shown if not line sized or otherwise implied.
6. Flow meter accuracies shall not be shown.
Comment: Use of a note to indicate special flow meter requirements is optional.
7. If used, flow conditioning devices (*e.g.*, straightening vanes) shall be labeled with an instrumentation tag (*e.g.*, "FX-...") associated with the flow measurement loop.

- 4.5.2.6 Quality designations (*e.g.*, ISO-9000) shall not be shown.

4.5.2.7 Temperature

1. A symbol and tag shall be shown for a thermowell if it is a stand-alone, spare, or test well.
2. Unless the loop association is not readily apparent, thermowell symbols or tags shall not be shown if a thermal measuring element is connected to it.
3. If a bare element is necessary (no thermowell), then a note or text label (*e.g.*, BARE) shall be added.

Comment: Text should be placed outside the symbol in the lower right.

4. Unless the loop association is not readily apparent (*e.g.*, dual elements), thermal or temperature measuring elements (TE) shall not be shown with a symbol or tag.

4.5.2.8 Purge and Blowback

1. Process connection purge and blowback requirements shall be shown for all measuring devices requiring it in accordance with Appendix A-1.
2. Purge media and pressure shall be included.
3. Detailed hardware associated with purge/blowback (*e.g.*, rotameters) shall be shown on installation details, auxiliary P&IDs, or cover sheets.

4.5.2.9 Air Supplies

1. Air supplies to individual devices are not generally shown.
2. Air supplies to solenoids or other special applications shall be shown as needed to clarify valve porting or operation (*e.g.*, trip solenoids or pneumatic hand switches).

4.5.2.10 Process Analyzers

1. Analyzer sample points, return lines, and connections shall be shown.
2. Analyzer piping shall be labeled in accordance with Appendix A-3.
3. Analyzer tubing shall be labeled with size and the applicable instrument piping and tubing system specification from *PIP PCSIP001*.
4. Sampling system hardware shall be shown on analyzer or other auxiliary drawings.
5. A single stream analyzer shall be shown on the same P&ID as its sample point.
6. Multi-stream analyzers shall be shown only once with off-page connectors from/to the multiple sample points/returns.

7. Sample connections that supply/return samples to/from multiple analyzers shall be shown only once, with continuations to/from other analyzers.
8. Measured components shall be shown at the upper left of each analyzer or sample point bubble as required.

4.5.2.11 Winterization and heat tracing requirements shall be shown for analyzers and instrumentation.

Comment: The insulation type code should be placed at the lower left of the bubble.

4.5.2.12 Indicators

1. If an indicator is integral to a transmitter, a single bubble and tag (*e.g.*, LIT) shall be used.
2. If separate devices are used for the transmitter and the indicator (*e.g.*, a remotely located indicator), separate bubbles and tags (*e.g.*, LT and LI) shall be shown.

4.5.2.13 Level Gauges

1. Level and gauge glasses shall be shown with the appropriate symbol and tag.
2. For level and gauge glasses, a single function (one bubble and tag) shall be used regardless of the number of individual sections required to span the length.

Comment: A text label or note can be used to define the number of sections.

3. Separate bubbles and tags shall be shown for redundant gauge glasses or for applications with separate taps (*e.g.*, overlapping gauges).
4. The distance between level gauge connections shall not be shown.

4.5.3 Valves

4.5.3.1 General

1. Valves shall be shown in accordance with Appendix A-3.

Comment: The symbols for automated valve bodies and for manual valves are identical.

2. The appropriate actuator symbols (*e.g.*, diaphragm and piston) shall be used to distinguish automated valves from manual valves.
(Reference Appendix A-4)

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.

3. The symbols shown in Appendix A-4 shall be used for pressure and temperature regulators.

4.5.3.2 Automated Valves

1. Automated valve fail actions shall be shown with text (FC/FO/FL/FI) in accordance with ISA-5.1. (Reference Section 4.2.4.6)

Comment: Using stem arrows as outlined in ISA-5.1 is not recommended.

2. For multi-port automated valves, FL and FI shall be used where appropriate.

Comment: FO and FC shall not be used; instead, arrows shall be used to show fail position flow paths. Note that multiple arrows may be required.

3. Valves with different fail actions for loss of signal and for loss of motive power require an explanatory note.
4. Valve body sizes shall be shown for all automated valves if not line sized or otherwise implied. (Reference Section 4.2.4.6)
5. Automated valve specifications or commodity codes shall not be shown.
6. For automated valves, tight shut-off requirements shall be identified by using the abbreviation "TSO." (Reference Section 4.2.4.6)

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

4.5.3.3 Identifying Tags

1. Valve identifying tags with bubbles shall not be shown if the associated loop tag is readily apparent.
2. An identifying tag with a bubble shall be shown for split range valves, self-contained regulators, or valves located on a separate P&ID from its controller. (Reference Section 4.2.1.6)

- 4.5.3.4 The ranges (*e.g.*, 0-50%, 50-100%) shall be shown for split range control valves.

Comment: The preferred labeling is controller percentage output because it applies to both pneumatic and electronic systems.

- 4.5.3.5 Valve positioners shall not be shown unless necessary to clarify loop operation (*e.g.*, if used with trip solenoids or pneumatic trip relays).

Comment: If shown, valve positioners are normally included with the automated valve symbol and are not tagged.

4.5.3.6 If engineered as a separate item from the control valve, current to pneumatic converters (I/Ps) shall be shown with a bubble symbol, tag, and function box only if furnished and mounted separately from the control valve, or if used with a trip solenoid valve.

4.5.3.7 Solenoid Valves

1. All solenoids that actuate final control elements (*e.g.*, trip valves and pneumatic relays) shall be shown.
2. Solenoid valve fail actions shall be shown using a directional arrow indicating the open flow path if de-energized.

Comment: A four-way solenoid valve requires two directional arrows to adequately define the flow paths.

3. Resets (manual or remote) shall be shown if included with the solenoid valve.

4.5.3.8 Limit Switches

1. Limit switches on automated valves shall be identified with a bubble and tag.

Comment: The open or closed tag can be depicted with ZSO or ZSC. If both limit switches are provided, a single bubble should be used with O and C modifiers outside the bubble.

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

4.5.3.9 Automated valve auxiliaries (*e.g.*, handwheels, volume tanks, nitrogen back-up bottles) shall be shown.

Comment: The use of typical details reduces clutter.

4.5.3.10 A note shall be used to identify the need for valve travel stops.

4.5.3.11 Set points on process regulators shall be shown.

4.5.4 Safety/Relief Devices

4.5.4.1 Relief devices and conservation vents shall be shown and tagged in accordance with Appendix A-4 (*e.g.*, PSE and PSV).

4.5.4.2 Optional explanatory text may be used 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)

4.5.4.3 PSE shall be used only for safety related service.

Comment: PSV typically refers to reclosing devices. PSE typically refers to non-reclosing devices (*i.e.*, rupture discs, buckling pin relief device). “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.” See *ISA-5.1* (Table 1, Note 8).

- 4.5.4.4 PCV or PCE shall be used for non-safety conservation vents.
- 4.5.4.5 The relief device set pressure shall be shown.
- 4.5.4.6 The relief device size shall be shown as follows:
 - a. PSVs – inlet size and outlet size
 - b. Rupture discs – disc diameter
 - c. Buckling Pin PSE – inlet size and outlet size
 - d. Conservation vents – inlet nozzle size if there is not a pipe away or tail piece, otherwise show inlet size and outlet size
 - d. Explosion panels – surface area or dimensions
- 4.5.4.7 The orifice size letter designation for relief valves shall be shown between the inlet and outlet sizes (*e.g.*, 3K4).
- 4.5.4.8 The relief device sizing basis or flow capacity shall not be shown.
- 4.5.4.9 The materials of construction for relief devices shall not be shown.

4.5.5 Equipment Start/Stops

- 4.5.5.1 The local start/stop hand switch for motors without automated controls shall not be shown.
- 4.5.5.2 Local (field) hand switches (bubble and tag) shall be shown that:
 - a. Are part of an operator control panel
 - b. Interface with other systems (*e.g.*, interlocks)
 - c. Otherwise need explanation
- 4.5.5.3 All control room (DCS or panel board) hand switches shall be shown with the appropriate bubble symbol and tag.
- 4.5.5.4 All hand switch positions or functions shall be labeled. The labels shall be located outside the bubble symbol, on the upper right, using the standard text abbreviations shown in the Appendixes. All others shall be spelled out.
- 4.5.5.5 All required feedback signals or functions (*e.g.*, valve positions, run lights) shall be clearly shown.

Comment: 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 and Alarms

4.5.6.1 Interlocks shall be shown only symbolically on the P&ID.

4.5.6.2 The functional definition shall be shown on auxiliary documents (*e.g.*, binary logic diagrams, descriptive narratives, truth tables).

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

Alarms can be similarly designed in a variety of ways. Alarms come from hardware, over serial links, from DCS software and can be 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 -84.01*, many documentation aspects of interlock and alarm system design should be defined by the owner.

4.5.6.3 Logic functions or interlocks shall be shown with the proper symbols in accordance with Section 4.5.1.

4.5.6.4 Binary logic gates, input/output tables, or descriptive narratives shall not be shown.

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

4.5.6.6 If Safety Instrumented Systems (SIS) are distinguished from other interlock systems, the preferred method shall be to add an "S" prefix to the unique interlock identification.

4.5.6.7 Each interlock shall be uniquely labeled, using a serial (not parallel) tagging scheme. The "S" prefix shall not be used to distinguish a unique interlock label.

Comment: A valid tagging scheme shall be I-100, I-101, SI-200, SI-201. The scheme I-100, SI-100 should not be used.

4.5.6.8 The type of logic solver hardware or level of redundancy shall not be shown except through the normal use of ISA symbols and the input and output signals described in Section 4.5.1 and the Appendixes.

