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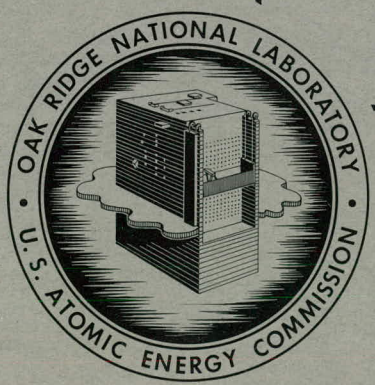
SYMBOLS FOR INSTRUMENT FLOWSHEETS AND DRAWINGS

A RECOMMENDED SYSTEM FOR APPLICATION TO ORNL INSTRUMENT WORK

R. K. Adams
D. G. Davis
R. F. Hyland
B. Lieberman



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INSTRUMENTATION AND CONTROLS DIVISION

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A Recommended System for Application to ORNL Instrument Work

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FOREWORD

This report supersedes ORNL CF-57-2-1, which was an extension and revision of ORNL CF-54-6-72. It was prepared by a committee consisting of representatives from each of the ORNL instrument application groups. The committee was assisted by F. C. Zapp of the Reactor Division and by W. R. Winsbro of the Chemical Technology Division in formulating a recommendation for pipeline designations and flowsheet definitions.

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SYMBOLS FOR INSTRUMENT FLOWSHEETS AND DRAWINGS

A Recommended System for Application to ORNL Instrument Work

R. K. Adams D. G. Davis R. F. Hyland B. Lieberman

1. INTRODUCTION

The recommended system of flow-plan symbols and drawings described in this report is presented to provide a satisfactory system of symbols and identifications for instruments and related equipment and to promote a uniformity of practice that will simplify and expedite work in which such symbols and drawings are used. The system, which should be considered as a recommended practice, is a modification of the widely used Instrument Society of America Recommended Practice (RP 5.1). The ISA standard was modified to meet the special requirements of ORNL as determined by a survey of ORNL practices and eight years of use of the system.

The objective of the system is to identify the function of all major instrument components and to show schematically the operation of the instrument relative to the process. It is not the objective to show details of the individual components. If details must be shown, special symbols may be used and so identified on the flowsheet.

2. DESCRIPTION OF THE SYSTEM

This system may be used for:

1. designation and identification of instruments on flowsheets;
2. recording in specifications, listings, requisitions, and purchase orders;
3. indication of items on piping diagrams and other construction drawings;
4. identification tagging of equipment;
5. description in technical and trade literature.

2.1 Outline of the System

Identification by Letters. – Combinations of two or three letters are used to denote the process variable or actuation and instrument function (Sec 3). Other letters may be added to the combination for more specific identification.

Identification by Numbers. – A numerical system is used to supplement the letter identification in order to establish specific identity. A recommended numbering system is detailed in Sec 6.

Application. – Typical flowsheet symbols are illustrated in Secs 3 through 5. These show the flowsheet symbols as used on engineering and instrument flowsheets defined in Sec 7.

Drawings. – Drawing scope and recommended usage are defined in Sec 7.

Line Identification. – A recommended line identification code is shown in Sec 8.

Symbols for Interconnections. – Interconnection between instrument symbols by use of the appropriate instrument line identifications is intended to be diagrammatic only and does not necessarily indicate actual connections.

2.2 Letters Used for Identification

The general identification consists of letters as listed in Table 1. They are used in the combinations shown in Table 2.

Table 1 shows the letters that are used, the definition or significance of each, and the position in which they are used. Table 2 shows the combinations of these identifying letters and defines the meaning of each letter group.

The letters or their combinations are used as follows:

1. First, second, and third identifying letters are written in upper case.
2. The maximum number of identifying letters in any combination is three, except as noted in item 3 below.
3. The specific identification letter is lower case and is applied as a subscript to the first identification letter.
4. No hyphens are used between letters or combinations of letters.

Table 1. Definitions and Permissible Positions of Identifying Letters*

Upper Case Letter	First Letter Process Variable or Actuation[1]	Second Letter Instrument Function	Third Letter Instrument Function	Specific Identification Letter(s)[2] (lower case)
A[3]	Analysis	Alarm	Alarm	Average (av)
C	Conductivity	Control	Control	
D	Density			Difference (d)
E[4,5]	Electric	Element		Volts (e)
F	Flow			Frequency (f)
G		Glass (noncalibrated devices, bull's-eye, gage glass)		
H	Manual (hand actuated)			
I	Interval (time)	Indicator		Current (i) Interface (if)
L	Level			
M[7]		Modifier	Modifier	Moisture (m)
O[8]			Operator	
P	Pressure			Power factor (pf) Concentration (pH)
Q		Quantity (totalizer)	Quantity (totalizer)	
R	Radiation	Recorder		Ratio (r)
S	Speed	Switch Safety (when used with third letter only)	Switch	
T[6]	Temperature	Transmitter	Transmitter	
V	Viscosity	Valve	Valve	Vibration (v)
W	Weight	Well		Power (w) (watts)
X	Special	Special	Special	
Z	Position (zone)			

*Superscripts refer to the notes on the next page.

NOTES TO TABLE 1

1. Control loops or measuring systems should carry a first-letter designation which is determined by the primary process variable to be measured or controlled (except in the case of manual actuation, as described below or as illustrated in system 52 of Sec 5). For example, in a heat-exchanger process in which steam flow is used to maintain a desired temperature, the loop should carry the first-letter designation "T," indicating that the primary process variable is temperature. Another example is the first-letter designation "F" for a thermal element used to measure flow.

If the actuating means is manual, the control system carries the designation "H" for all symbols. An example is remote-manual control of steam flow to a process, whether for the purpose of flow or temperature control.

2. The following illustrates the usage of the specific identification letter(s):

When considered necessary, the specific identification letter(s) may be shown as a lower-case subscript following the first letter, such as P_dR and A_mCV, for pressure differential and moisture analysis, respectively. The use of readily recognized self-defining chemical symbols such as CO_2, O_2, etc., falls in this same category. An alternative method of identification is to define the specific variable by means of a note on the flowsheet.

3. The letter "A" is used as the first letter for all analysis and physical-property variables, except where there is a first-position identification letter for the physical property or analysis. The first letter "A" is commonly used in combination with a specific identification-letter subscript.

4. The letter "E" should be used as a first letter only where the process variable is electrical. Instruments using electrical principles to adjust other variables should be designated by the primary process-variable letter; for example, a solenoid valve actuated by a level switch to control the level in a vessel should carry the designation "L" as the first letter. An example of correct usage of the letter "E" as a first letter is the use of E_wR for recording wattmeter. Detailed electrical control circuits and components such as relays, transformers, etc., should not be shown on the flowsheets; however, they should be referred to by note.

5. An element is a primary measuring device by means of which the process variable (namely pressure, temperature, flow, etc.) is converted to a strain, emf, force, change in electrical resistance or impedance, differential pressure, etc., and which has no amplifying device to provide signal transmission.

6. A transmitter is a device which receives a signal, either directly from the process variable or indirectly through a primary element, amplifies the signal in power or amplitude for remote transmission, and transmits the signal.

7. A modifier is a device (not used primarily for remote transmission) which receives one or more signals and performs amplification or mathematical operations on them. It may also be used to convert one type of signal transmission to another (e.g., electric to pneumatic).

8. An operator is a device which receives a signal from a controller and/or which adjusts a variable to effect the control action. An operator may be a saturable reactor, a pneumatic-electric interrupter, a pneumatic or hydraulic operator on a pump or speed changer, a pneumatic cylinder operating a variable autotransformer, or other such device which does not readily reduce to the case of a control valve. Typical applications are shown on pages 10 and 19–22.

Table 2. Combinations of Letters for Instrument Identification

The symbol (--) indicates improbable or impossible combinations

The letter "X" (Special) may also be used as a second- or third-letter identification symbol

Process Variable or Actuation		Alarm	Control	Element	Glass	Indicator	Modifier	Quantity (Totalizer)	Recorder	Switch	Transmitter	Self or Manually Operated Valve	Well	Remotely Controlled Operator	Remotely Controlled Valve	Indicator Controller	Indicator Modifier	Indicator Transmitter	Recorder Controller	Safety Switch	Safety Valve
		A	C	E	G	I	M	Q	R	S	T	V	W	CO	CV	IC	IM	IT	RC	SS	SV
Analysis	A	AA	AC	AE	--	AI	AM	--	AR	AS	AT	--	--	ACO	ACV	AIC	AIM	AIT	ARC	ASS	ASV
Conductivity	C	CA	CC	CE	--	CI	CM	--	CR	CS	CT	--	--	CCO	CCV	CIC	CIM	CIT	CRC	CSS	CSV
Density	D	DA	DC	DE	--	DI	DM	--	DR	DS	DT	--	--	DCO	DCV	DIC	DIM	DIT	DRC	DSS	DSV
Electric	E	EA	EC	EE	--	EI	EM	EQ	ER	ES	ET	--	--	ECO	ECV	EIC	EIM	EIT	ERC	ESS	ESV
Flow	F	FA	FC	FE	FG	FI	FM	FQ	FR	FS	FT	FV	--	FCO	FCV	FIC	FIM	FIT	FRC	FSS	FSV
Hand (manual)	H	HA	HC	--	--	--	--	--	--	HS	--	HV	--	HCO	HCV	HIC	HIM	HIT	--	HSS	HSV
Interval (time)	I	IA	IC	--	--	II	--	IQ	IR	IS	--	--	--	--	--	--	--	--	--	ISS	--
Level	L	LA	LC	LE	LG	LI	LM	--	LR	LS	LT	LV	--	LCO	LCV	LIC	LIM	LIT	LRC	LSS	LSV
Pressure	P	PA	PC	PE	--	PI	PM	--	PR	PS	PT	PV	--	PCO	PCV	PIC	PIM	PIT	PRC	PSS	PSV
Radiation	R	RA	RC	RE	--	RI	RM	RQ	RR	RS	RT	--	--	RCO	RCV	RIC	RIM	RIT	RRC	RSS	RSV
Speed	S	SA	SC	SE	--	SI	SM	--	SR	SS	ST	SV	--	SCO	SCV	SIC	SIM	SIT	SRC	SSS	SSV
Temperature	T	TA	TC	TE	--	TI	TM	--	TR	TS	TT	TV	TW	TCO	TCV	TIC	TIM	TIT	TRC	TSS	TSV
Viscosity	V	VA	VC	VE	--	VI	VM	--	VR	VS	VT	--	--	VCO	VCV	VIC	VIM	VIT	VRC	VSS	VSV
Weight	W	WA	WC	WE	--	WI	WM	WQ	WR	WS	WT	--	--	WCO	WCV	WIC	WIM	WIT	WRC	WSS	WSV
Special	X	XA	XC	XE	--	XI	XM	XQ	XR	XS	XT	XV	XW	XCO	XCV	XIC	XIM	XIT	XRC	XSS	XSV
Position	Z	ZA	ZC	ZE	--	ZI	--	--	ZR	ZS	ZT	--	--	ZCO	ZCV	ZIC	ZIM	ZIT	ZRC	ZSS	ZSV

3. SYMBOLS FOR INSTRUMENT APPLICATION

Instrument-application symbols are shown in Fig. 1. Valve and equipment symbols are shown in Fig. 2.

