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Drawings, Diagrams, and Line Lists

GP 01-01-01

Scope

[I] This Global Practice (GP) covers:

- 1) Equipment, Piping, and Instrument designations (letters, numbers, and symbols) to be used on drawings and other project documents, such as loop, logic, or system diagrams.
- 2) Information that is typically shown on Flow Plans produced by ExxonMobil and information to be shown on Piping & Instrument (P&I) diagrams and piping line lists produced by Contractors.
- 3) Graphic symbols to be used on control system visual display units (VDUs) to depict processes and process equipment.

[I] It also explains the instrument designations used on Flow Plans prepared by ExxonMobil.

[I] An asterisk (*) indicates that either a decision by the Owner's Engineer is required, that additional information is to be furnished by the Owner's Engineer, or that information for Owner's Engineer approval is to be supplied by Contractor.

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1. Required References

This Section lists Practices and Standards that are generically referenced and assumed to be a part of this document. Unless otherwise specified herein, use the latest edition.

1.1. Global Practices–ExxonMobil Engineering Practices

GP 01-01-02	CAD Drawing Standards
GP 15-07-03	Alarm Systems

1.2. ASME–American Society of Mechanical Engineers

ASME B31.3	Process Piping
ASME Y32.11	Graphical Symbols for Process Flow Diagrams in the Petroleum and Chemical Industries R(1998)

1.3. ISA–The Instrumentation, Systems and Automation Society

ISA 5.1	Instrumentation Symbols and Identification
ISA 5.2	Binary Logic Diagrams for Process Operations
ISA 5.4	Instrument Loop Diagrams
ISA 5.5	Graphic Symbols for Process Displays

* [I] Any designation used which is not specified or otherwise covered in this practice, in ASME Y32.11 or ISA 5.1, shall be explained on the drawings, diagrams, and line lists.

2. Unit, Equipment and Instrumentation Designations

2.1. Unit Designations

* The process, utility and offsite unit or system shall be assigned either an identifying number or an alphanumeric code, in accordance with project specifications and recognized local practices. For example, a crude unit may be designated as number 100 or PS1 and a sulfur unit as 110 or S1.

- 1) The unit designation shall be used in all drawing, equipment, instrumentation, pipeline numbers, etc. However, with the approval of the Owner's Engineer, the unit designation need only be shown in the drawing title block except where more than one unit is represented on the same drawing.
- 2) All drawings shall be grouped according to unit designation in the PID system.

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2.2. Instrumentation Designations

- 1) [I] Whether local or transmitted, each instrument measurement or control loop shall be designated by an alphanumeric code or tag number. Instrument designations shall consist of letters, symbols, and numbers as follows:
 - a) * Instrument functionality shall be defined using the VARIABLE identification letters in Table 1 and any amendments in the project specifications.
 - b) * Graphic representation of instrumentation for ExxonMobil Flow Plans shall typically be in accordance with standard symbols and notation shown in Figures 1–6, Figures 9–13, and any amendments in the project specifications.
 - c) * All instrumentation shall be consecutively numbered within each process unit by VARIABLE type (Table 1). Numbers shall range from 001 to 999. The Owner's Engineer shall be responsible for supplying all final tag numbers.
 - d) Each instrument of similar VARIABLE type (flow, pressure, level, etc.) shall have a unique number in that unit. The use of sequence letters (A, B, C, etc.) should be avoided, but where used must be approved by the Owner's Engineer.
 - e) Local gauges (i.e., PIs, TIs, Gauge Glasses, etc.) and restriction orifices shall also be numbered in accordance with Item c above.
 - f) Individual instruments within an instrument or control loop, such as transmitters, alarms, recorders, and control valves, shall have the same variable type and number designation as the primary instrument. In the case of a loop containing two or more actuating devices (e.g., split-range control valves), each actuating device shall have the same number as the primary instrument, followed by suffix letters as required (example: "A," "B," "C," etc.). In the case of a loop having two or more input devices of the same VARIABLE type (e.g., two thermocouples to measure temperature difference), each input device shall have the same number as the loop followed by suffix letters as required.
- 2) [I] Auxiliary instrument components, such as transmitters, alarm switches, transducers, types of transmission lines, and similar components, do not appear on flow plans prepared by ExxonMobil. Contractor shall engineer these components and show them on all P&I drawings.
- 3) * [I] The instrument identification tag shall be written as:
 (UNIT) (VARIABLE) (FUNCTION) (LOOP NUMBER) (SUFFIX LETTERS)
 For example:
 - a) Flow (Indicating) Controller: S1FC001
 - b) The unit identification may be a three digit number to fit with recognized local practices, e.g., Sulfur Unit = 110
 - c) Control Valve associated with this Flow Controller: S1FV001
 - d) Control Valves in split range S1FV001A, S1FV001B.
 - e) Low Flow Alarm associated with this Flow Controller: S1FAL001
 - f) Flow Recorder Controller (dedicated pen): S1FRC001
- 4) * [I] Flow plan designations shall be according to Figures 1–13, ASME Y32.11 and ISA 5.1 except as modified by the project specifications.