4.5.6.9 Classifications or Safety Integrity Levels (SIL) shall not be shown for interlocks.

4.5.6.10 All operator-initiated interlock trip and reset hand switches shall be shown.

- 4.5.6.11 If used, all bypass hand switches for SIS interlocks shall be shown, including all individual initiator and system bypass switches.

Comment: Unnecessary clutter can be avoided by use of a table or reference note if large numbers of bypasses are necessary.

- 4.5.6.12 All hardwired alarms shall be shown.
- 4.5.6.13 All alarms that require engineering or other review and approval based on safety or operability shall be shown.
- 4.5.6.14 Hardware-based diagnostic alarms shall be shown.
- 4.5.6.15 Software-based diagnostic alarms shall be shown only if safety or operationally related (*e.g.*, defined in safety reviews).

Comment: Measurement out-of-range alarms are an example of software diagnostic alarms not generally shown.

- 4.5.6.16 Required alarms shall be shown with tag and level (*e.g.*, PAH), but alarm trip points or settings shall not be shown.
- 4.5.6.17 For alarms based on analog measurements, the functional tag (*e.g.*, PI) shall be shown inside the bubble and the alarm levels shall be shown outside the bubble.
- 4.5.6.18 High alarms (*e.g.*, H, HH) shall be placed at the upper right outside the bubble, and low alarms (*e.g.*, L, LL) shall be placed at the lower right outside the bubble.

Comment: The alarm modifier (A) should not be shown.

- 4.5.6.19 For discrete alarm points (on/off signals), the complete functional tag and alarm level (*e.g.*, PAH) shall be shown inside the bubble.
- 4.5.6.20 Standard ISA-5.1 abbreviations shall be used for both trip and alarm functions (*e.g.*, LSHH and LAHH).

4.5.7 DCS Points

- 4.5.7.1 A DCS point shall be shown if operations manipulates the process with it or receives information from it, or if the point is essential to understanding the functional operation of the process controls.

Comment: It is not necessary for every point configured in a DCS to be shown. It is not necessary for implied functions (*e.g.*, I for indicate, R for recorder) to be included in every DCS point tag.

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 that 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 requirements to specific systems shall determine which DCS points to show. DCS points not shown can be displayed on special purpose auxiliary drawings.

- 4.5.7.2 DCS points that indicate measured process values, including both analog and digital values obtained from hardwired inputs or via software links shall be shown (*e.g.*, flows, temperatures, pressures, compositions from analyzers, and valve open/closed status).
- 4.5.7.3 DCS points that exist solely to transmit input signals from field hardware to other DCS points shall not be shown (*e.g.*, a flow indicator point shall not be shown if the value is represented by a flow controller point on the P&ID).
- 4.5.7.4 DCS points that manipulate analog or digital output hardware devices shall be shown (*e.g.*, flow, temperature and pressure controllers, hand switches, and logic points).
- 4.5.7.5 DCS points that exist solely to transmit control signals from other DCS points to field hardware shall not be shown (*e.g.*, analog and digital output points).
- 4.5.7.6 DCS points that operations employ to manipulate the process via the BPCS shall be shown (*e.g.*, regulatory controllers and pump start/stop switches).
- 4.5.7.7 DCS points that provide operations an interface to manipulate the process through a software link to other systems shall be shown (*e.g.*, points that interface with controllers in the linked system and SIS reset hand switches).
- 4.5.7.8 DCS points that are essential to understanding the operation of the process controls shall be shown (*e.g.*, selectors in override controls or enthalpy calculators in heat duty controls).
- 4.5.7.9 DCS points that are required for regulatory compliance and mechanical integrity needs shall be shown (*e.g.*, rolling averages for emissions monitoring or compressor runtimes).
- 4.5.7.10 DCS points that are necessary to understand the functional operation of process control schemes shall be shown.
- 4.5.7.11 DCS points needed only for implementation shall not be shown (*e.g.*, points that provide bumpless transfer, initialization, some logic functions).
- 4.5.7.12 Higher Level Control Systems shall not be shown (*e.g.*, model predictive multivariable control systems).
- 4.5.7.13 Symbols (*e.g.*, hexagons, footballs) to indicate that a BPCS DCS point is being manipulated by a Higher Level Control System shall not be added.
Comment: A note can be used to reference HLCS details.
- 4.5.7.14 DCS points that exist solely to facilitate information transfer via a software link shall not be shown.

4.5.7.15 DCS points that are used solely to log, journal, or time stamp events shall not be shown.

4.5.7.16 Nonprocess indicators and alarms in locations such as rack rooms and motor control centers on auxiliary P&IDs shall be shown.

Comment: Indicators such as loss of power supply or UPS power, loss of cabinet fans, and smoke alarms should be considered.

4.5.8 Miscellaneous

4.5.8.1 The following information shall be specifically excluded:

- a. Controller actions
- b. Controller and alarm set points
- c. Configuration information (*e.g.*, controller or output actions, address information)

4.5.8.2 Miscellaneous instrument symbols shall be shown in accordance with Appendix A-4.

4.5.8.3 Typical details illustrating the use of implied tags shall be shown in accordance with Appendix B.

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Appendixes Summary

The Appendixes of this Practice contain tables of commonly used symbols, abbreviations and other identifiers; 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 inches x 34 inches) 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.

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 inches x 34 inches) P&IDs, but reduced to standard 8-1/2 inch x 11-inch pages for electronic distribution purposes. It is recommended that the cover sheets and P&IDs be printed on 11-inch x 17-inch pages.

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Appendix A – Tables and Symbols

A-1 Format Tables and Symbols

1. Abbreviations
2. Miscellaneous Symbols

A-2 Equipment Tables and Symbols

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

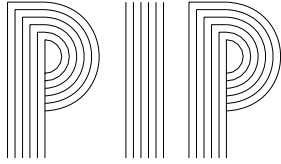
A-3 Piping Tables and Symbols

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

A-4 Instruments & Controls Tables and 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

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PROCESS INDUSTRY PRACTICES
APPENDIX

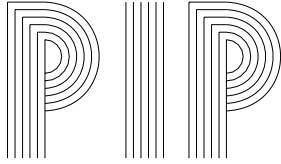
A-1

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PAGE 1 OF 2

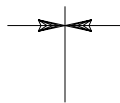
ABBREVIATIONS

PRACTICE REF. PIC001

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



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



POINT OF CHANGE
IN LINE CLASS OR
INSULATION REQUIREMENT



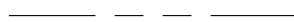
BATTERY LIMITS
(OR MATCH LINE)



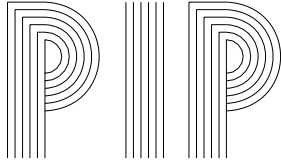
PURGE CONNECTION
(XXXX = PURGE PRESSURE AND MEDIUM)



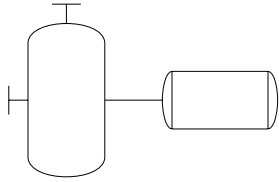
SAMPLE CONNECTION
(XX/YY = TYPE/NUMBER)



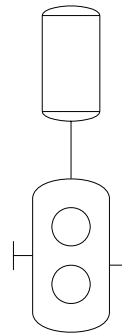
PACKAGED EQUIPMENT LIMITS



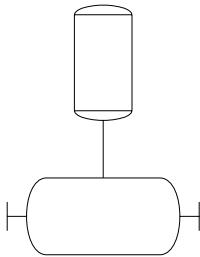
EQUIPMENT SYMBOLS
PUMPS



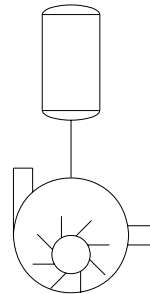
HORIZONTAL
CENTRIFUGAL PUMP



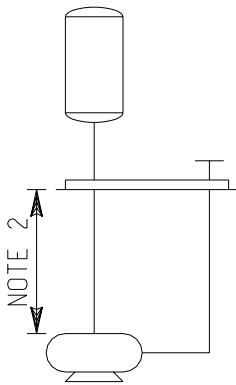
POSITIVE
DISPLACEMENT PUMP



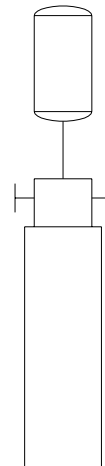
VERTICAL
INLINE PUMP



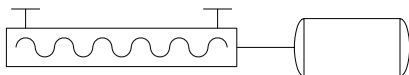
LIQUID RING
VACUUM PUMP



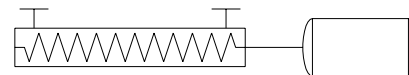
CENTRIFUGAL
SUMP PUMP



VERTICAL CAN PUMP



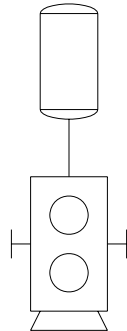
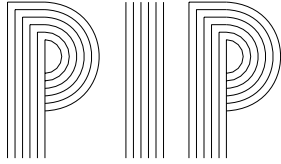
PROGRESSIVE CAVITY PUMP



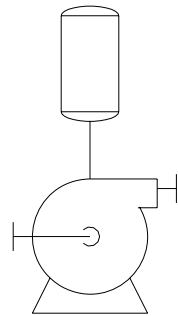
SCREW PUMP

NOTES:

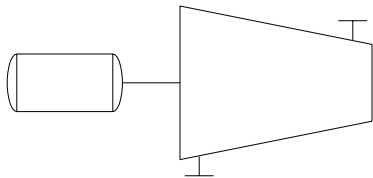
1. SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" DOCUMENTS.
2. LENGTH VARIES DEPENDING UPON DEPTH OF SUMP.
3. MOTORS SHOWN HERE TO ILLUSTRATE DRIVER ORIENTATION. FOR DRIVER SYMBOLS, SEE APPENDIX A-2, p.3.