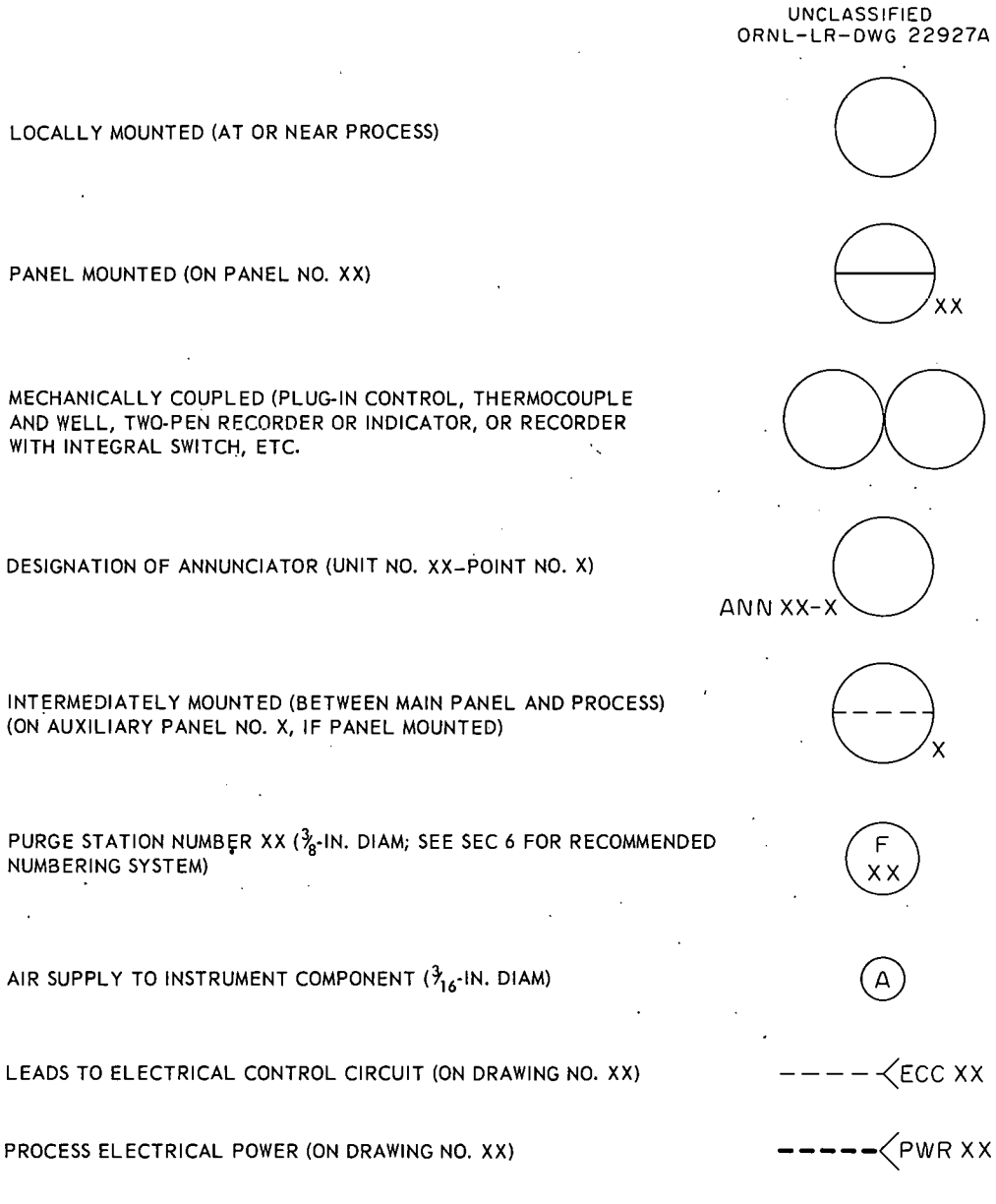

Fig. 1. Symbols for Instrument Application.

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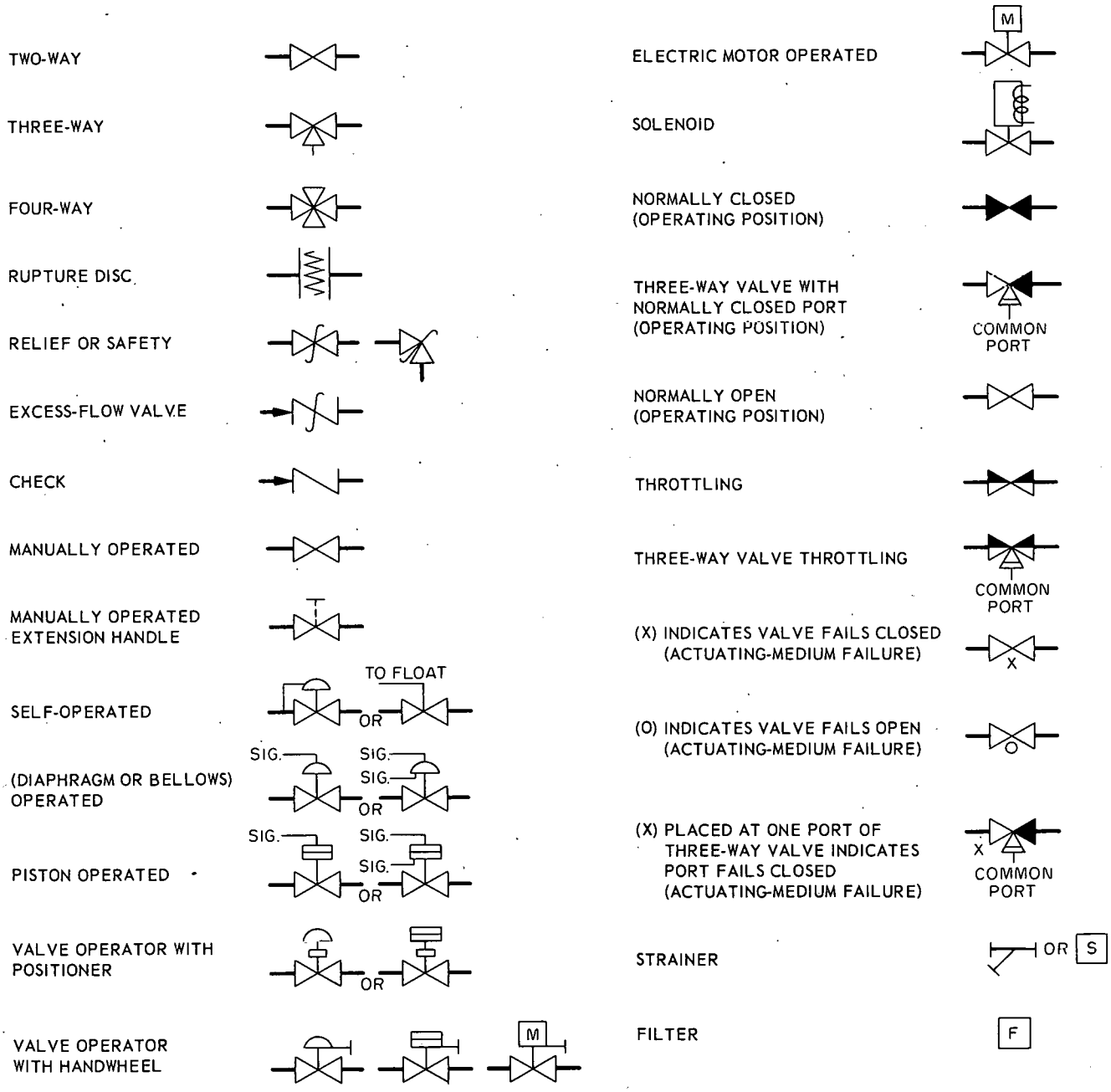

Fig. 2. Symbols for Valves and Equipment.

4. SYMBOLS FOR IDENTIFICATION OF PROCESS AND INSTRUMENT LINES

The identification of process and instrument lines and junctions or crossovers is shown in Fig. 3.

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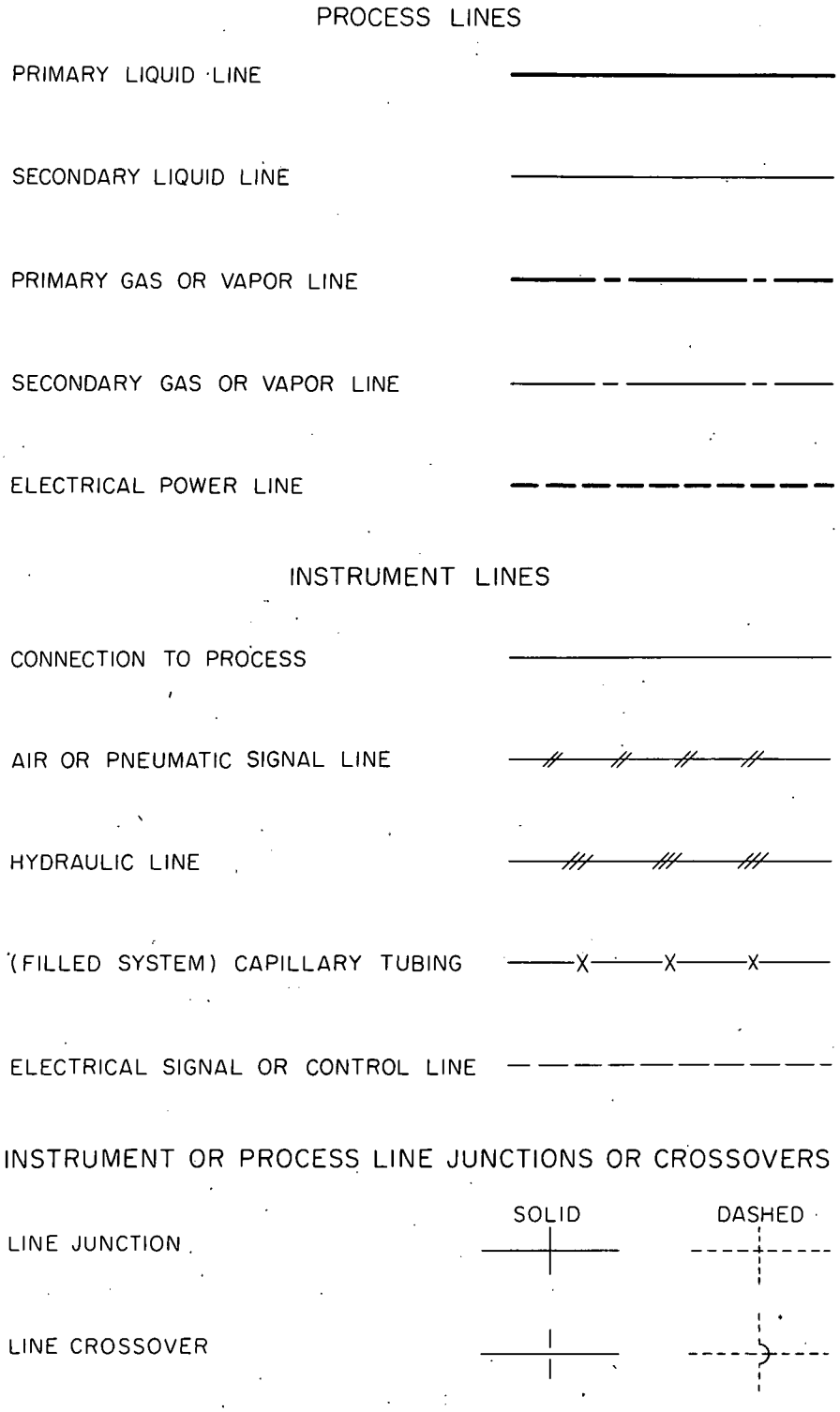
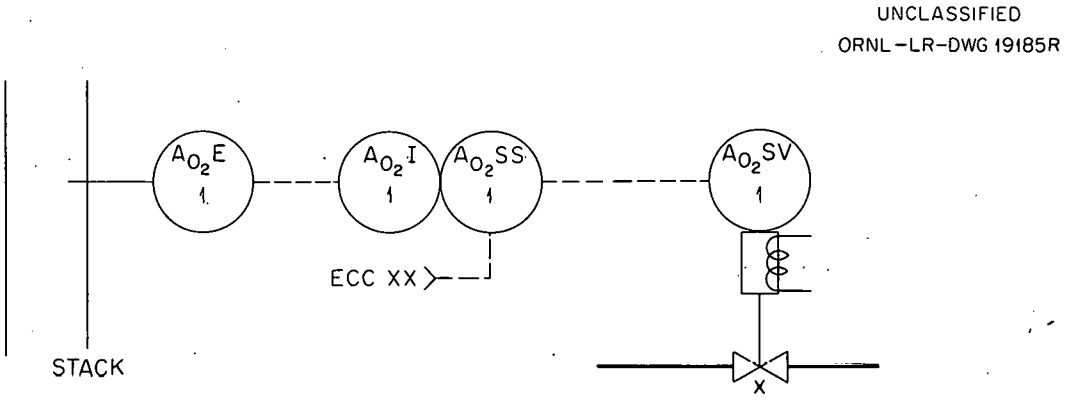