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2.3. Process Alarm Designations

[I] Process alarms have three priority levels as defined in [GP 15-07-03](#). Priority 1 alarms are displayed on an independent annunciator system. Priority 2 alarms are typically only displayed in the DCS. Priority 3 alarms are typically computer control applications-generated alarms or messages and do not show up on ExxonMobil Flow Plans. The alarm set point shall be indicated and located adjacent to the appropriate loop symbol.

[I] For application examples of process alarms, see Figures 9–13.

2.4. Equipment Designations

- 1) [I] Process equipment designations consist of letters, symbols, and numbers as follows:
 - a) * Piping and valve symbols shall be according to Figures 1 and 2 and any amendments in the project specifications.
 - b) * Identification letters shall be according to Tables 2, 3, and 4 and any amendments in the project specifications.
 - c) Typical equipment symbols used on flow plans prepared by ExxonMobil are illustrated in Figure 14.
- 2) [I] Sequence number of equipment shall be as follows:
 - a) Each type of equipment, such as pumps, exchangers, and drums to be numbered consecutively within each unit or established section. Deleted equipment numbers shall not be reused.
 - b) If two or more pieces of similar equipment are in the same service, each is designated with a sequence letter (A, B, C, etc.) following the equipment letter.

3. Process and Utility Flow Plans (or Diagrams)

- 1) [I] Process Flow Plans (referred to as Process Flow Diagrams by some affiliates) are required for all plant installations.
- 2) [I] Utility Flow Plans (referred to as Utility Flow Diagrams by some affiliates) are required for each significant utility system such as cooling water, steam, fuel gas, fuel oil, and plant and instrument air.
- 3) [I] Equipment shall be arranged in a logical flow sequence progressing from left to right with process streams entering and leaving at the side border.
- 4) [I] Instrument signal lines shall be shown without indicating any preference for signal type.
- 5) * [I] For further requirements of these drawings consult the project specifications and the Owner's Engineer.

4. P&I Diagrams

[I] P&I diagrams shall show all equipment to be installed in the plant and all base regulatory controls of the unit. As a minimum, the details and identifying information given in Table 7 shall appear on the diagrams for the listed equipment and facilities. The symbology used on the P&I diagrams shall be

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according to ISA 5.1 with the addition of the supplements shown in Figures 7 and 8 and the project specifications. Instrument signal lines shall define the signal type, pneumatic, electronic, etc.

[I] Piping and equipment representation on P&I diagrams shall be according to the following:

- 1) Within process boundary lines—Flow representation for process streams.
- 2) Utility and chemical piping within process plant areas—If not specified, either flow or geographical representation is acceptable.
- 3) Outside process plant boundary lines—Geographic representation for piping, and interconnecting piping between process plants and tankage.
- 4) Package units shall be indicated by enclosing with a dotted line.

5. Logic Diagrams

- 1) [I] Logic diagrams and equivalent cause and effect or event diagrams, shall be produced for all applications where instrument equipment performs logic functions. Logic diagrams shall be separate from P&I diagrams.
- 2) [I] Logic diagrams shall show the interlocking and sequencing of switching systems for the start-up, operation, and shutdown of equipment and processes.
- 3) * [I] Logic diagrams shall be drawn using the symbols shown in ISA 5.2.
- 4) * [I] Logic diagrams show the flow of information and do not imply the type of equipment to be used to implement them. Implementation may be by programmable logic controller, relay logic, computer, or a combination of any of these.

6. Loop and System Diagrams

[I] A loop or system diagram shall be provided for every instrument loop (control, indicating, protective, etc.) to illustrate its operating philosophy. This is an extension of P&Is, which shows the components and accessories of the instrument loop, connections between devices, cable, junction box and terminal numbering codes, and identification of component action. An example of a typical loop or system diagram layout is shown in ISA 5.4, Figure 6.

[I] As a minimum, the loop or system diagram shall contain the following information:

- 1) Identification of the loop and loop components.
- 2) Indication of interrelationships to other instrumentation loops, including overrides, interlocks, cascaded set points, etc.
- 3) All point-to-point interconnections with identifying numbers or colors of electrical cables, conductors, pneumatic tube bundles, and individual pneumatic and hydraulic tubing. This identification of interconnections includes junction boxes, bulkheads, ports, and grounding connections.
- 4) General location of equipment such as field, panel, rack termination cabinet, etc.