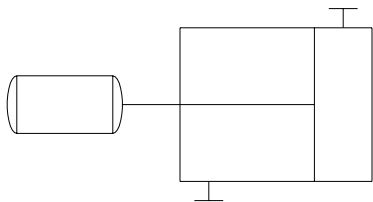
POSITIVE DISPLACEMENT BLOWER



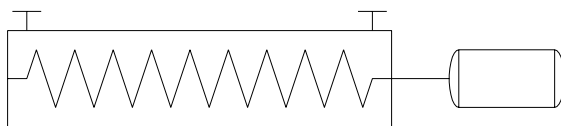
CENTRIFUGAL BLOWER



CENTRIFUGAL COMPRESSOR



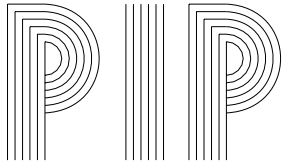
RECIPROCATING COMPRESSOR



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.



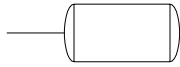
PROCESS INDUSTRY PRACTICES
APPENDIX

A-2

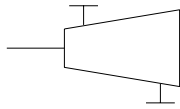
ISSUED: 7/15/98
REAFFIRMED: APRIL 2008
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EQUIPMENT SYMBOLS
DRIVERS & AGITATOR/MIXER

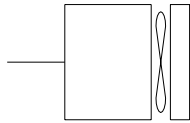
PRACTICE REF. PIC001



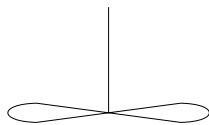
ELECTRIC MOTOR



TURBINE DRIVER

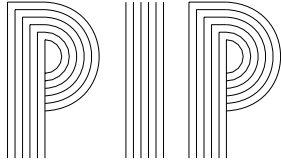


DIESEL ENGINE

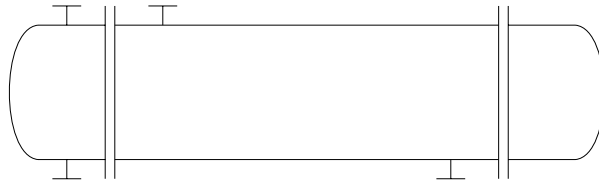


AGITATOR/MIXER

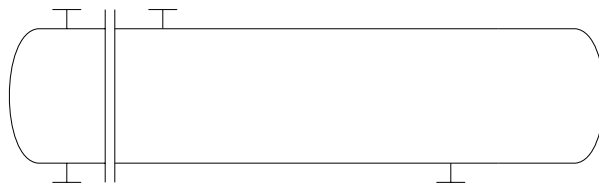
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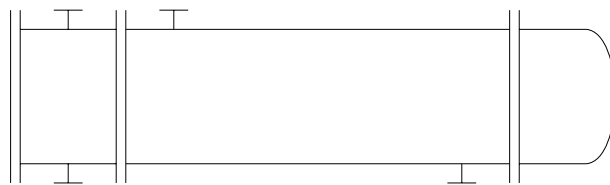
EQUIPMENT SYMBOLS
TEMA TYPE EXCHANGERS



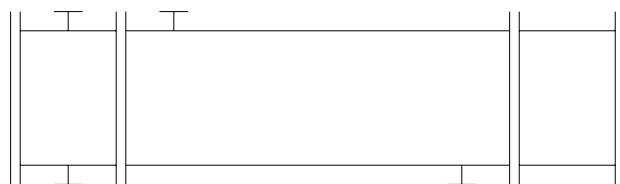
TEMA TYPE BEM



TEMA TYPE BEU



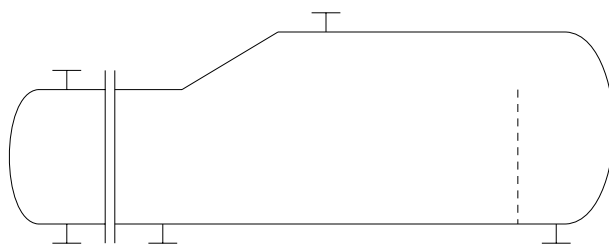
TEMA TYPE AEM



TEMA TYPE AEL



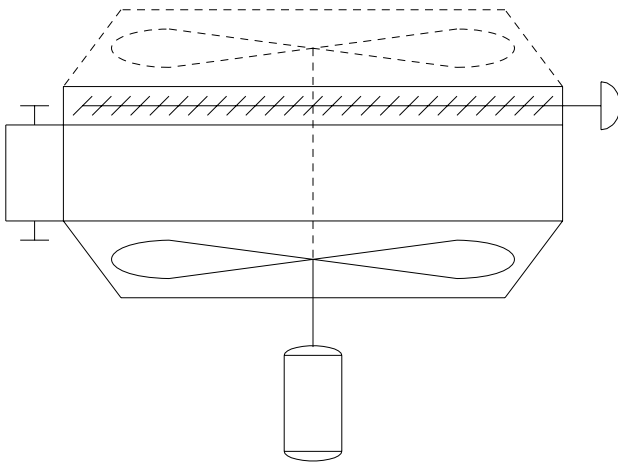
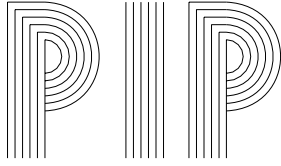
TEMA TYPE NEN



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.



AIR COOLED EXCHANGER
(LOUVERS OPTIONAL)

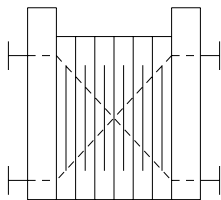
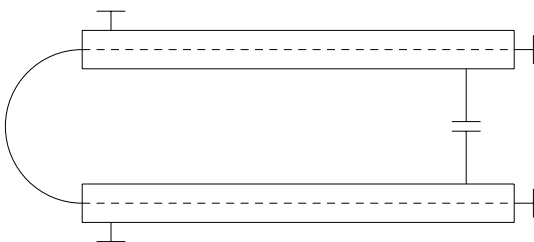
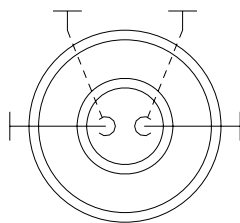


PLATE AND FRAME EXCHANGER

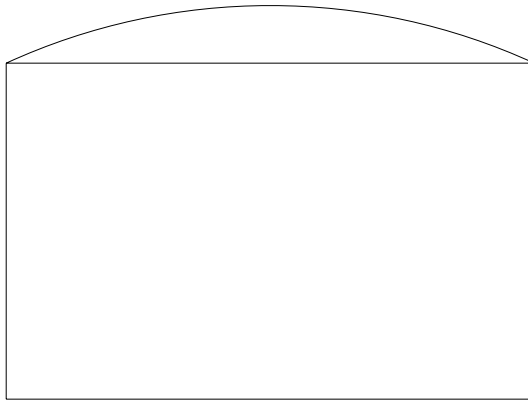
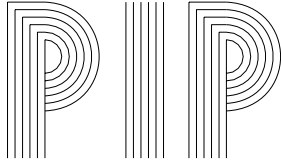


DOUBLE PIPE EXCHANGER



SPIRAL EXCHANGER

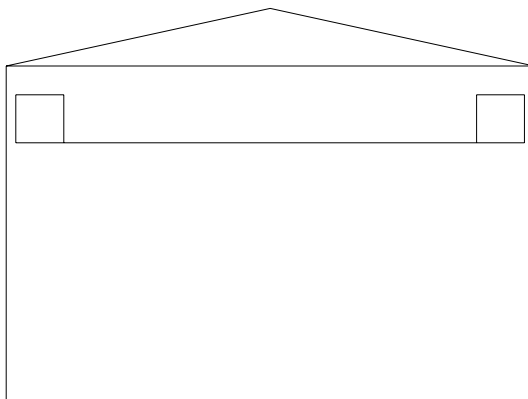
NOTE: SYMBOLS SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" DOCUMENTS.



DOME ROOF TANK

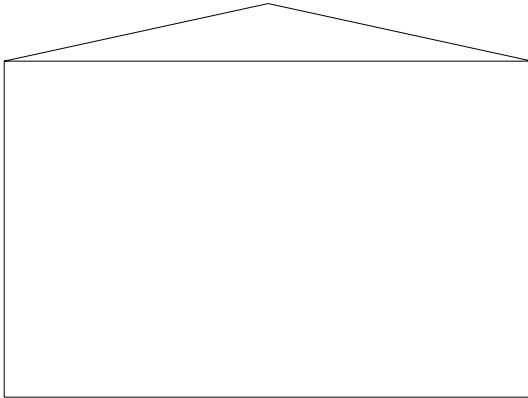
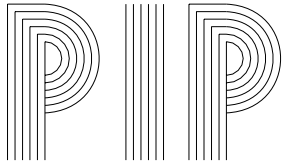


OPEN TOP TANK

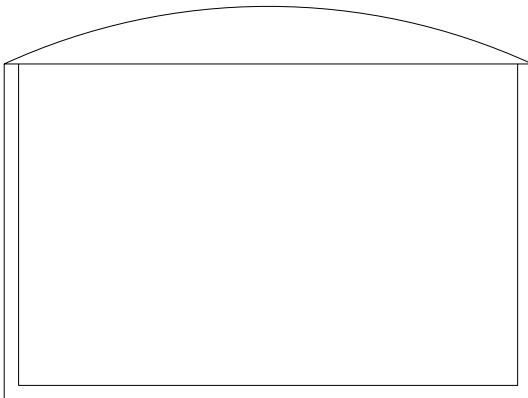


INTERNAL FLOATING ROOF TANK

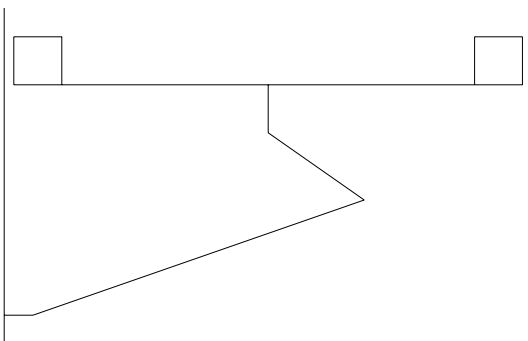
NOTE: ACTUAL SIZE WILL VARY.