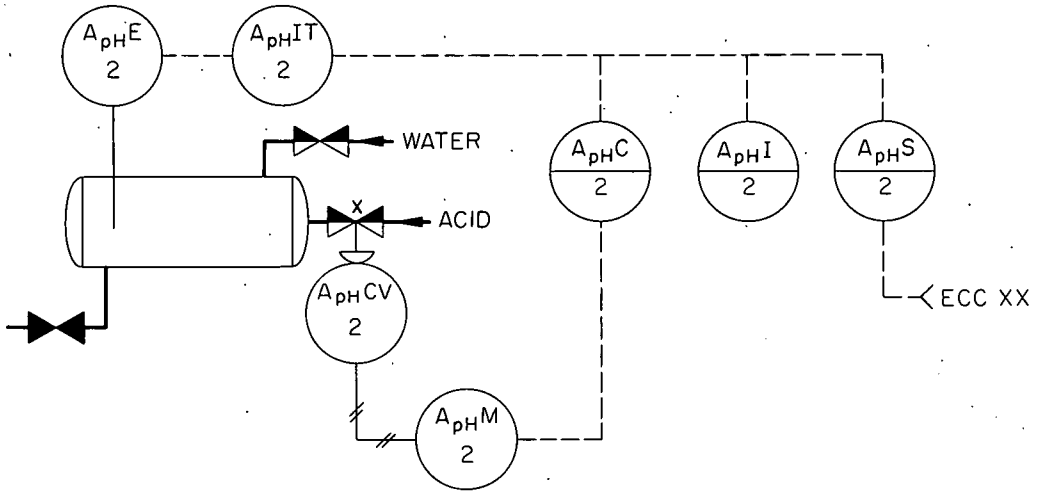
Fig. 3. Symbols for Identification of Process and Instrument Lines.

5. ILLUSTRATIONS OF THE USAGE OF INSTRUMENT SYMBOLS

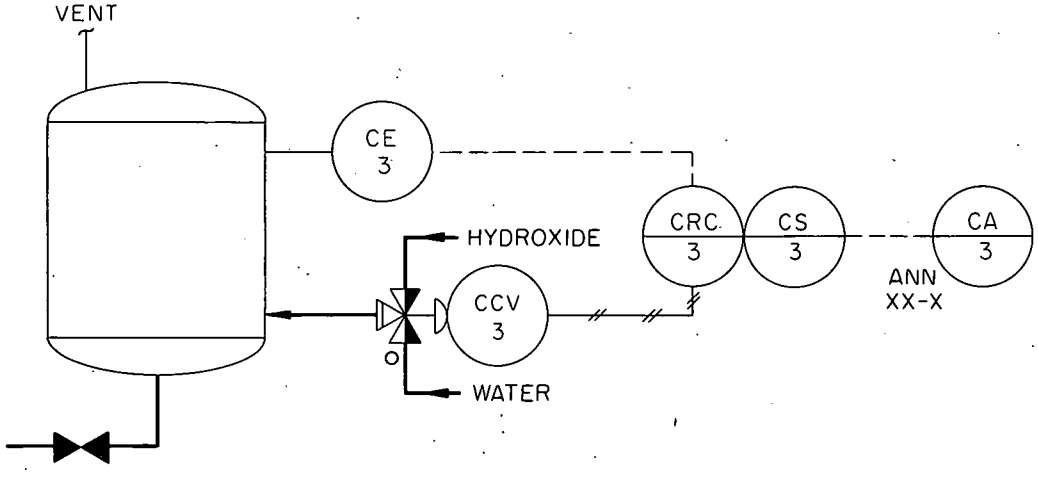
On the following pages 53 typical instrument systems are illustrated to show how this identification system is used.



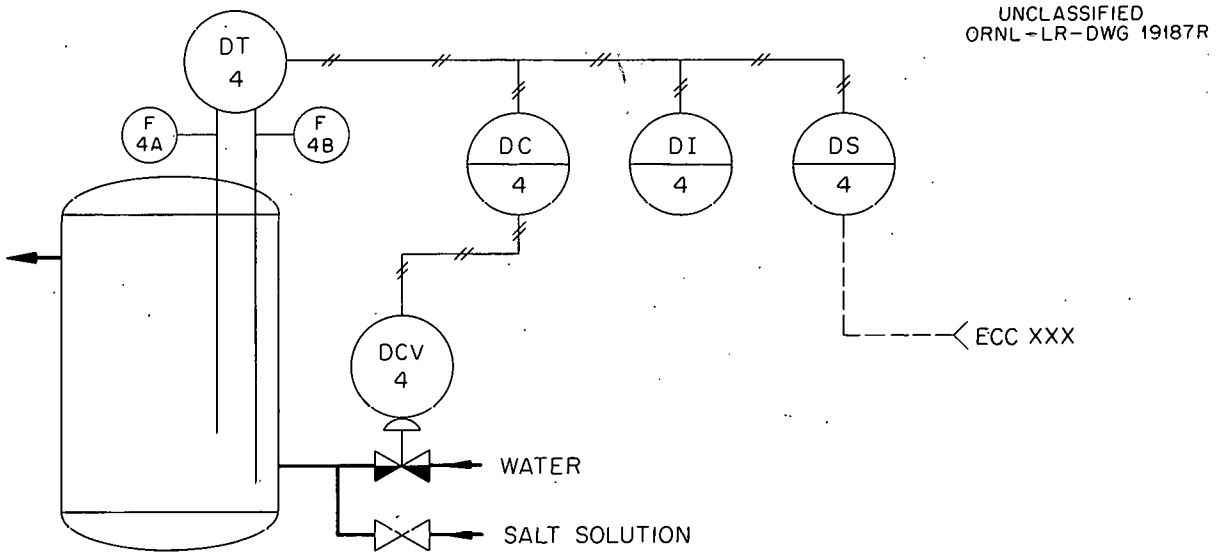
System 1. Analysis (Oxygen) Element and Indicator with Safety Switch and Normally Open, Fail-Closed Safety Valve.



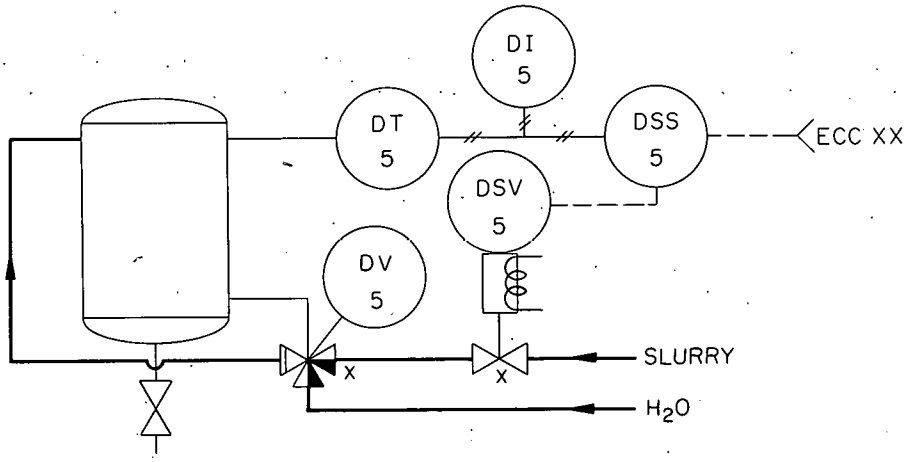
System 2. Analysis (pH) Controller, Indicator and Switch (for Electric Control Circuit), Board Mounted, with Modifier (Electric to Pneumatic Relay), Control Valve, Indicating Transmitter and Element.



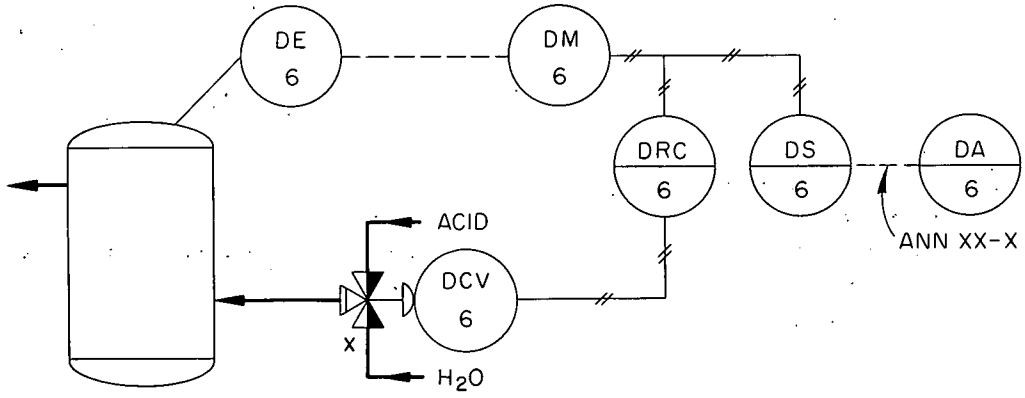
System 3. Conductivity Recorder-Controller, Having Integral Switch and Switch Alarm (Board Mounted) with Local Control Valve. Element is a conductivity cell.



System 4. Density Controller, Indicator and Switch (for Electric Circuit), Board Mounted, with Control Valve and Transmitter Locally Mounted with Purged Dip Tubes.



System 5. Self-Actuated Density Valve, Transmitter and Indicator with Safety Switch and Safety Valve.



System 6. Density-Recording Controller, Switch and Alarm, Board Mounted, with Control Valve. Element (load cell) with electric transmission to modifier (electric to pneumatic).

