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STANDARD

**INSTRUMENTATION
SYMBOLS AND IDENTIFICATION**



Sponsor

INSTRUMENT SOCIETY of AMERICA
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Pittsburgh, Pennsylvania 15222

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PREFACE

This preface is included for informational purposes and is not a part of Standard S5.1.

This Standard has been prepared as a part of the service of the Instrument Society of America toward a goal of uniformity in the field of instrumentation. To be of real value, this document should not be static but should be subjected to periodic review. Toward this end, the Society welcomes all comments and criticisms, and asks that they be addressed to the Standards and Practices Board Secretary, Instrument Society of America, 400 Stanwix St., Pittsburgh, Pennsylvania 15222.

The system described in this Standard is based on advances in technology and the collective industrial experience gained since the publication of Recommended Practice RP5.1 in 1949. This revision is based on the philosophy of achieving the maximum over-all utility by striking the optimum balance among the following objectives:

1. To adhere to past practice.
2. To make changes shown by experience to be needed.
3. To provide complete and unambiguous coverage of present application needs while providing the ability to adapt to the needs of a changing technology.
4. To provide simplicity of use and interpretation.

From a study of numerous standards and systems used by industrial organizations, it was apparent that there was a universal need for a means of providing an individual tagging designation for each instrument. The tagging system presented here was selected by the committee after intensive study of a number of different systems and after analysis of the results of a questionnaire that was distributed to more than 550 instrumentation people representing a large variety of industries. This was followed by a questionnaire covering a complete proposed revised Standard that was distributed to 1000 reviewers.

The subject "Graphical Symbols for Instrumentation" is handled by International Organization for Standardization, Technical Committee 10, Subcommittee 3 (ISO/TC 10/SC 3), of which the United States is a member. If an international standard is approved as the result of the ISO work, the United States will subsequently consider whether to recommend changes to Standard S5.1.

The ISA Standards and Practices Department is aware of the growing need for attention to the metric system of units in general, and the International System of Units (SI) in particular, in the preparation of instrumentation standards. The Department is further aware of the benefits to USA users of ISA Standards of incorporating suitable references to the SI (and the metric system) in their business and professional dealings with other countries. Towards this end this Department will endeavor to introduce SI and SI-acceptable metric units as optional alternatives to English units in all new and revised standards to the greatest extent possible. The Metric Practice Guide, which has been published by the American National Standards Institute as ANSI Z210.1, and future revisions, will be the reference guide for definitions, symbols, abbreviations and conversion factors.

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1. SCOPE

1.1 General

- 1.1.1 The purpose of this Standard is to establish a uniform means of designating instruments and instrumentation systems used for measurement and control. To this end, a designation system is presented that includes symbols and an identification code.
- 1.1.2 The differing established procedural needs of various organizations are recognized, where not inconsistent with the objectives of the Standard, by providing alternative symbolism methods. A number of options are provided for adding information or simplifying the symbolism, if desired.
- 1.1.3 Process equipment symbols are not part of this Standard, but are included only to illustrate applications of instrumentation symbols.
- 1.1.4 If a given drawing, or set of drawings, uses graphic symbols that are similar or identical in shape or configuration and that have different meanings because they are taken from different standards, then adequate steps shall be taken to avoid misinterpretation of the symbols used. These steps may be to use caution notes or reference notes, comparison charts that illustrate and define the conflicting symbols, or other suitable means. This requirement is especially critical if the graphic symbols used, being from different disciplines, represent devices, conductors, flow lines, or signals whose symbols, if misinterpreted, might be dangerous to personnel or cause damage to equipment.

1.2 Application to Industries

- 1.2.1 Despite the variety of instruments that have been developed, they all fit into common functional categories. The Standard is suitable for use in the chemical, petroleum, power generation, air-conditioning, metal refining, and numerous other industries.
- 1.2.2 Certain fields, such as astronomy, navigation, and medicine, use very specialized instruments that are different from the conventional industrial process instruments. No specific effort was made to have the Standard meet the requirements of those fields. However, it is expected that the Standard will be flexible enough to meet many of the needs of special fields.