CONE ROOF TANK

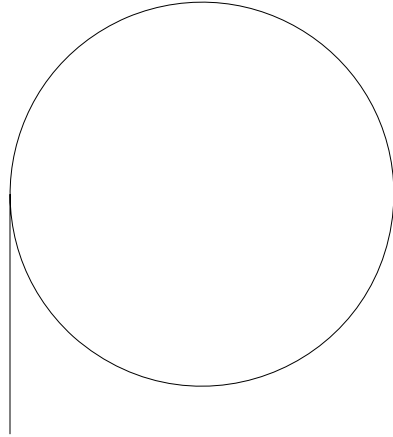
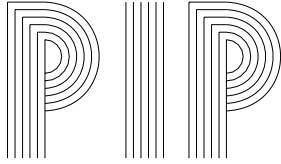


DOUBLE WALL TANK

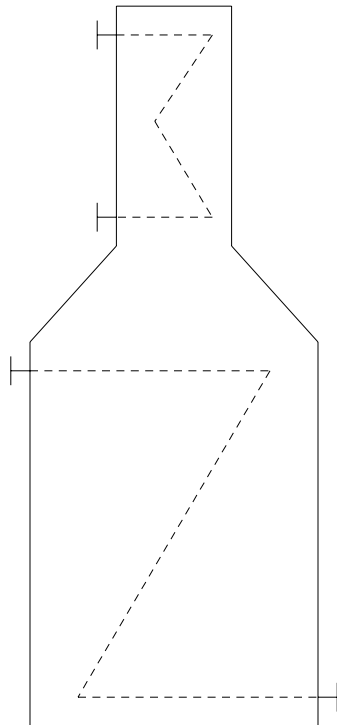


EXTERNAL FLOATING ROOF TANK

NOTE: ACTUAL SIZE WILL VARY.

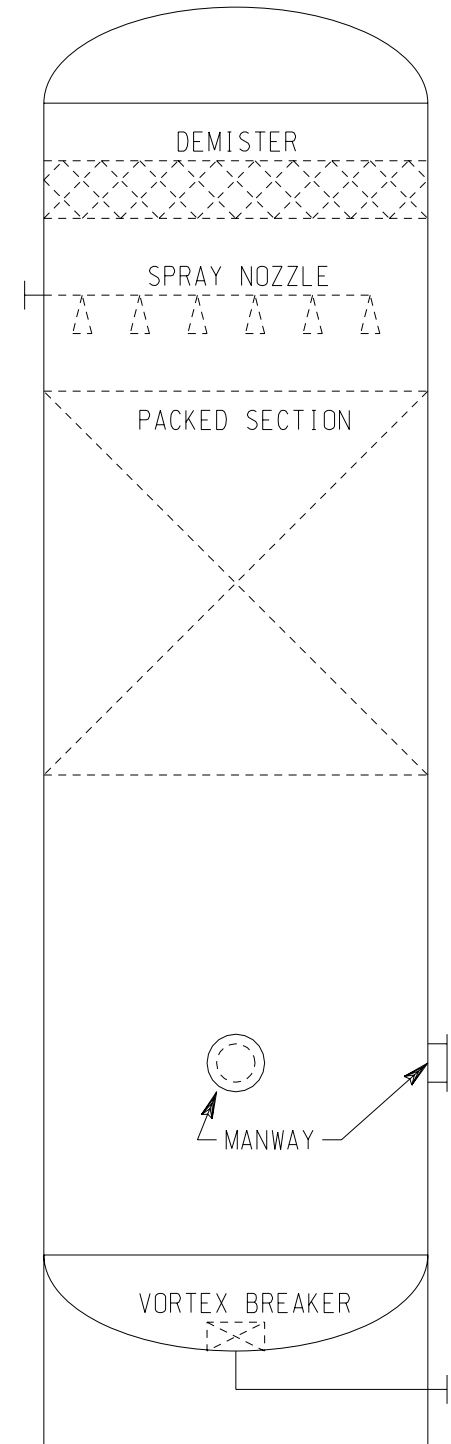
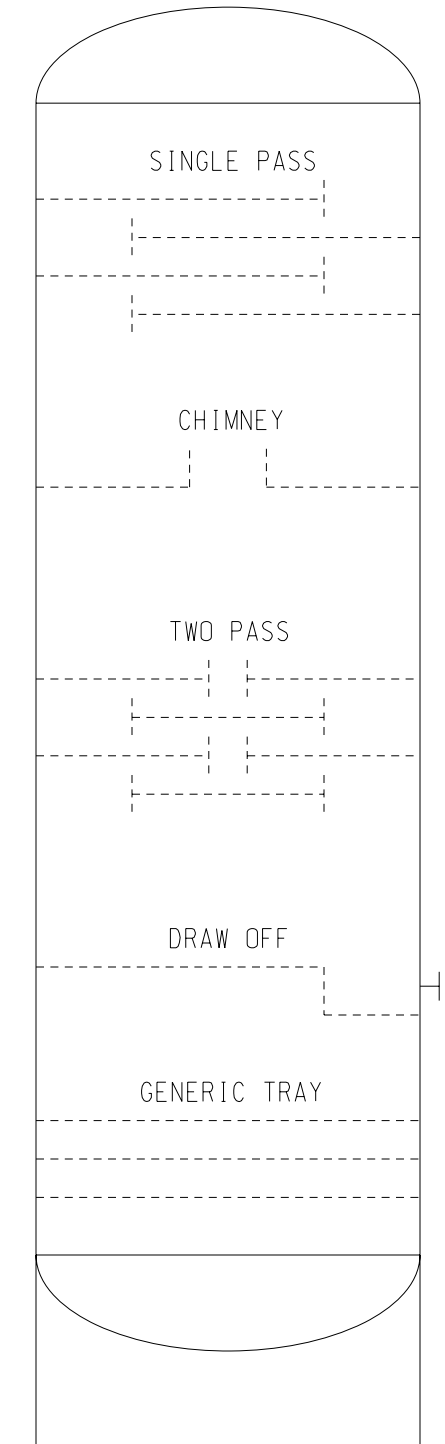
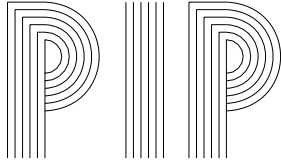


SPHERE

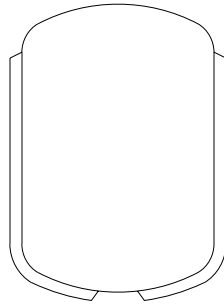
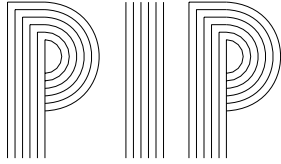


FURNACE

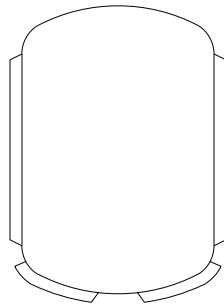
NOTE: ACTUAL SIZE WILL VARY.



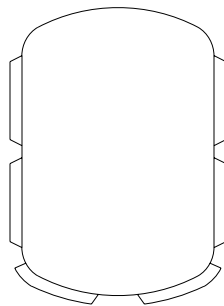
NOTE: ACTUAL SIZE WILL VARY.



JACKETED PRESSURE VESSEL
(1 ZONE)

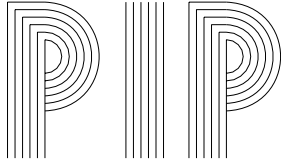


JACKETED PRESSURE VESSEL
(2 ZONES)



JACKETED PRESSURE VESSEL
(3 ZONES)

NOTE: ACTUAL SIZE WILL VARY.

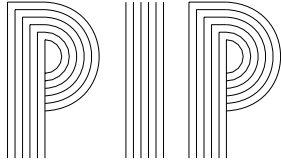


LINE DATA
IDENTIFICATION

UNIT/AREA (NUMERIC)	SERVICE (ALPHA)	SEQUENCE (NUMERIC)	SIZE (NUMERIC)	LINE CLASS (NOTE 1)
XX	-	XXX	-	XXXXX - XXXX - XXXXXXXX
(-----) XXXX - XXXX - XXXX				
	INSULATION TYPE (NOTE 2)	INSULATION THICKNESS (NUMERIC)	OPTIONAL (USER DEFINED)	

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.
3. USER IS NOT LIMITED TO THE NUMBER OF SPACES REPRESENTED BY THE "XX" CHARACTERS IN THE LINE DATA IDENTIFICATION EXAMPLE.