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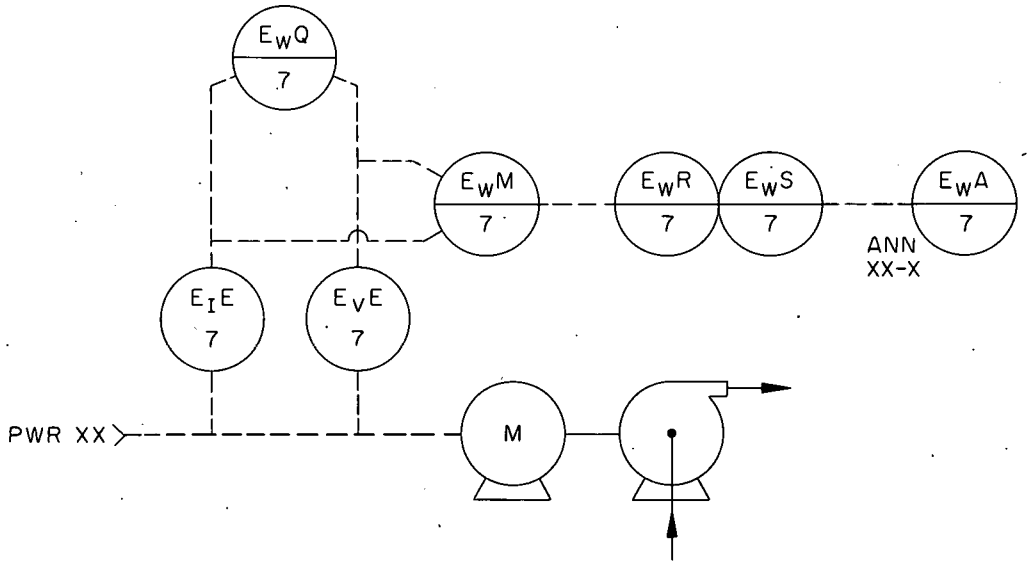
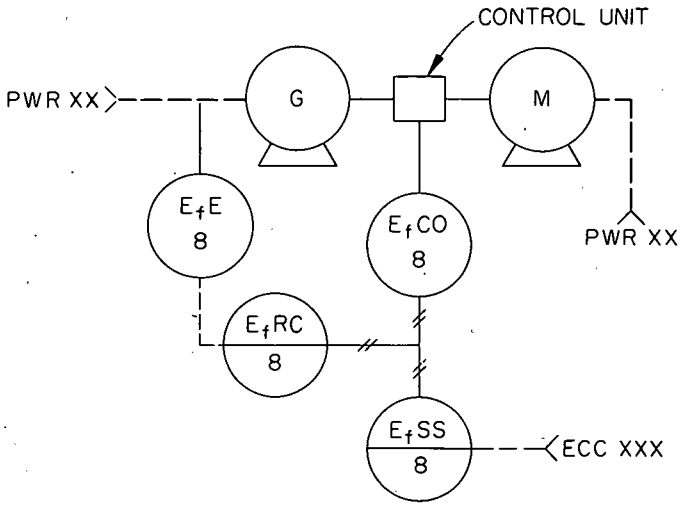
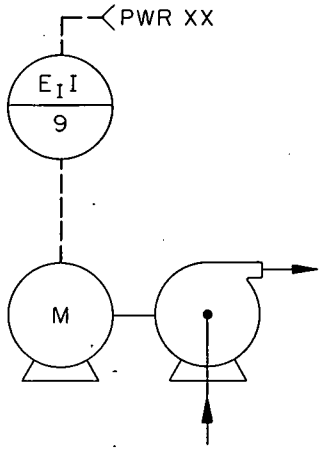


System 7. Electrical Power Measurement, Showing Locally Mounted Electrical Elements (Current and Potential Transformers) and Board-Mounted Totalizing Wattmeter, Modifier (Thermal Converter), Recording Wattmeter, Switch in Recorder Case, and Alarm.



System 8. Electrical Element (Frequency), Recorder-Controller, and Pneumatically Controlled Variable-Frequency Generator. Safety switch controls frequency limit.



System 9. Indicating Ammeter, Board Mounted. No current transformer.

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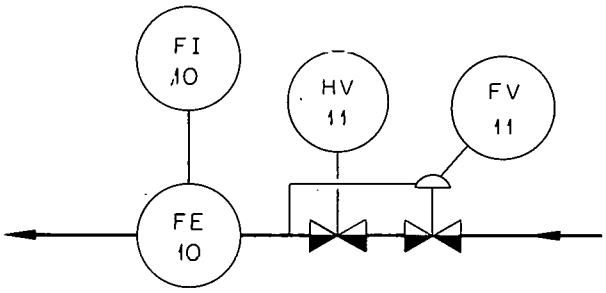
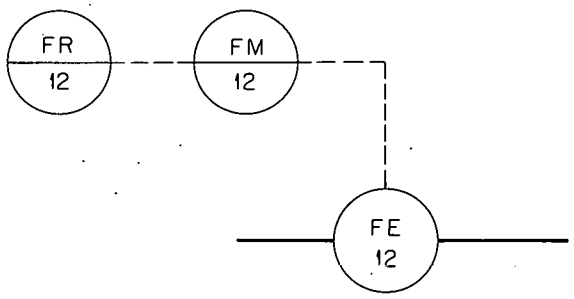
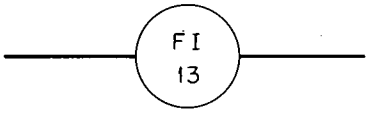


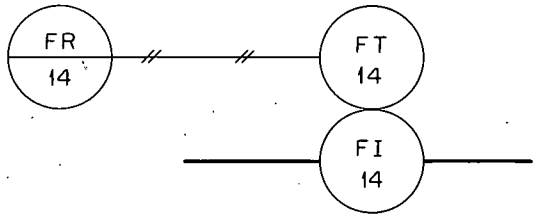
Systems 10, 11. Self-Actuated Flow Valve, Flow Indicator Locally Mounted with Orifice, Venturi or Flow Nozzle, Etc., Used for Primary Element.



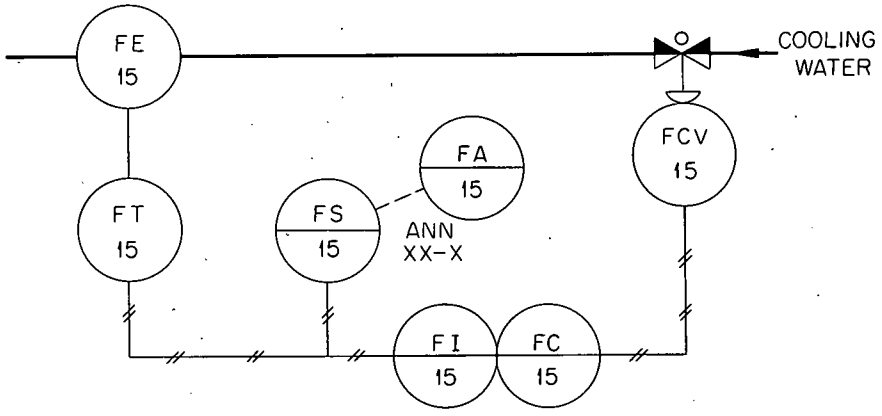
System 12. Flow Recorder and Flow Modifier, Board Mounted, with a Turbine-Type, Magnetic, or Other Electrical Sensing Element.



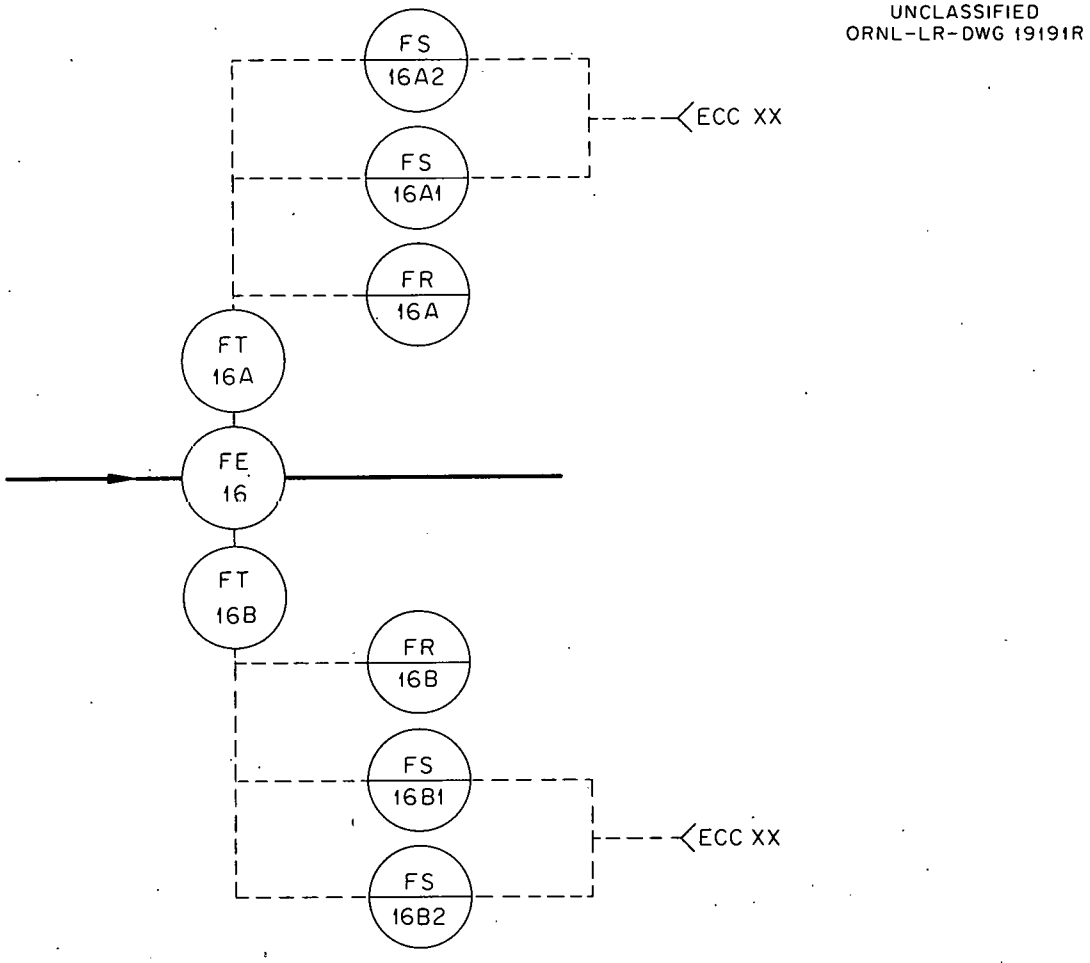
System 13. Flow Indicator, In-Line Mounted, Variable-Area Type. Could be flow glass, FG; flow totalizer, FQ; flow switch, FS.



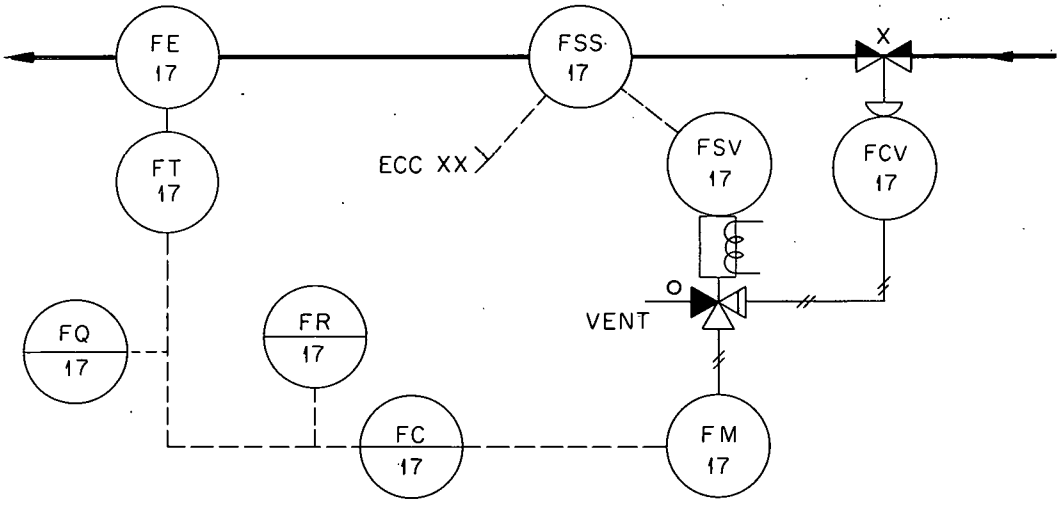
System 14. Flow Recorder, Board Mounted, with Pneumatic Transmitter Attached to In-Line Variable-Area Flow Indicator.



System 15. Flow Control, Showing Element, Local Transmitter, Fail-Open Control Valve with Board-Mounted Indicator, Plug-In Controller, Switch, and Alarm.



System 16. Flow Element with Two Sets of Taps, Two Transmitters, and Board-Mounted Recorders and Switches.