1.3 Application to Work Activities

- 1.3.1 The Standard is suitable for use whenever any reference to an instrument is required. Such references may be required for the following uses as well as others:

Flow diagrams, process and mechanical
Instrumentation system diagrams
Specifications; purchase orders; manifests; and
other lists

Construction drawings
Technical papers; literature; and discussions
Tagging of instruments
Installation, operating, and maintenance instructions, drawings, and records

- 1.3.2 The Standard is intended to provide sufficient information to enable anyone reading a flow diagram and having a reasonable amount of plant knowledge to understand the means of measurement and control of the process without having to go into the details of instrumentation that require the knowledge of an instrument specialist.

1.4 Extent of Functional Identification

The Standard provides for the identification and symbolization of the key functions of an instrument. The full details of the instrument are left to be described in a suitable specification, data sheet, or other document intended for those people interested in such details.

1.5 Extent of Loop Identification

The Standard covers the identification of an instrument and all other instruments associated with it in a loop. The user is free to apply additional identification--by serial number, plant number, or otherwise--as he may deem advisable to distinguish among projects, or for other purposes.

2. DEFINITIONS

For the purposes of this Standard, the following definitions apply. A definition that makes reference to another document has been modified from a definition given in that document to correspond to the format of this Standard. Terms in italics in a definition are also defined in this section. Where examples are given, the list is not intended to be all inclusive.

Alarm - A device that signals the existence of an abnormal condition by means of an audible or visible discrete change, or both, intended to attract attention.

Balloon - The circular symbol used to denote an instrument or instrument tagging.

Behind the Board - A term applied to a location that (1) is within an area that contains the instrument board, and (2) is within or in back of the board, or is otherwise not accessible to the operator for his normal use, and (3) is not designated as *local*.

Board - A structure that has a group of instruments mounted on it and that is chosen to have an individual designation. The *board* may consist of one or more component panels, cubicles, desks, or racks.

Board-Mounted - A term applied to an *instrument* that is mounted on a *board* and that is accessible to the operator for his normal use.

Computing Relay - A *relay* that performs one or more

calculations or logical functions or both, and sends out one or more resultant output signals.

Controller - A device that has an output that can be varied to maintain a controlled variable at a specified value or within specified limits or to alter the variable in a specified manner.

An automatic controller varies its output automatically in response to a direct or indirect input of a measured process variable. A manual controller is a manual loading station, and its output is not dependent on a measured process variable but can be varied only by manual adjustment.

A controller may be integral with other functional elements of a control loop. (Also see Table 1, Note 13.)

Control Station - A manual loading station that also provides switching between manual and automatic control modes of a control loop. It is also known as an auto-manual station and an auto-selector station.

Control Valve - A device, other than a common hand-actuated on-off valve, that directly manipulates the flow of one or more fluid process streams. In some applications, it is commonly known as a damper or louver. (Also see Table 1, Note 13.)

It is expected that use of the designation hand control valve will be limited to hand-actuated valves that (1) are used for process throttling, or (2) are special valves for control purposes and that are to be specified by an instrumentation group or instrument engineer.

Converter - A device that receives information in the form of an instrument signal, alters the form of the information, and sends out a resultant output signal. A converter is a special form of relay.

A converter is also referred to as a transducer, although transducer is a completely general term and its use specifically for signal conversion is not recommended.

Final Control Element - The device that directly changes the value of the manipulated variable of a control loop.

Function - The purpose of or action performed by a device.

Identification - The sequence of letters or digits or both used to designate an individual instrument or loop.

Instrument - A device used directly or indirectly to measure or control a variable or both. The term includes control valves, relief valves, and electrical devices such as annunciators and pushbuttons. The term does not apply to parts, e.g., a receiver bellows or a resistor, that are internal components of an instrument.

Instrumentation - The application of instruments.

Local - The location of an instrument that is neither on nor behind a board. Local instruments are commonly in the vicinity of a primary element or a final control element.

Local Board - A board that is not a central or main board. Local boards are commonly in the vicinity of plant subsystems or sub-areas.

Loop - A combination of one or more interconnected instruments arranged to measure or control a process variable, or both.

Manual Loading Station - A device having a manually adjustable output that is used to actuate one or more remote devices. Although the remote devices may be controller elements, the station does not provide switching between manual and automatic control modes of a control loop. (See Controller and Control Station.) The station may have integral gages, lights, or other features. It is also known as a manual station, or a remote manual loader.