PROCESS INDUSTRY PRACTICES
APPENDIX

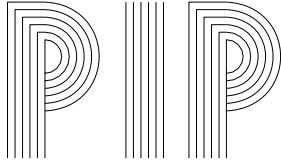
A-3

ISSUED: 7/15/98
REAFFIRMED: APRIL 2008
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LINE SERVICE
CODES

PRACTICE REF. PIC001

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



PROCESS INDUSTRY PRACTICES
APPENDIX

A-3

ISSUED: 7/15/98
REAFFIRMED: APRIL 2008
PAGE 3 OF 9

PIPING LINE
SYMBOLS

PRACTICE REF. PIC001

PRIMARY (AG & UG)



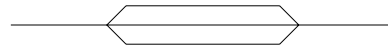
SECONDARY / UTILITY (AG & UG)

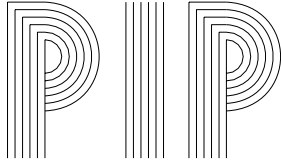


FUTURE OR EXISTING ON NEW P&IDs



JACKETED OR DOUBLE CONTAINMENT





PROCESS INDUSTRY PRACTICES
APPENDIX

A-3

ISSUED: 7/15/98
REAFFIRMED: APRIL 2008
PAGE 4 OF 9

VALVE
SYMBOLS

PRACTICE REF. PIC001



GATE (OR GENERIC)



PLUG



CHECK



DIAPHRAGM



STOP CHECK



3-WAY



GLOBE



4-WAY



BUTTERFLY



PINCH



NEEDLE



ANGLE



BALL

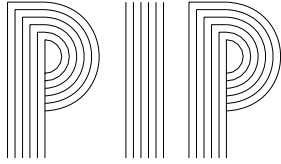


KNIFE



GENERIC ROTARY (1/4 TURN)

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



PROCESS INDUSTRY PRACTICES
APPENDIX

A-3

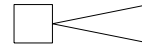
ISSUED: 7/15/98
REAFFIRMED: APRIL 2008
PAGE 5 OF 9

PIPING
SPECIALTY ITEMS

PRACTICE REF. PIC001



Y-TYPE STRAINER



EJECTOR/EDUCTOR



CONE STRAINER



REMOVABLE SPOOL



TEMPORARY STRAINER



DESUPERHEATER



T-TYPE STRAINER



FLEXIBLE HOSE



DUPLEX STRAINER



EXPANSION JOINT



BASKET STRAINER



DAMPER



FILTER



BREATHER



DETONATION ARRESTOR



VENT COVER



FLAME ARRESTOR



IN-LINE MIXER



STEAM TRAP



DIVERTER VALVE



EXHAUST HEAD



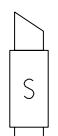
ROTARY VALVE



IN-LINE SILENCER



EXCESS FLOW VALVE

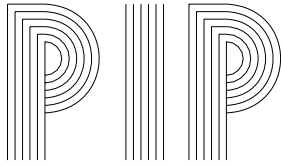


VENT SILENCER



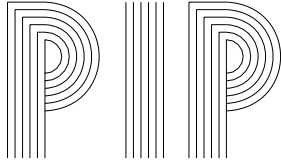
PULSATION DAMPENERS

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

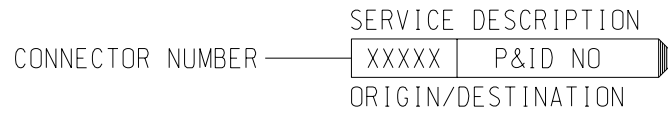


	FLANGE
	WELDED CONNECTION
	CAP
	CONCENTRIC (OR GENERIC) REDUCER
	ECCENTRIC REDUCER
	HOSE CONNECTION
	SPACER
	BLANK
	OPEN FIGURE 8 BLIND
	CLOSED FIGURE 8 BLIND
	PLUG
	BLIND FLANGE

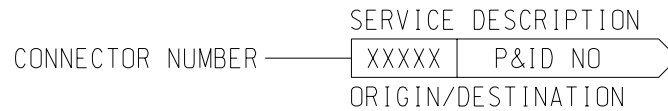
NOTE: SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS



A. OFF-PLOT CONNECTOR



B. OFF-PAGE CONNECTOR



C. UTILITY CONNECTOR

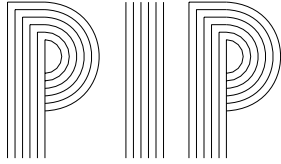


D. TIE-IN SYMBOL



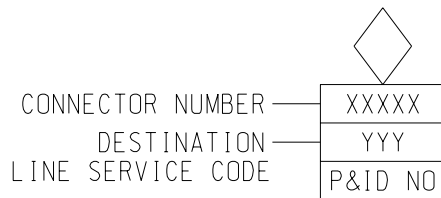
NOTES:

1. SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS.
2. ADJUST THE SIZE OF THE SYMBOL TO ALLOW THE P&ID NO. TO BE CONTAINED IN THE SYMBOL.



E. DRAIN CONNECTORS

CLOSED DRAIN



OPEN DRAIN



CLOSED DRAIN (NO P&ID)

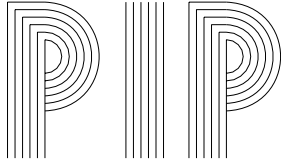


OPEN DRAIN (NO P&ID)



NOTES:

1. SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS.
2. ADJUST THE SIZE OF THE SYMBOL TO ALLOW THE P&ID NO. TO BE CONTAINED IN THE SYMBOL.



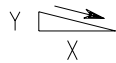
1. FOR GENERAL PIPING REQUIREMENTS, SEE DESIGN SPECIFICATION PIP PNE00001. FOR INSTRUMENT PIPING AND TUBING SYSTEMS CRITERIA, SEE PIP PCCIP001.

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.

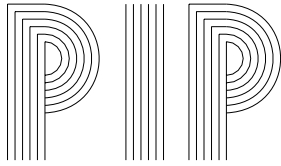
FREE DRAINING TO XXXX NO POCKETS PERMITTED.

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.



PROCESS INDUSTRY PRACTICES
APPENDIX

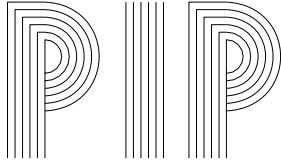
A-4

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REAFFIRMED: APRIL 2008
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INSTRUMENT IDENTIFICATION
LETTERS

PRACTICE REF. PIC001

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	



PROCESS INDUSTRY PRACTICES
APPENDIX

A-4

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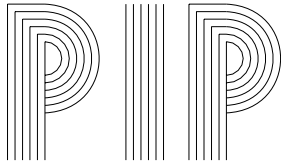
GENERAL INSTRUMENT
SYMBOLS

PRACTICE REF. PIC001

LOCATION/ACCESSIBILITY	DISCRETE INSTRUMENTS	SHARED DISPLAY AND CONTROL (DCS)	PLC	DISCRETE HARDWARE INTERLOCK
<p>FIELD MOUNTED</p> <ol style="list-style-type: none"> 1. FIELD OR LOCALLY MOUNTED. 2. ACCESSIBLE TO AN OPERATOR AT DEVICE. 				
<p>PRIMARY LOCATION NORMALLY ACCESSIBLE TO AN OPERATOR</p> <ol style="list-style-type: none"> 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. 				
<p>PRIMARY LOCATION NORMALLY INACCESSIBLE TO AN OPERATOR</p> <ol style="list-style-type: none"> 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. 				
<p>AUXILIARY LOCATION NORMALLY ACCESSIBLE TO AN OPERATOR</p> <ol style="list-style-type: none"> 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. 				
<p>AUXILIARY LOCATION NORMALLY INACCESSIBLE TO AN OPERATOR</p> <ol style="list-style-type: none"> 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



PROCESS INDUSTRY PRACTICES
APPENDIX

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INSTRUMENT FUNCTION
SYMBOLS

PRACTICE REF. PIC001



SUMMING



HIGH SELECT



AVERAGING



LOW SELECT



DIFFERENCE



HIGH LIMIT



MULTIPLYING



LOW LIMIT



DIVIDING



BIAS



SQUARE ROOT



UNSPECIFIED FUNCTION



EXPONENTIAL



USER DEFINED



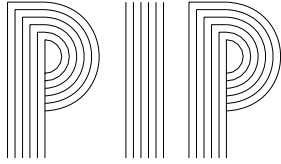
CONVERSION
INPUT/OUTPUT

/

A ANALOG
B BINARY
D DIGITAL
E VOLTAGE
H HYDRAULIC

I CURRENT
O ELECTROMAGNETIC, SONIC
P PNEUMATIC
R RESISTANCE (ELECTRICAL)

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



INSTRUMENT LINE
SYMBOLS

INSTRUMENT SUPPLY OR
CONNECTION TO PROCESS



PNEUMATIC SIGNAL



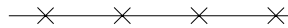
ELECTRIC SIGNAL



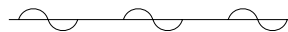
HYDRAULIC SIGNAL



CAPILLARY TUBE



ELECTROMAGNETIC, SONIC,
OPTICAL, OR NUCLEAR SIGNAL



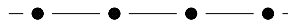
SOFTWARE OR DATA LINK



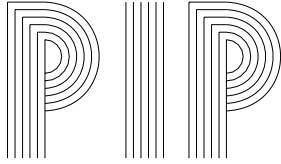
MECHANICAL LINK



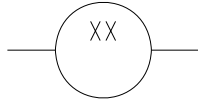
FIELDBUS



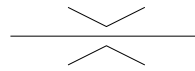
NOTE: SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS



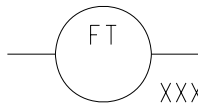
PRIMARY ELEMENT
SYMBOLS (FLOW)



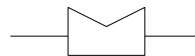
GENERAL SYMBOL
IN-LINE ELEMENT
XX = FS, FG, FE, FT



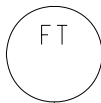
FLUME



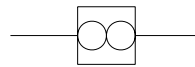
IN-LINE FLOW ELEMENT
WITH INTEGRAL TRANSMITTER
XXXX = MASS, CORIOLIS,
THERMAL, INT. ORIFICE ...



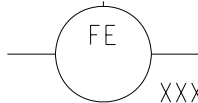
WEIR



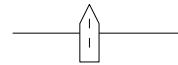
IN-LINE FLOW ELEMENT
WITH SEPARATE TRANSMITTER
XXXX = MASS, CORIOLIS,
THERMAL...