System 17. Flow Control, Showing Element, Local Transmitter, Fail-Closed Control Valve with Board-Mounted Totalizer, Recorder, Controller, Locally Mounted Modifier (Electric-to-Pneumatic Relay) and Safety Valve, and In-Line-Mounted Safety Switch.

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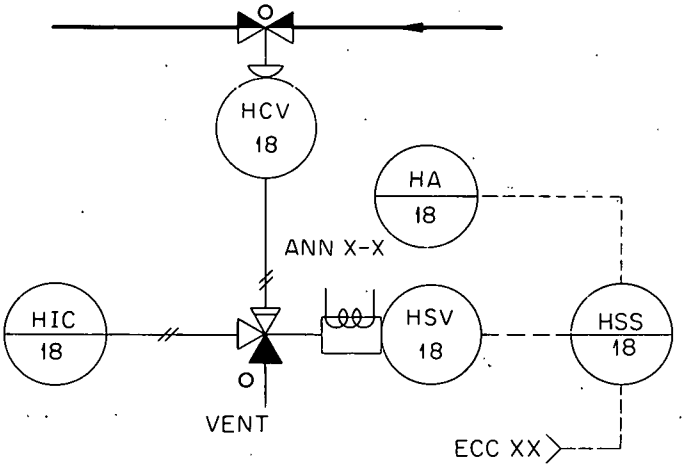
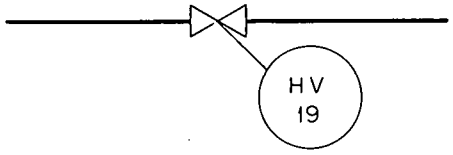
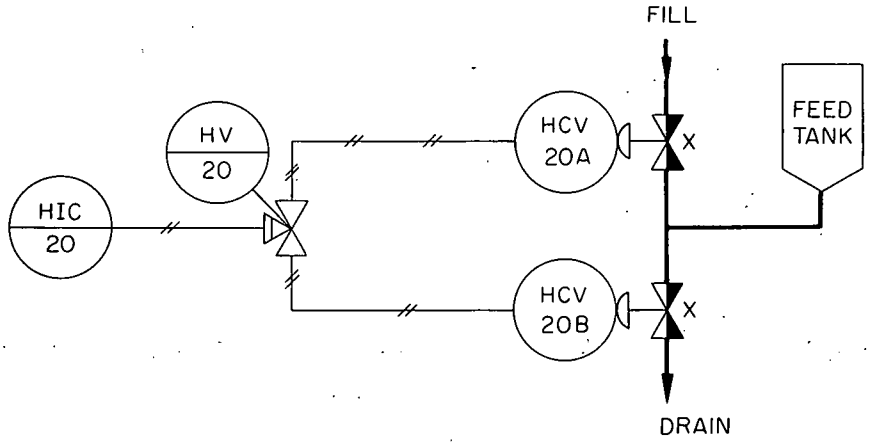


System 18. Manual Indicator-Controller, Alarm and Safety Switch (Board Mounted) with Control Valve and Safety Valve.



System 19. Manually Operated Valve (Globe, Gate, Needle, Etc.).



System 20. Board-Mounted Manual Indicator Controller and Four-Way Selector Valve for Actuating One of Two Control Valves.

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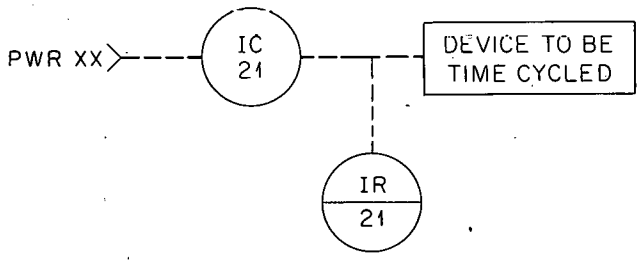
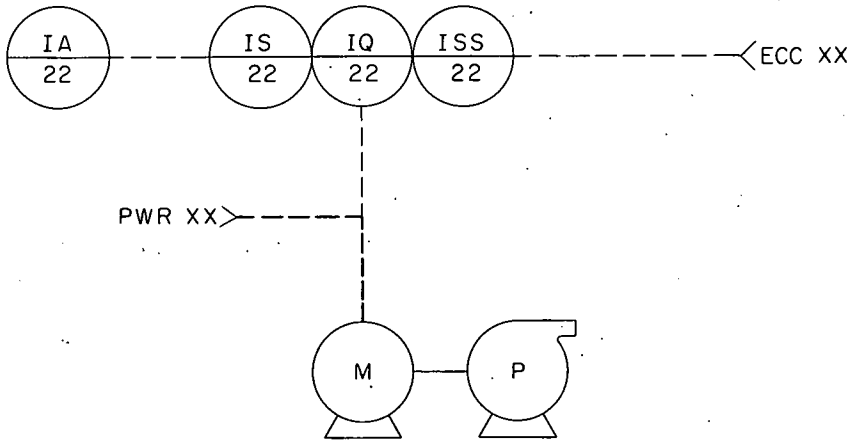


System 21. Time Controller (Repeat Cycle, Cam Operated, Etc.) Locally Mounted with Board-Mounted Recorder (Operational Recorder).



System 22. Running-Time Totalizer with Alarm Switch and Safety Switch Actuating an Alarm and Control Circuit.

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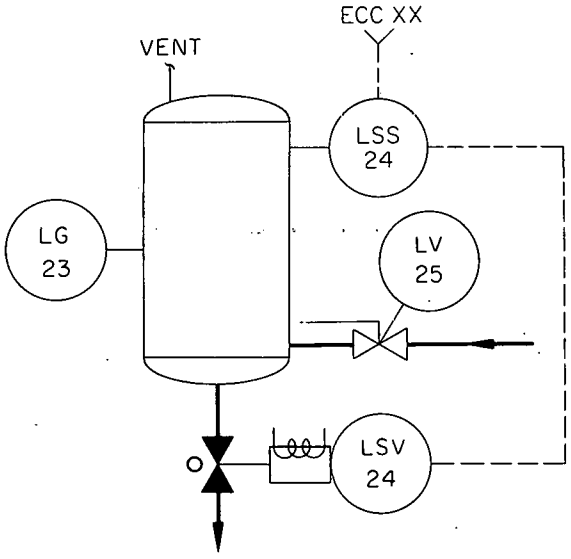
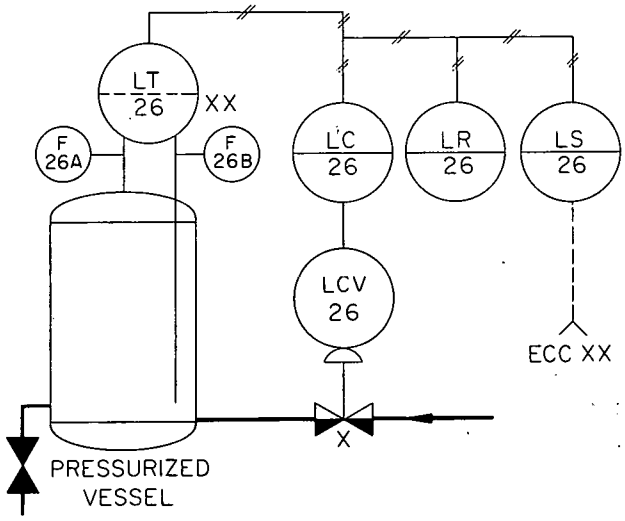


System 23, 24, 25. Self-Controlling Level Valve, Level Glass, Level Safety Switch, and Safety Valve.



System 26. Level Controller, Recorder and Switch (Board Mounted) with Level-Control Valve and Pneumatic Level Transmitter (on Intermediate Panel XX) with Purged Dip Tubes.

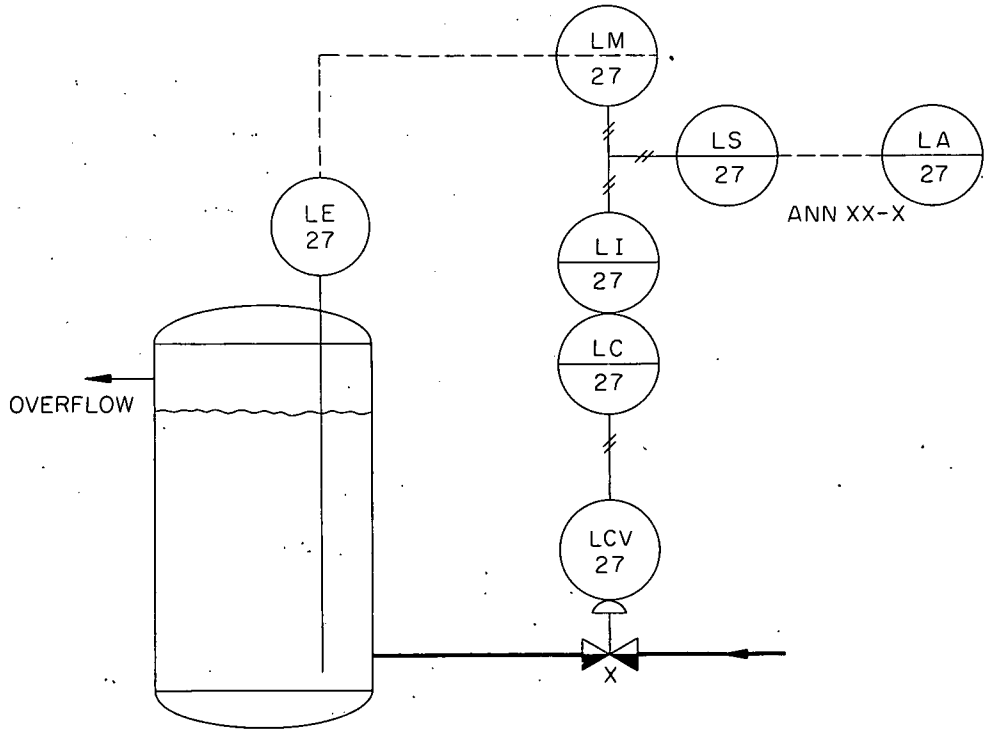


Fig. 27. Level Control with Electrical Level Element, Intermediate-Mounted Modifier (emf to Pneumatic), and Valve with Board-Mounted Indicator, Plug-In Controller, Switch, and Alarm.

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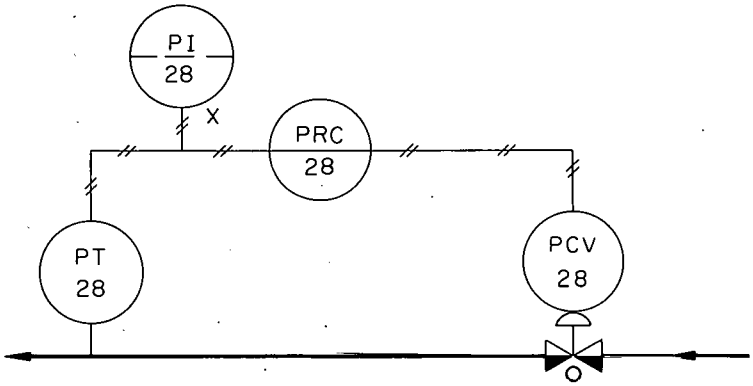


Fig. 28. Pressure Control, Showing Local Valve and Transmitter, Board-Mounted Integral (Full-Case) Recorder-Controller and Pressure Indicator on Intermediate Panel Board X.

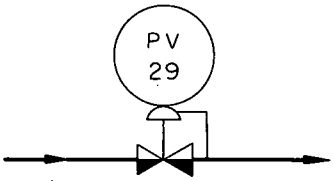


Fig. 29. Pressure-Regulating Valve, Self-Operated, Manually Set, Locally Mounted.

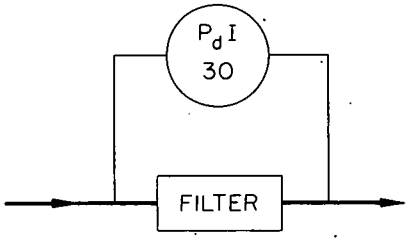


Fig. 30. Differential-Pressure Indicator.