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- 5) Energy sources of equipment such as electrical power, air supply, and hydraulic fluid supply. Identify voltage, pressure, and other applicable requirements. For electrical sources, identify circuit or disconnect numbers.
- 6) Actions or fail-safe positions of devices such as switches, control valves, and solenoid valves.
- 7) Identification of all auxiliary components used to make up the full functionality of an instrument loop shall be shown even when the equipment has been designed and provided in whole or in part by different Vendors/Contractors and is detailed across more than one P&I diagram.

7. Electronic Design Tools

- 1) * [I] If Contractor uses a Computer-Aided Design Documentation (CADD) package to generate project P&I diagrams, the Owner's Engineer shall be contacted to assure compatibility between Contractor's system and the Owner's.
- 2) [I] If Contractor uses an Instrument Design and Documentation System (IDDS) package to generate project documentation (loop diagrams, spec. sheets, cable schedule, etc.), the Owner's Engineer shall be contacted to assure compatibility between Contractor's system and database format and the Owner's.
- 3) [I] Logic system Vendors/Contractors will provide logic diagrams and associated documentation according to ISA 5.2.

8. Piping Line Lists

[I] Line tabulation sheets shall contain the following identifying information for each line:

- 1) Line number.
- 2) Piping material classification (if referenced to a piping material specification, a symbol shall be used).
- 3) Nominal pipe size and wall thickness (schedule number).
- 4) Origin and termination.
- 5) Fluid (liquid, gas or mixed).
- 6) Design temperature and pressure.
- 7) Specified corrosion allowance.
- 8) Heat tracing (indicate steam or electric). Indicate whether tracing is for process protection or winterization.
- 9) Insulation type and thickness.
- 10) Test pressure (indicate hydrostatic or pneumatic).
- 11) If allowances for variations from normal operations are being made, according to ASME B31.3, Paragraph 302.2.4, indicate the pressure-temperature condition which governs the design, and identify the situation (i.e., regeneration, decoking, etc.) causing these conditions.

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- 12) P& I Drawing number.
- 13) The following information may be shown on supplemental data sheets:
- 14) Piping metal temperatures used for flexibility check (indicate more than one temperature if multiple temperature conditions apply).
- 15) Identify the governing condition for piping flexibility design such as maximum or minimum operating temperature, equipment steam-out or line steam-out, line bypassed, regeneration, decoking, steam tracing, and tank nozzle rotation.

Table 1: Instrument or Loop Tag Identification Letters ⁽³⁾

Letter	Variable Type	Function Codes		
		Position 1	Position 2	Position 3
A	Analysis	Alarm	Alarm	Alarm
B	Burner Flame	Block		
C	Corrosion	Controller	Controller	Controller
		Closed	Closed	Closed
			Cut In (CI)	Cut In (CI)
			Cut Out (CO)	Cut Out (CO)
D	Density Draft	Dial (Indicator)	Dial (Indicator)	
		Differential		
E	Voltage Emergency	Element (Primary)	Element (Primary)	
F	Flow	Ratio (Fraction)		
G		Glass/Gauge		
H	Hand Actuated	High	High	
I	Current	Indicating Indicator ⁽⁵⁾	Indicating Indicator ⁽⁵⁾	
J	Power			
K	Time Frequency	Rate of Change		
L	Level	Low	Low	
		Light/Lamp	Light/Lamp	
M	⁽¹⁾		Metal	
N	⁽¹⁾			
O	⁽¹⁾	Open	Open	Open
P	Pressure			
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Letter	Variable Type	Function Codes		
		Position 1	Position 2	Position 3
Q	(1)	Integrator/Totalizer	Integrator/Totalizer	Integrator/Totalizer
R	Radiation Remote Operated	Recorder Pan (2)	Recorder Pan (2)	
S	Speed	Switch/Pushbutton	Switch/Pushbutton	
T	Temperature	Transmitter (4)	Transmitter (4)	
U	Digital Temperature Indicator			
V	Vibration	Valve/Damper/	Valve/Damper/	Valve/Damper/
		Louver	Louver	Louver
W	Weight	Well		
X	Unclassified	Auxiliary Instrument (Protective Systems Only)		
Y	Event/State	Relay/Computation Function/Other Auxiliary Instrument		
Z	Position (Displacement)			
Notes:				
(1)	Variable type to be specified as required for individual project.			
(2)	Where pen is permanently connected to process variable.			
(3)	This table replaces Table 1 of ISA 5.1.			
(4)	Modifier code typically not used on flow plan drawings prepared by ExxonMobil.			
(5)	Indicator function code is implied for DCS loops.			

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Figure 1: Piping and Valve Symbols Used on ExxonMobil Flow Plans (For Additional Symbols, See ASME Y32.11 and ISA 5.1)