POSITIVE
DISPLACEMENT



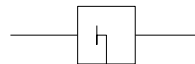
XXXX



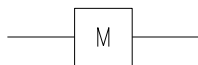
ORIFICE IN QUICK
CHANGE FITTING



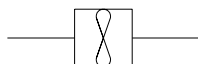
ORIFICE



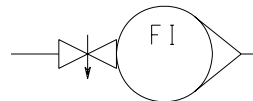
TARGET



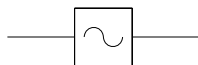
MAGNETIC



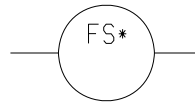
TURBINE OR PROPELLER



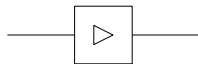
ROTAMETER (OR PURGE)
(SHOWN WITH OPTIONAL
INTEGRAL VALVE)



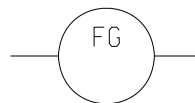
ULTRASONIC



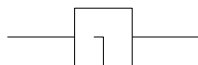
FLOW SWITCH
* = H/L



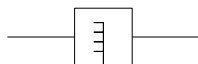
VORTEX



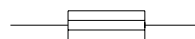
FLOW GLASS



PITOT TUBE



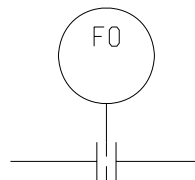
AVERAGING PITOT TUBE



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



FLOW NOZZLE



RESTRICTION ORIFICE



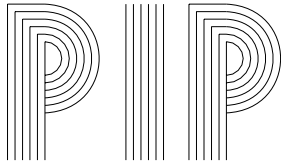
VENTURI



WEDGE METER

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)

T

MANUAL OPERATOR



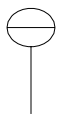
MOTOR OPERATED



DIAPHRAGM



ELECTRO-HYDRAULIC



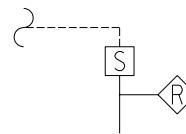
PRESSURE BALANCED
DIAPHRAGM



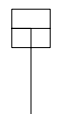
SINGLE SOLENOID



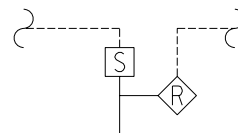
HANDWHEEL - USED
WITH ANY ACTUATOR



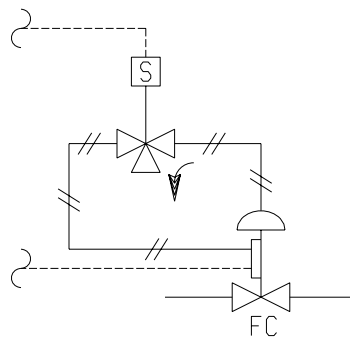
SINGLE SOLENOID
WITH MANUAL RESET



CYLINDER/PISTON



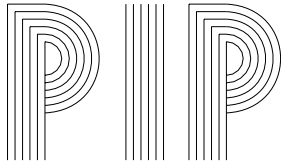
SINGLE SOLENOID
WITH REMOTE RESET



TYPICAL CONTROL VALVE
WITH POSITIONER AND
SOLENOID

NOTE:

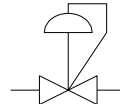
1. SYMBOLS ARE SHOWN HERE AT ACTUAL SIZE USED ON 22"x34" SIZE DOCUMENTS
2. SEE PIPING APPENDIX A-3, p.4 FOR TYPICAL VALVE SYMBOLS. BY ADDING AN ACTUATOR TO THE BASIC VALVE SYMBOL, THE VALVE BECOMES A CONTROL VALVE.



SELF-ACTUATED
DEVICES



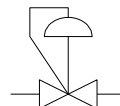
RUPTURE DISC OR
SAFETY HEAD FOR
PRESSURE RELIEF
(EXPLOSION PANEL)



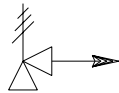
PRESSURE REDUCING
REGULATOR
(SELF-CONTAINED)



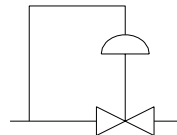
RUPTURE DISC OR
SAFETY HEAD FOR
VACUUM RELIEF
(EXPLOSION PANEL)



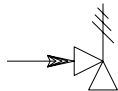
BACK PRESSURE
REGULATOR
(SELF-CONTAINED)



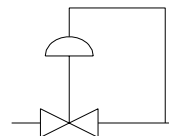
PRESSURE RELIEF
OR SAFETY VALVE



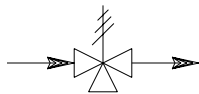
BACK PRESSURE
REGULATOR
W/ EXTERNAL TAP



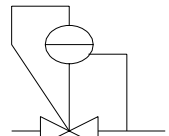
VACUUM RELIEF
VALVE



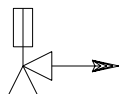
PRESSURE REDUCING
REGULATOR
W/ EXTERNAL TAP



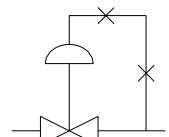
PRESSURE AND VACUUM
RELIEF VALVE OR
CONSERVATION VENT



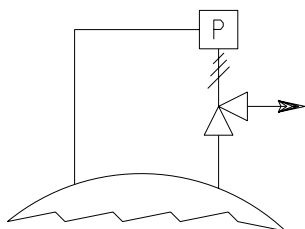
DIFFERENTIAL PRESSURE
REDUCING REGULATOR



BUCKLING PIN
RELIEF VALVE



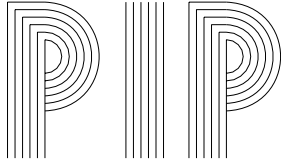
TEMPERATURE REGULATOR
FILLED SYSTEM TYPE



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

NOTE:

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



PROCESS INDUSTRY PRACTICES
APPENDIX

A-4

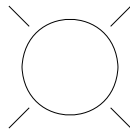
ISSUED: 7/15/98
REAFFIRMED: APRIL 2008
PAGE 8 OF 8

MISCELLANEOUS
INSTRUMENT SYMBOLS

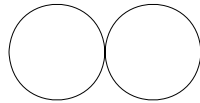
PRACTICE REF. PIC001



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

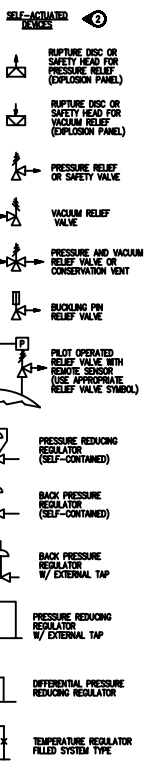
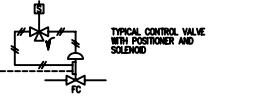
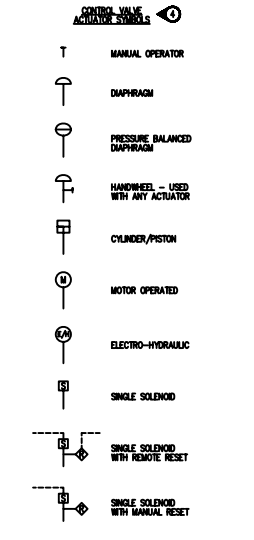
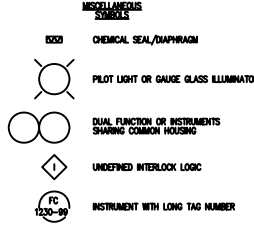
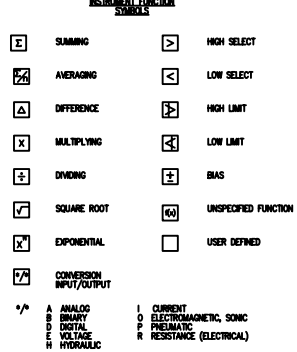
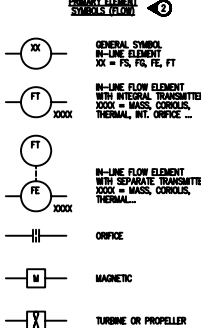
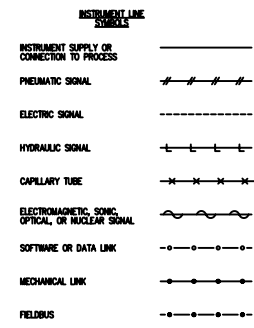
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Appendix B – Cover Sheets

- B-1: Symbols and Nomenclature – Typical Piping
- B-2: Symbols and Nomenclature – Typical Instrumentation
- B-3: Symbols and Nomenclature – Typical Equipment
- B-4: Typical Details with Implied Components

Note: The example cover sheets in this Appendix are not all-inclusive of the potential uses of implied components. The implied component examples shown do not cover all actual occurrences or design possibilities for instrument assemblies, such as the level bridles shown. The user must ensure that the cover sheets capture their piping/instrument requirements for their use of implied components. There are many more systems that may require a cover sheet explanation to show the implied components – pump seals, sampling systems, analyzer systems for example, as well as other types of level systems than those shown here.