Measurement - The determination of the existence or magnitude of a variable. Measuring instruments include all devices used directly or indirectly for this purpose.

Pilot Light - A light that indicates which of a number of normal conditions of a system or device exists. It is unlike an alarm light, which indicates an abnormal condition. The pilot light is also known as a monitor light.

Primary Element - That part of a loop or of an instrument that first senses the value of a process variable, and that assumes a corresponding predetermined and intelligible state or output. The primary element may be separate from or integral with another functional element of a loop. The primary element is also known as a detector or sensor.

Process - Any operation or sequence of operations involving a change of energy state, of composition, of dimension, or of other property that may be defined with respect to a datum.

The term process is used in this Standard to apply to all variables other than instrument signals.

Process Variable - Any variable property of a process.

Relay - A device that receives information in the form of one or more instrument signals; modifies the information or its form, or both, if required; sends out one or more resultant output signals; and is not designated as a controller, a switch, or otherwise. (Also see Computing Relay.)

The term relay is also specifically applied to an electric switch that is remotely actuated by an electric signal. However, for the purposes of the Standard, the term is not so restricted. (Also see Table 1, Note 13.)

The term is also applied to the functions performed by relays.

Scan - To sample each of a number of inputs intermittently. A scanning device may provide additional functions such as record or alarm.

Switch - A device that connects, disconnects, or transfers one or more circuits and is not designated as a *controller*, a *relay*, or a *control valve*. (Also see Table 1, Note 13.)

The term is also applied to the functions performed by switches.

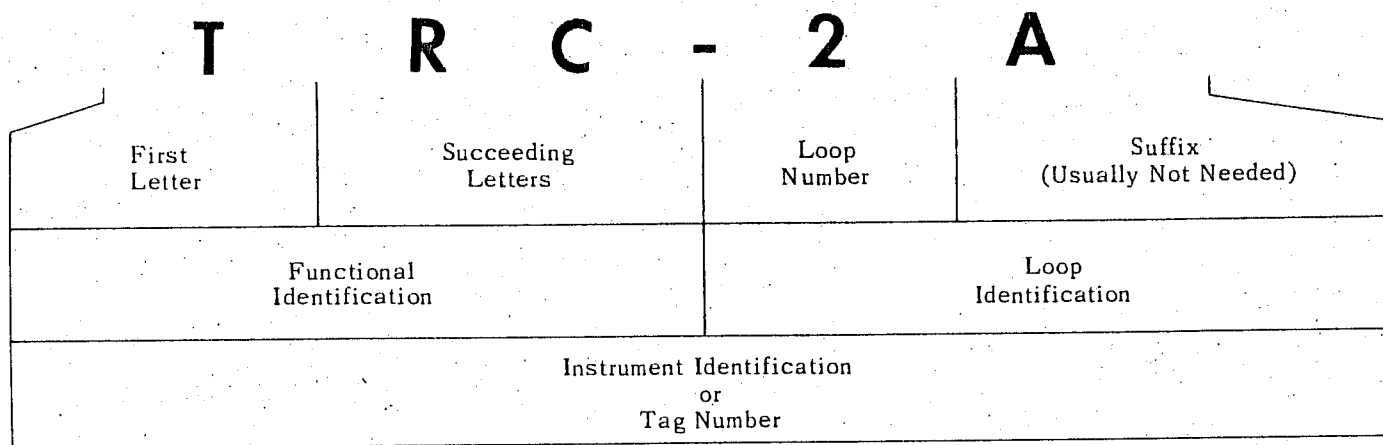
Telemetry - The practice of transmitting and receiving the measurement of a variable for readout or other uses. The term is most commonly applied to electric signal systems.

Test Point - A process connection to which no in-

strument is permanently connected, but which is intended for temporary, intermittent, or future connection of an *instrument*.

Transducer - A general term for a device that receives information in the form of one or more physical quantities; modifies the information or its form or both, if required; and sends out a resultant output signal. Depending on the application, the *transducer* can be a *primary element*, a *transmitter*, a *relay*, a *converter*, or other device. (Reference 2.)

Transmitter - A device that senses a *process variable* through the medium of a *primary element*, and that has an output whose steady-state value varies only as a predetermined function of the *process variable*. The *primary element* may or may not be integral with the *transmitter*. (Reference 2.)