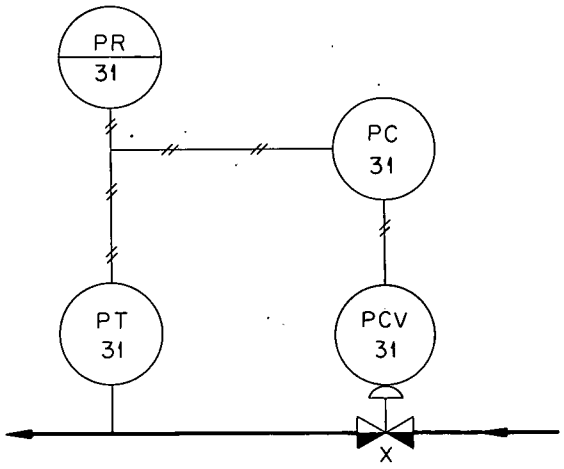
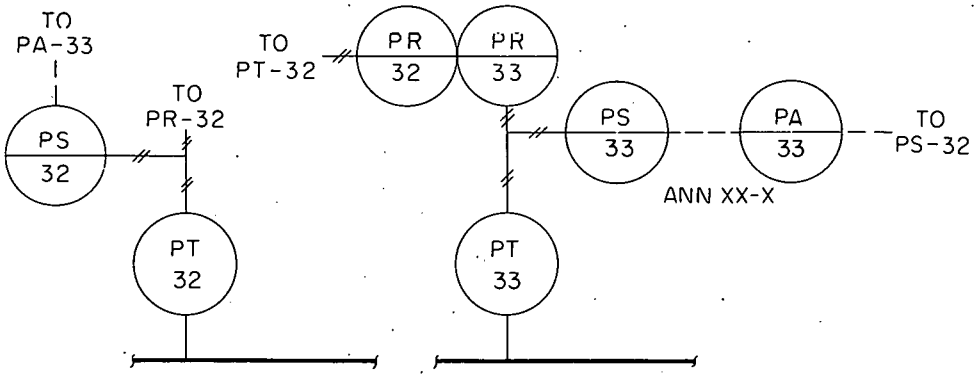


Fig. 31. Pressure Control, Showing Local Transmitter, Valve, and Controller with Board-Mounted Recorder.



Systems 32, 33. Board-Mounted Two-Pen Pneumatic Recorder Receiving Two Independent Inputs from Pressure Transmitters (Widely Separated on Flowsheet). Board-mounted pressure switches and common annunciator.

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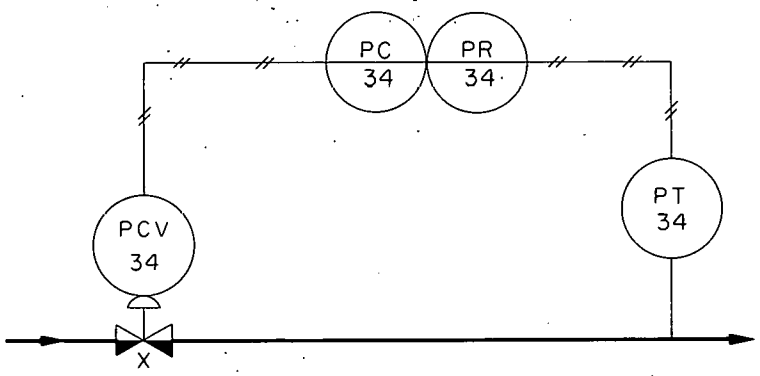
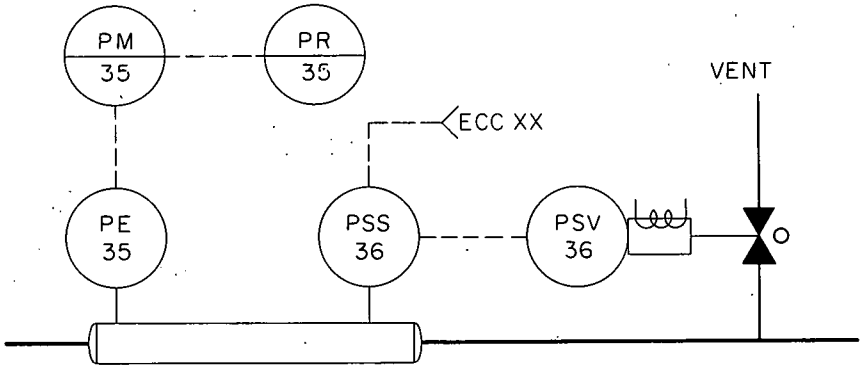


System 34. Pressure Control, Showing Board-Mounted Plug-In Recorder-Controller with Local Valve and Transmitter.



Systems 35, 36. Pressure Element, Output Modified to Drive a Standard Recorder (Typical Application Would Be a Strain Gage Type of Transducer Fed into a Strain-Gage Bridge and Millivolt Recorder); Also Local Safety Switch Actuating Solenoid Safety Valve.

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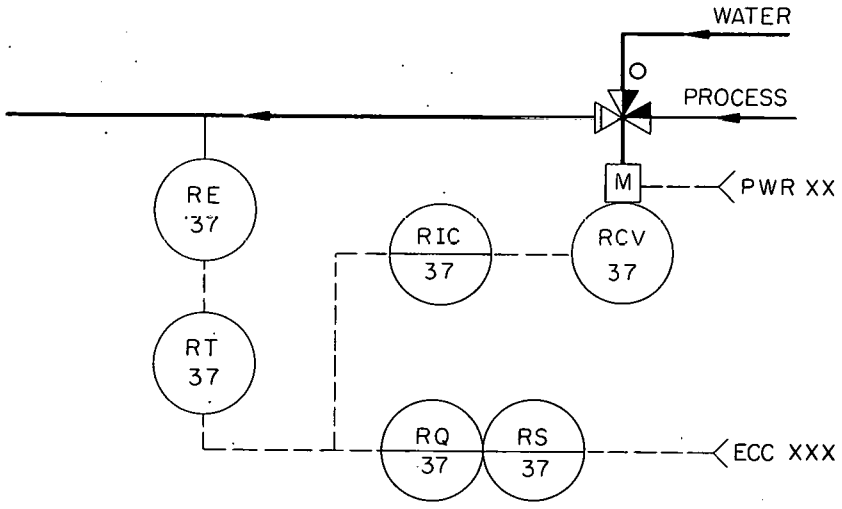
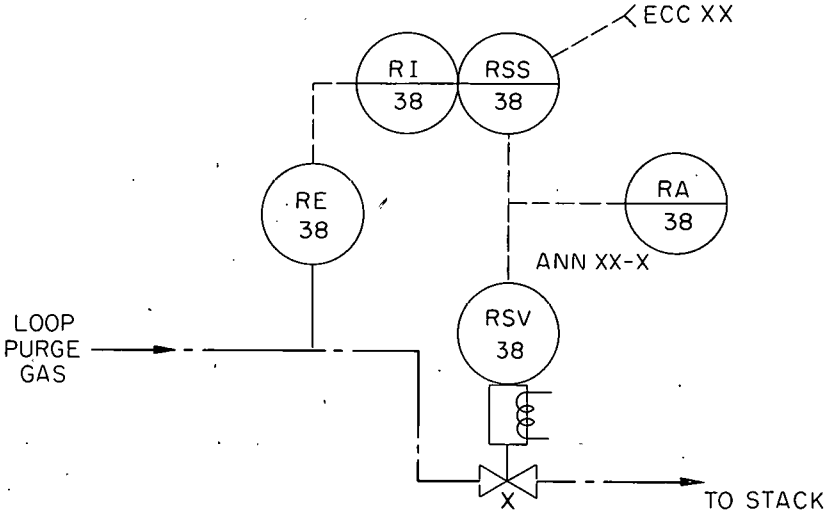


System 37. Board-Mounted Radiation Counter (Scaler) with Integral Switch. Indicating controller and motor-operated valve receiving signal from radiation element (Geiger tube, fission chamber, etc.) and radiation transmitter (preamplifier).



System 38. Radiation Safety Circuit with Element, Indicator with Integral Safety Switch, Alarm (Board Mounted), and Safety Valve.

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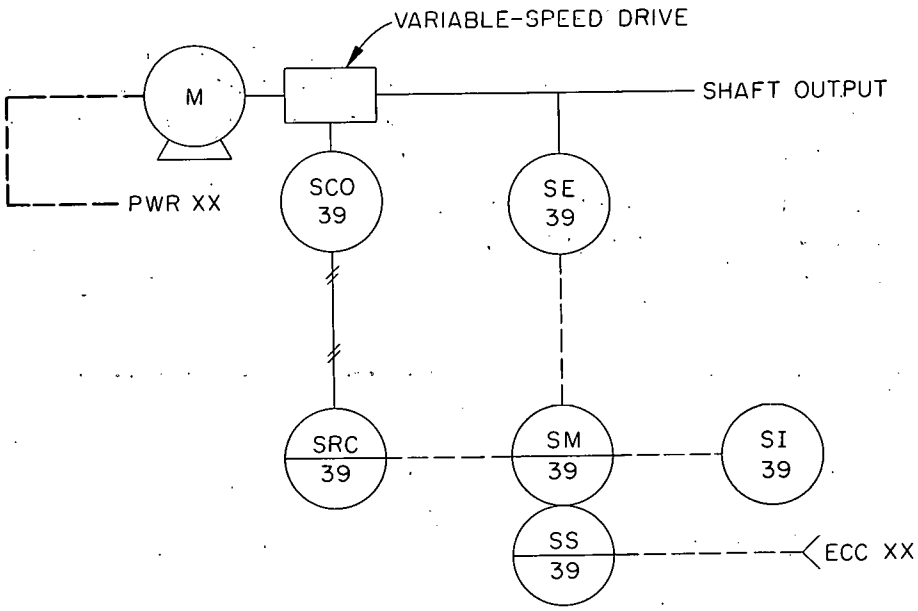
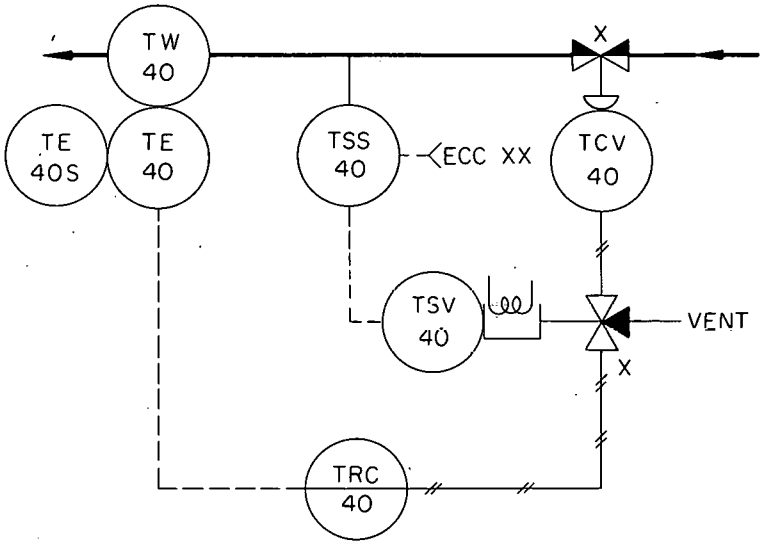


System 39. Speed Control, Showing Element and Modifier. Modifier with integral switch drives local speed indicator and board-mounted recorder-controller which positions variable-speed drive through speed-control operator.



System 40. Temperature Control, Showing In-Line Well, Local Element and Spare, Safety Valve and Safety Switch, Control Valve, and Board-Mounted Integral Recorder-Controller.