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GENERAL INSTRUMENT SYMBOLS

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 MARK CONTROL ROOM. 2. FRONT OF MARK PANEL OR CONSOLE MOUNTED. 3. VISIBLE ON NEED DISPLAY. 4. ACCESSIBLE TO AN OPERATOR AT DEVICE OR CONSOLE.	◐	◑	◑	◑
PRIMARY LOCATION NORMALLY INACCESSIBLE TO AN OPERATOR 1. CENTRAL OR MARK CONTROL ROOM. 2. REAR OF PANEL OR CABINET MOUNTED. 3. NOT VISIBLE ON NEED 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 NEED 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 NEED 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
A	ANALYSIS		ALARM	
B	BURNER, FLAME, COMBUSTION		USER'S CHOICE	USER'S CHOICE
C	USER'S CHOICE (TYPICALLY CONDUCTIVITY - ELECTRICAL)			CONTROL
D	USER'S CHOICE (TYPICALLY DENSITY OR SPECIFIC GRAVITY)		DIFFERENTIAL	
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)	
F	FLOW RATE	RATIO (FRACTION)		
G	USER'S CHOICE OR GAUGING (DIMENSIONAL)		GLASS, WEIGHING 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
O	USER'S CHOICE		ORIFICE, RESTRICTION	OPEN
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION	
Q	QUANTITY OR HEAT DUTY	INTEGRATE, TOTALIZE		
R	RAMINATION		RECORD	
S	SPEED, FREQUENCY	SAFETY		SWITCH
T	TEMPERATURE		TRANSMIT	THROUGH
U	MULTIFUNCTIONAL		MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECHANICAL ANALYSIS		VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE	X AXIS	WELL	UNCLASSIFIED
X	UNCLASSIFIED	Y AXIS	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE OR PRESENCE	Z AXIS		RELAY, COMPUTE, CONVERT
Z	POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT

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

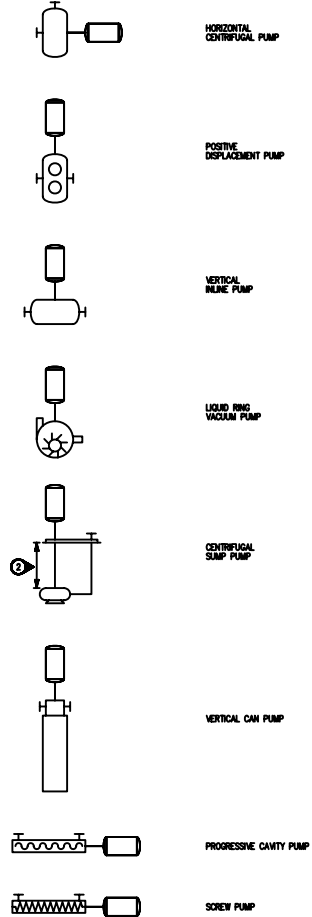
PROCESS INDUSTRY PRACTICES
PIPING AND INSTRUMENTATION DIAGRAM

SYMBOLS AND NOMENCLATURE
TYPICAL INSTRUMENTATION COVER SHEET
APPENDIX B

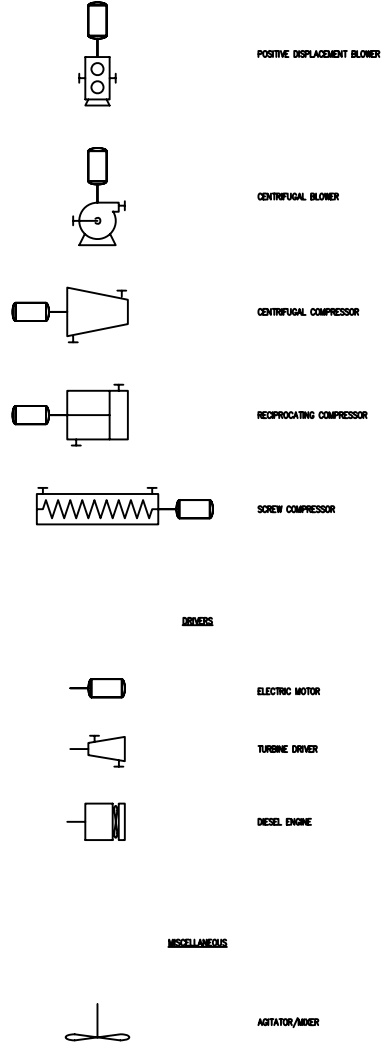
PIP

PRACTICE REF. PIP001
ISSUED: APRIL 2008
REPLACES: PAGE 2 OF 4
PIP-00-002

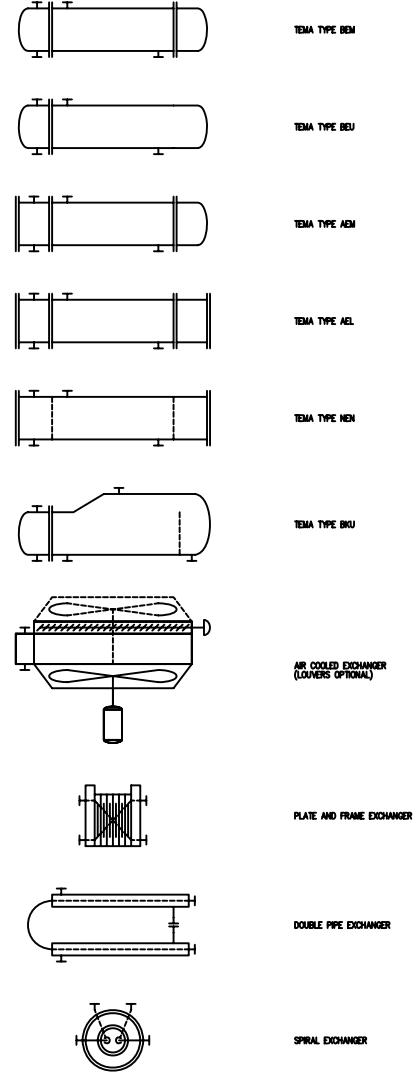
PUMPS ①



COMPRESSORS & BLOWERS ①



HEAT EXCHANGERS ②



- 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.

PROCESS INDUSTRY PRACTICES
PIPING AND INSTRUMENTATION DIAGRAM

SYMBOLS AND NOMENCLATURE
TYPICAL EQUIPMENT COVER SHEET
APPENDIX B

PIP

PRACTICE REF. PIP001
ISSUED: 7/75/88
REAPPROVED: APRIL 2008
PAGE 3 OF 4
PIP-00-003

FIELD MOUNTED PRESSURE INSTRUMENT
(PI, PT, PS)



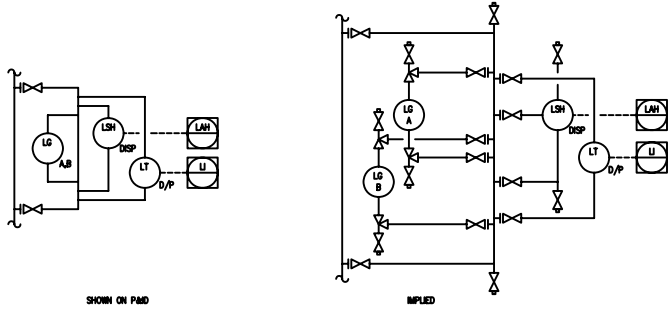
LEVEL OR D/P INSTRUMENT
(PL, PDT, LC, LA, LT, LS)



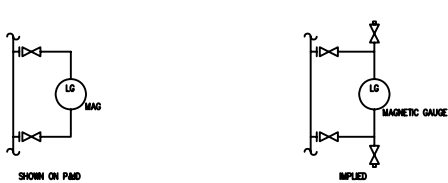
ORIFICE FLANGE - MOUNTED FLOW INSTRUMENT
(FI, FT)



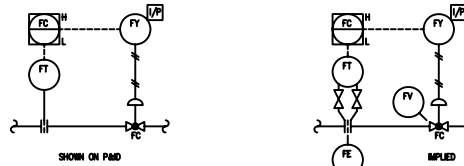
LEVEL BRIDLE EXAMPLE



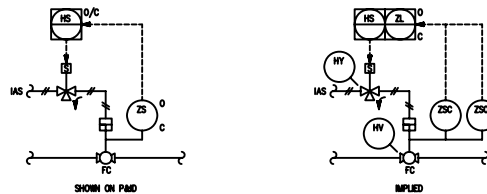
SINGLE MAGNETIC FOLLOWER TYPE LEVEL GAUGE



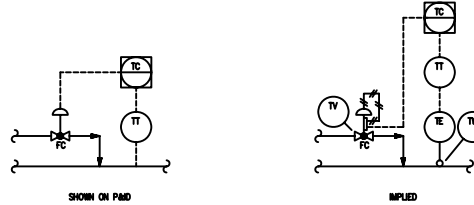
TYPICAL FLOW LOOP WITH SEPARATE I/P



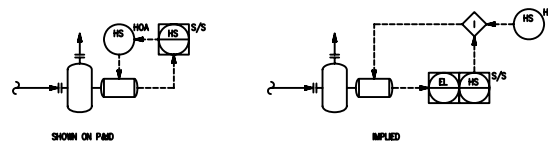
TYPICAL VALVE DETAIL



TYPICAL TEMPERATURE LOOP WITH VALVE POSITIONER



TYPICAL PUMP MOTOR CONTROLS



NOTES:
1. FOR NOTES, SYMBOLS AND ABBREVIATIONS, SEE "SYMBOLS AND NOMENCLATURE", PIP-00-01 THROUGH 03.