3. OUTLINE OF THE IDENTIFICATION SYSTEM

3.1 General

3.1.1 Each instrument shall be identified first by a system of letters used to classify it functionally. To establish a loop identity for the instrument, a number shall be appended to the letters. This number will, in general, be common to other instruments of the loop of which this instrument is a part. A suffix is sometimes added to complete the loop identification. A typical tag number for a temperature recording controller is shown below.

3.1.2 The instrument tag number may include coded information such as plant area designation. (See Section 3.3.2.)

3.1.3 Each instrument may be represented on diagrams by a symbol. The symbol may be accompanied by an identification.

3.2 Functional Identification

3.2.1 The functional identification of an instrument shall consist of letters from Table 1, and shall

include one first-letter, covering the measured or initiating variable, and one or more succeeding-letters covering the functions of the individual instrument. An exception to this rule is the use of the single letter *L* to denote a pilot light that is not part of an instrument loop. (See Table 1, Note 11.)

3.2.2 The functional identification of an instrument shall be made according to the *function* and not according to the construction. Thus, a differential-pressure recorder used for flow measurement shall be identified as an *FR*; a pressure indicator and a pressure switch connected to the output of a pneumatic level transmitter shall be identified as *LI* and *LS*, respectively.

3.2.3 In an instrument loop, the first letter of the functional identification shall be selected according to the *measured or initiating variable* and not according to the manipulated variable. Thus, a control valve varying flow according to the dictates of a level controller is an *LV*, not an *FV*.

3.2.4 The succeeding-letters of the functional iden-

tification designate one or more readout or passive functions, or output functions, or both. A modifying-letter may be used, if required, in addition to one or more other succeeding-letters. Modifying letters may modify either a first-letter or other succeeding-letters, as applicable.

3.2.5 The sequence of identification letters shall begin with a first-letter. (See exception in Section 3.2.1.) Readout or passive functional letters shall follow in any sequence, and output functional letters shall follow these in any sequence, except that output letter C (control) shall precede output letter V (valve); e.g., HCV, a hand-actuated control valve. However, modifying letters, if used, shall be interposed so that they are placed immediately following the letters they modify.

3.2.6 An instrument tagging designation on a flow diagram may be drawn with as many tagging balloons as there are measured variables or outputs. Thus, a flow-ratio recording transmitter with a flow-ratio switch may be identified on a flow diagram by two tangent circles, one inscribed FFRT-3 and the other FFS-3. The instrument would be designated FFRT/FFS-3 for all uses in writing and reference.

If desired, however, the abbreviated FFRT-3 may serve for general identification or purchasing while FFS-3 may be used for electric circuit diagrams.

3.2.7 The number of functional letters grouped for one instrument should be kept to a minimum according to the judgment of the user. The total number of letters within one group should not exceed four. The number within a group may be kept to a minimum by these means:

- (1) Arrange the functional letters into sub-groups. This practice is described in Section 3.2.6 for instruments having more than one measured variable or output, but it may also be done for other instruments.
- (2) If an instrument both indicates and records the same measured variable, then the I (indicate) may be omitted.

3.2.8 All letters of the functional identification shall be uppercase.

3.3 Loop Identification*

3.3.1 The loop identification of an instrument shall generally use a number assigned to the loop of which the instrument is a part. Each instrument loop shall have a unique number. An instrument common to two or more loops may have a separate loop number, if desired.

3.3.2 A single sequence of loop numbers shall be

used for all instrument loops of a project or sections of a project regardless of the first letter of the functional identification of the loops.† A loop numbering sequence may begin with the number 1 or with any other convenient number, such as 301 or 1201, that may incorporate coded information such as plant area designation.‡

3.3.3 If a given loop has more than one instrument with the same functional identification, then, preferably, a suffix shall be appended to the loop number; e.g., FV-2A, FV-2B, FV-2C, etc., or TE-25-1, TE-25-2, TE-25-3, etc. However, it may be more convenient or logical in a given instance to designate a pair of flow transmitters, for example, as FT-2 and FT-3 instead of FT-2A and FT-2B. The suffixes may be applied according to the following guidelines:

- (1) Suffix letters, which shall be uppercase should be used, i.e., A, B, C, etc.
- (2) For an instrument such as a multi-point temperature recorder that prints numbers for point identification, the primary elements may be numbered TE-25-1, TE-25-2, TE-25-3, etc. The primary element suffix numbers should correspond to the point numbers of the recorder. Optionally, they may not correspond.
- (3) Further subdivisions of a loop may be designated by alternating suffix letters and numbers (See Section 5.9R (3).)