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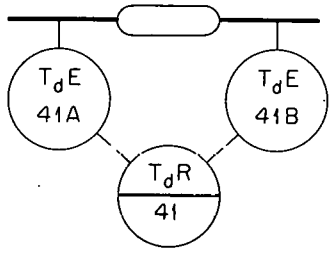
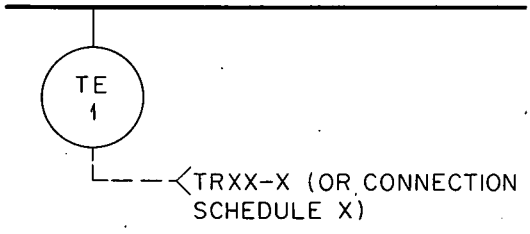
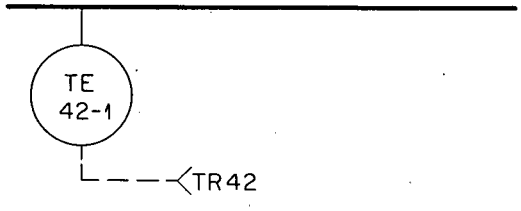


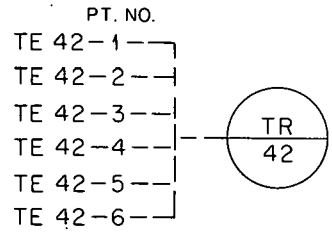
System 41. Differential-Temperature Elements (Two Surface-Mounted Elements), Connected to Temperature-Differential Recorder.



TE 1 -- TRXX-X
TE 2 -- TRX-X
TE 3 -- TRXXX-X
TE 4 -- TRXX-X
TE 5 -- TRX-X
TE 6 -- TRX-X

System 42 (Experimental Installation). Installation Showing Arbitrary Thermocouple Numbering and Random Assignment to Recorders. Schedule may be shown either on flowsheet or separately. Thermocouple numbers are never changed.





System 42 (Permanent Installation). Installation Showing Thermocouple Connected to Multipoint Instrument. Thermocouples carry recorder number and input number. All information should be shown on flowsheet.

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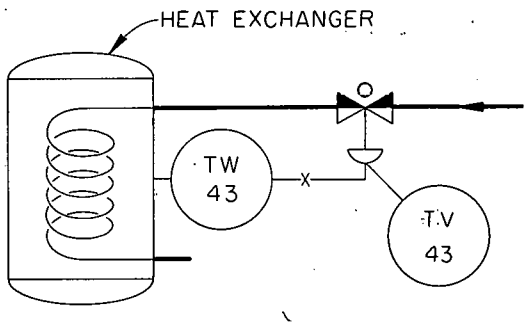
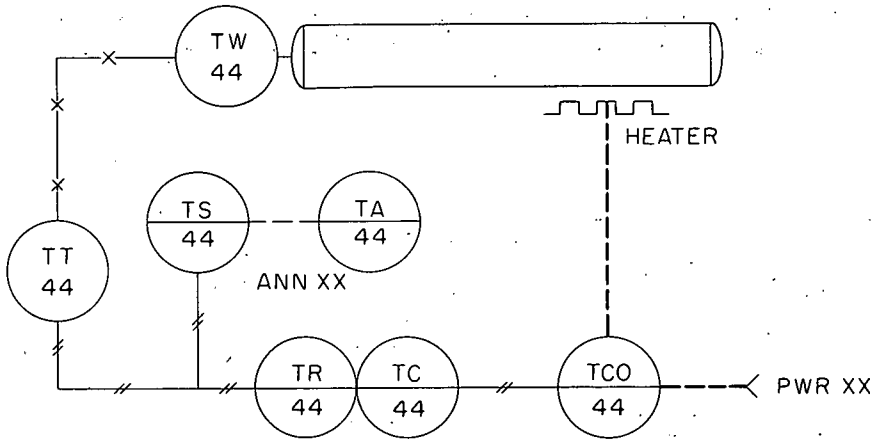


System 43. Self-Actuated Temperature Valve (Bulb In Well).



System 44. Temperature Control, Showing Locally Mounted Transmitter (Bulb In Well), Board-Mounted Recorder, Plug-In Controller, Control Operator (Pneumatically Actuated Variable Autotransformer, Electropneumatic Operator, Etc.), Switch, and Alarm.

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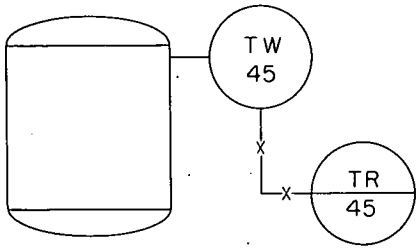
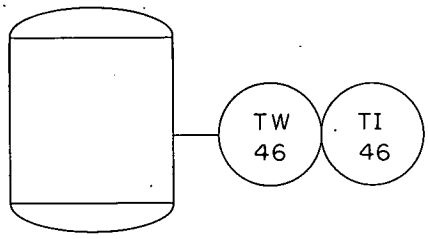
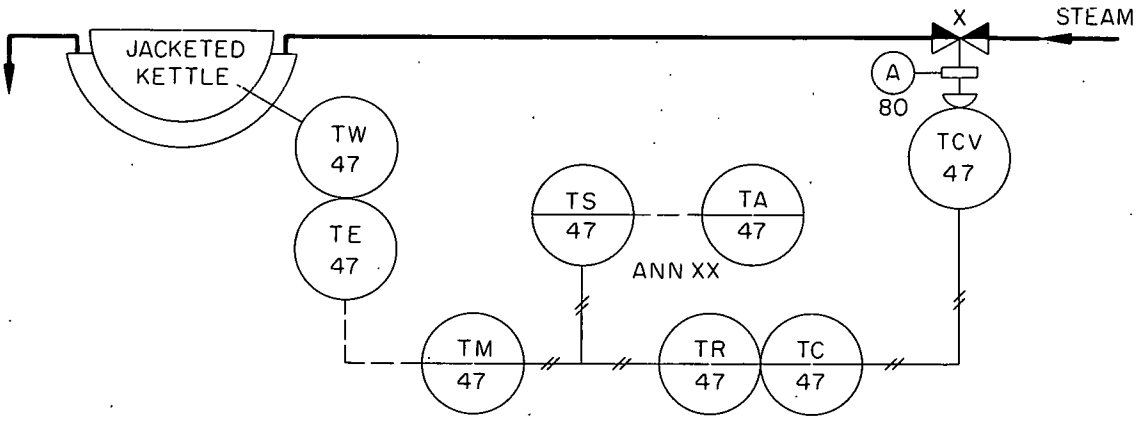


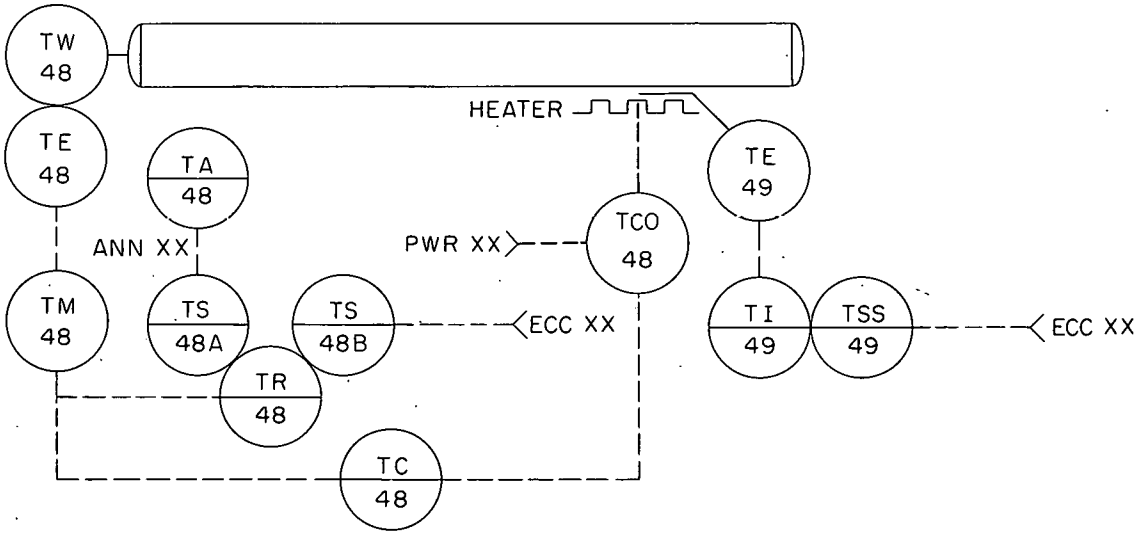
System 45. Board-Mounted Temperature Recorder (Filled-System Type), Showing Bulb and Well in Vessel.



System 46. Temperature Indicator (Industrial Glass or Dial Type) in Well in Vessel.



System 47. Temperature Control, Showing Well, Element, Fail-Closed Control Valve with Positioner (Requiring 80-psig Air Supply), Board-Mounted Modifier (Electropneumatic), Recorder, Plug-In Controller, Switch, and Alarm.



Systems 48, 49. Temperature Control, Showing Well, Element, Modifier (emf Converter), Recorder (with Integral Switches for Alarm and ECC), and Separate Controller Driving Control Operator. Safety circuit provides heater protection.

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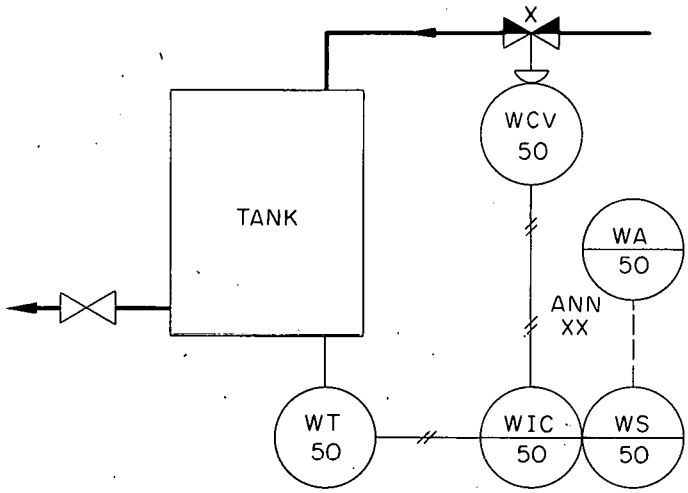
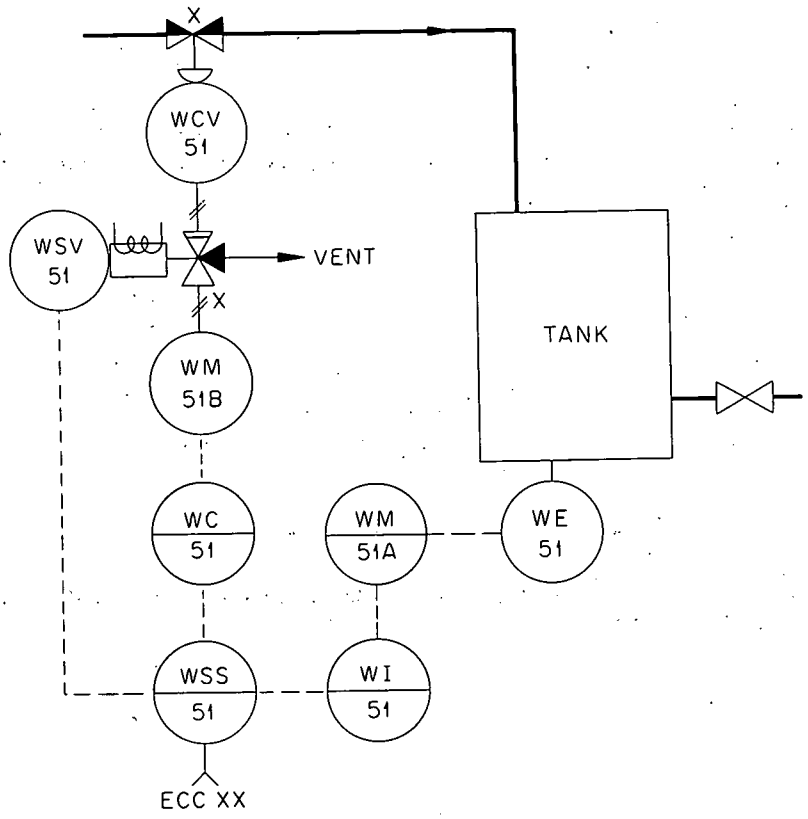


System 50. Weight System, Showing Transmitter, Board-Mounted Indicator-Controller (with Integral Alarm Switch), and Locally Mounted Control Valve.