PROCESS INDUSTRY PRACTICES
PIPING AND INSTRUMENTATION DIAGRAM



TYPICAL DETAILS WITH IMPLIED COMPONENTS
APPENDIX B

PRACTICE REF. PIP001
ISSUED: APRIL 2008
REAPPROVED:
PAGE 4 OF 4
PIP-00-004

Appendix C – Example P&IDs

C-1: Example P&ID 1

C-2: Example P&ID 2

C-3: Example Utility P&ID

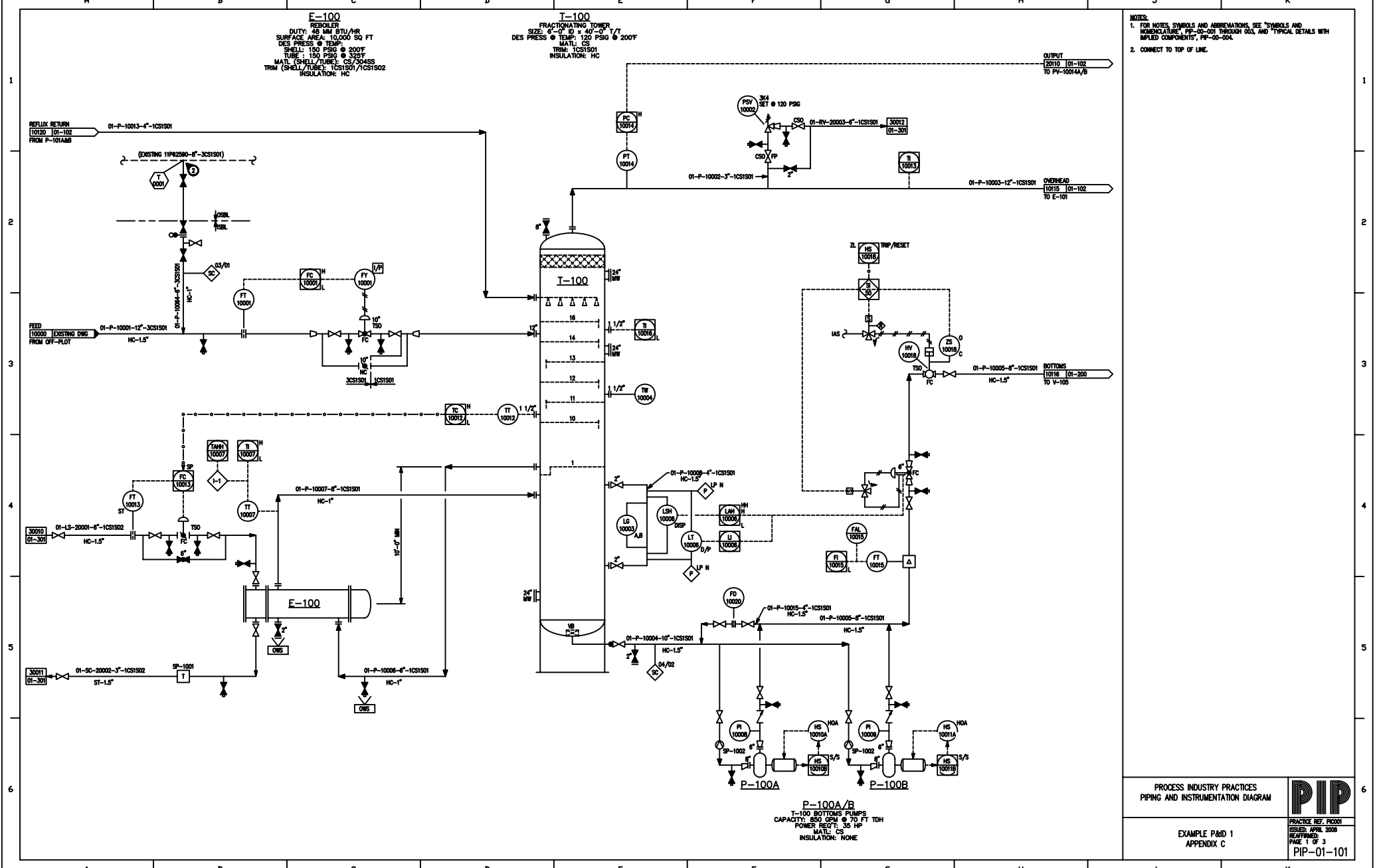
Note: The examples shown on the sample P&IDs in this Appendix are not all-inclusive of the potential uses of implied components. The user must ensure that the cover sheets capture their piping/instrument requirements for their use of implied components. There are many more systems that may require a cover sheet explanation to show the implied components – pump seals, sampling systems, analyzer systems for example, as well as other types of level systems than those shown here.

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E-100
 REBOILER
 DUTY: 49 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): 1CS1S01/1CS1S02
 INSULATION: HC

T-100
 FRACTIONATING TOWER
 SIZE: 6'-0" D x 43'-0" T/T
 DES PRESS @ TEMP:
 MATL: CS
 TRIM: 1CS1S01
 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.



OUTPUT
 25010 01-102
 TO PH-1001A/B

OVERHEAD
 10110 01-102
 TO E-101

BOTTOMS
 10118 01-200
 TO V-105

P-100A/B
 T-100 BOTTOMS PUMPS
 CAPACITY: 850 GPM @ 70 FT TDH
 POWER: REC'L, 33 HP
 MATL: CS
 INSULATION: NONE

PROCESS INDUSTRY PRACTICES
 PIPING AND INSTRUMENTATION DIAGRAM

EXAMPLE PAID 1
 APPENDIX C

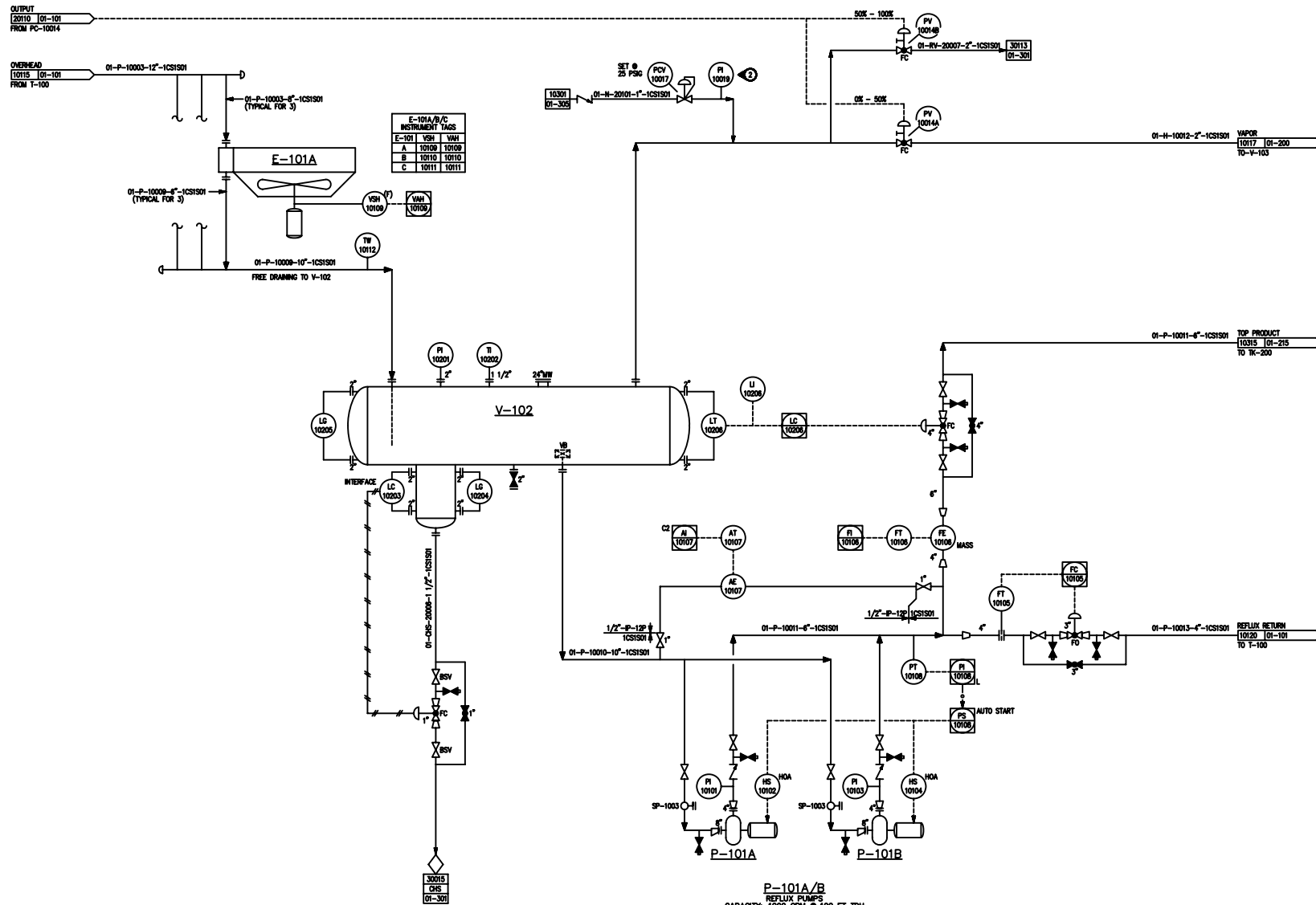
PIP

PRACTICE REF. PIP001
 ISSUED: APRIL 2008
 REAPPROVED:
 PAGE 1 OF 3
 PIP-01-101

E-101A/B/C
 CONDENSER
 DUTY: 50 MM STU/HR
 SURFACE AREA: 12,500 SQ FT
 DES PRESS: 120 PSIG @ 200F
 MATL: (TUBS) 304SS
 TRIM: 1CS1S01

V-102
 REFLUX DRUM
 SIZE: 6'-0" TD x 14'-0" T/T
 BOOT: 2'-0" ID x 4'-0" T/T
 DES PRESS: 180 PSIG @ 150F
 MATL: CS
 TRIM: 1CS1S01
 INSULATION: NONE

E-101A/B/C INSTRUMENT TAGS		
E-101	VSH	VWH
A	10109	10109
B	10110	10110
C	10111	10111



P-101A/B
 REFLUX PUMPS
 CAPACITY: 1000 GPM @ 100 FT TDH
 POWER REQ: 50 HP
 MATL: CS
 INSULATION: NONE

NOTES:
 1. FOR NOTES, SYMBOLS AND ABBREVIATIONS, SEE "SYMBOLS AND NOMENCLATURE" PIP-00-001 THROUGH 004, AND "TYPICAL DETAILS WITH IMPLIED COMPONENTS", PIP-00-004.
 2. LOCATE IN VIEW OF PCD-10017.

PROCESS INDUSTRY PRACTICES
 PIPING AND INSTRUMENTATION DIAGRAM

EXAMPLE P&ID 2
 APPENDIX C

PIP

PRACTICE REF. PICO01
 ISSUED: 7/15/08
 REAPPROVED: APRIL 2008
 PAGE 2 OF 3
 PIP-01-102

- 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-01-001.