System 51. Weight System, Showing Element, Board-Mounted Electric Converter, Indicator, Safety Switch, Controller, and Electric-to-Pneumatic Modifier Actuating Control Valve.

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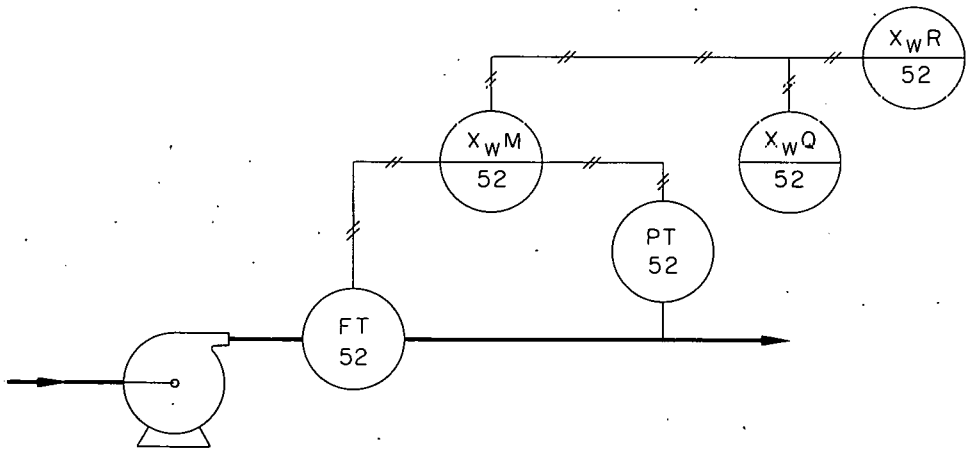
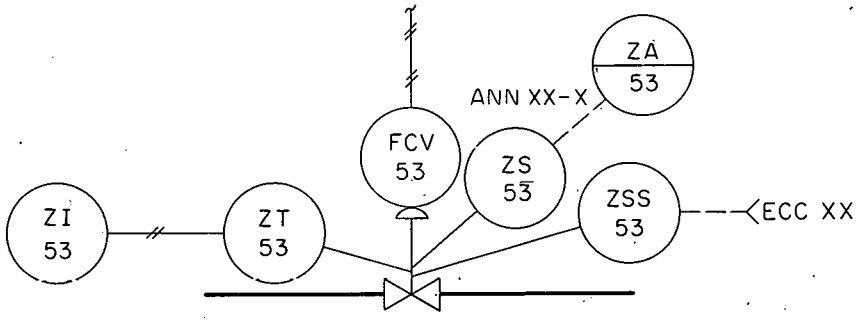


System 52. Illustration of a Special Measuring System In Which Flow and Pressure Are Multiplied To Obtain Power Measurement. The system shows a modifier (multiplier), recorder, and totalizer, board mounted.



System 53. Valve-Position Systems, Showing Two Limit Switches, Continuous Position Transmitter, Indicator, and a Board-Mounted Alarm at End of System.

6. RECOMMENDED SYSTEM FOR NUMERICAL IDENTIFICATION OF INSTRUMENT COMPONENTS

A system in which instrument-application symbols or groups of symbols are numbered consecutively for an entire chemical or physical process, for example, regardless of instrument first-letter identification or process-equipment identification, is illustrated by the typical application of symbol numbering shown in Sec 5. Note that all instruments in a measuring or control system carry the same number, except as noted in paragraph 4 below, and that these numbers are never duplicated in the same process.

If desired, blocks of numbers, related to specific portions of the process, may be assigned. For example, numbers 100–199 may designate the primary-coolant portion of the process, 200–299 the fuel-preparation portion, etc.

An extension of this numbering system is required for the following:

1. All items which have duplicate letter and numerical identifications in a common measuring or control system should be identified by an uppercase letter following the number, except as noted in paragraph 3 below. See Sec 5, systems 20 and 41. System 16 in Sec 5 illustrates a further expansion of the rule.

2. Spare elements should be designated by the letter "S" following the last number. Where one element is installed as the spare for another, it should have the same number followed by "S." See Sec 5, system 40.

3. For relatively permanent installations, it is desirable that the thermocouples or other elements bear numbers corresponding to the multipoint-receiver number followed by a dash and an individual identifying number. For example, TR 42 (in system 42) has thermocouples TE 42-1, TE 42-2, TE 42-3, etc., connected to points 1, 2, 3, etc.

4. For experimental installations where the thermocouples or other elements are subject to assignment to any receiver, a more flexible system than is indicated in paragraph 3 above should be used. In this case, a system in which the thermocouples are assigned arbitrary, permanent numbers and which uses a connection schedule listing the recorders and their associated thermocouples has been found to work well (see Sec 5, page 8).

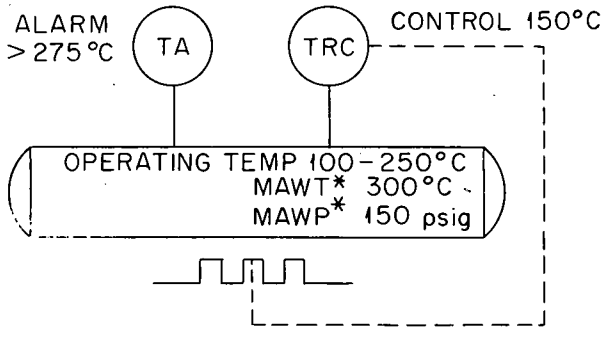
5. Purge stations may be identified by the same number as the control loop or measuring system with which they are used. See system 26, Sec 5.

7. RECOMMENDED FLOWSHEETS

The flowsheets listed below are recommended. For projects such as simple test facilities, etc., combinations may be used.

1. *The schematic flowsheet* (chemical or physical) shows the basic process, without auxiliaries, giving temperatures, pressures, flows, concentrations, percent constituents, etc. *It is originated by process development groups, chemists, etc.* Specific instrument application is not shown on the schematic flowsheet.

2. *The process flowsheet* (also called equipment flowsheet), *originated by the process design group, shows the points in the process where instruments are to be applied for measurement, control, alarms, etc., of temperature, flow, pressure, etc.* It also shows the expected operating point, range of operation, and design conditions for each variable. Although the process flowsheet is schematic in form, it is more quantitative, the process being shown in more detail than on the schematic flowsheet, and the auxiliaries to the process should be included. The following illustration shows system 44, Sec 5, as it would appear on a process flowsheet. It should be noted that the instruments are shown on the process flowsheet in an abbreviated form, with the nomenclature of Table 2 being used. The following is an example of a process flowsheet.



*Maximum allowable working temperature and maximum allowable working pressure.

3. *The instrument flowsheet* shows a simplification of the process, illustrating only those portions of the process which are instrumented. It should contain sufficient detail when used in combination with the process and/or engineering flowsheets to facilitate complete specification, procurement, and detailing of the installation. It is especially recommended because it provides a clear picture of the control and measurement instruments without the cluttering effects of process engineering details. *The instrument flowsheet is originated by the instrument group concerned and is used primarily on large projects.*

4. *The engineering flowsheet* shows all equipment, piping, and instruments in detail, giving line, equipment, and instrument identification, etc. It may or may not give values of variables, but it gives sufficient information, which when used in conjunction with vessel drawings, equipment layout, etc., enables a piping draftsman to lay out the piping. Electrical motors, pumps, heaters, etc., are shown with their power requirements in order to enable electrical schematics to be drawn. The instruments shown on this flowsheet should show sufficient detail, for use in combination with the process and/or instrument flowsheets, to facilitate the complete specification, procurement, and detailing of the installation of the instruments. *The engineering flowsheet is a result of the collaboration of all the engineering groups responsible for the process. It may be originated by any of the groups.*

5. *The operating flowsheet gives a simplification of the engineering flowsheet in order to provide information for operation of the process.* It is usually originated by the operating group.

8. ADDITIONAL TYPES OF ENGINEERING DOCUMENTS

8.1 Documents

The following documents are recommended as containing the minimum amount of information necessary to the adequate design of a project. (On smaller projects, one or more of the listed drawings may be combined or omitted.)

1. Panel layout and cutout drawings.
2. Elementary pneumatic and electrical control diagrams.
3. Instrument indices, specification sheets, and tabulations.
4. Detailed installation drawings.
5. Electrical interconnection wiring diagrams.
6. Pneumatic interconnection piping diagrams.
7. Circuit diagrams of individual components.
8. Maintenance elementary diagrams (a combination schematic and wiring diagram).
9. Manufacturers' instruction manuals.
10. Control block diagrams.

The following documents should be provided by the other design groups:

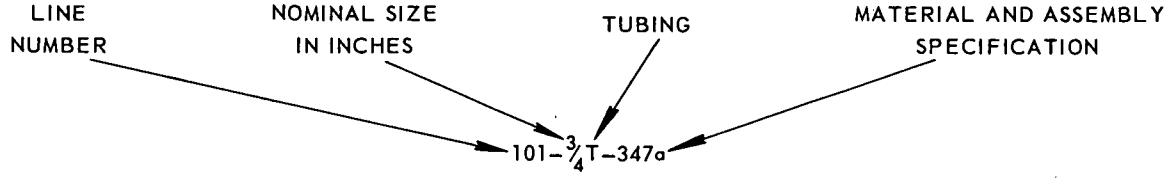
1. Electrical and piping schedules and drawings.
2. Equipment schedules and drawings.
3. Assembly specifications and drawings.
4. Equipment and material specifications.

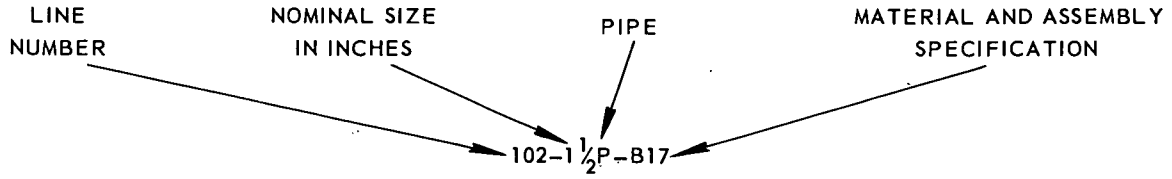
8.2 Photographs

Photographs are recommended as an invaluable and inexpensive means of project documentation.

9. IDENTIFICATION CODE FOR PROCESS AND INSTRUMENT LINES IN ENGINEERING FLOWSHEETS

The following code is recommended for identification of process and instrument lines on engineering flowsheets.





The line number may include the number of the equipment piece which the line enters, the type of service, etc. Line-number convention should be defined at the start of each project.

Nominal size shall designate IPS in the case of pipe and OD in the case of tubing.

Material and assembly specification may give material (type 347 stainless steel, copper, 309 ELC, pipe weight or tubing thickness, etc.), and may also designate assembly procedure (Swagelok fittings, metal arc, Heliarc, etc.). Convention should be defined at the start of each project.

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