3.3.4 An instrument that performs two or more functions may be designated by all of its functions. For example, a flow recorder FR-2 with pressure pen PR-4 is preferably designated FR-2/PR-4; alternatively, it may be designated UR-7 (See Sections 5.8U and 5.9U); a two-pen pressure recorder may be PR-7/8; and a common annunciator window for high- and low-temperature alarm may be TAH/L-9.

3.3.5 Instrument accessories, such as purge rotameters, air sets, and seal pots that are not explicitly shown on a flow diagram but that need a tagging designation for other purposes should be tagged individually according to their function and shall use the same loop

*The rules for loop identification need not be applied to those instruments or accessories, e.g., steam traps, pressure indicators, temperature wells, that are purchased in bulk quantities, if such is the user's practice.

†Although not recommended, parallel numbering is a method that has been used to designate loops. In this method, a new numbering sequence is begun for each first letter.

‡An optional method that has been used for designating plant areas is to use coded numbers to prefix the functional identification of an instrument. (See Section 5.2 (4).)

number as that of the instrument they directly serve. Application of such a designation does not imply that the accessory must be shown on the flow diagram. Alternatively, the accessories may use the identical tag number as that of their associated instrument, but with clarifying words added, if required. Thus, an orifice flange union associated with orifice plate FE-7 should be tagged FX-7, but may be tagged FE-7 flanges. A purge rotameter-regulator associated with pressure gage PI-8 should be tagged FICV-8 but may be tagged PI-8 purge. A thermowell used with thermometer TI-9 should be tagged TW-9, but may be tagged TI-9 thermowell.

3.4 Symbols

- 3.4.1 The drawings, below, illustrate the symbols that are intended to depict instrumentation on flow diagrams and other drawings, and cover their application to a variety of processes. The applications shown were chosen to illustrate principles of the methods of symbolization and identification. Additional applications that adhere to these principles may be devised as required. The examples show numbering that is typical for the pictured instrument inter-relationships, but the numbering may be varied to suit the situation. The symbols indicating the various locations of instruments have been applied in typical ways in the illustrations; this does not imply, however, that the applications or the designations of the instruments are therefore restricted in any way. No inference should be drawn that the choice of any of the schemes for illustration constitutes a recommendation for the illustrated methods of measurement or control. Where alternative symbols are shown without a statement of preference, the relative sequence of the symbols does not imply a preference.
- 3.4.2 The circular balloon may be used to tag distinctive symbols, such as that for a control valve, when such tagging is desired. (In such instances, the line connecting the balloon to the instrument symbol shall be drawn close to but not touching the symbol.) In other instances, the balloon serves to represent the instrument, proper.
- 3.4.3 A distinctive symbol whose relationship to the remainder of the loop is easily apparent from a diagram need not be individually tagged on the diagram.* For example, it is expected that an orifice plate or a control valve that is part of a larger system will not usually be shown with a tag number on a diagram. Also, where there is an electrical primary element connected to another instrument on a diagram, use of a symbol to represent the primary element on the diagram is optional. (See Sections 5.8C,

3.4.6 Aside from the general drafting requirement for neatness and legibility, all symbols may be drawn with any orientation. Likewise, signal lines may be drawn on a diagram entering or leaving the appropriate part of a symbol at any angle. Directional arrowheads shall be added to signal lines when needed to clarify the direction of flow of intelligence.

3.4.7 The electric, pneumatic, or other power supply to an instrument is not expected to be shown unless it is essential to an understanding of the operation of the instrument or the loop. (See Sections 5.1 (1) and 5.10 (9), (12), and (26).)

3.4.8 In general, one signal line will suffice to represent the interconnections between two instruments on flow diagrams even though they may be connected physically by more than one line.

3.4.9 The sequence in which the instruments of a loop are connected on a flow diagram shall reflect the functional logic; this arrangement will not necessarily correspond to the signal connection sequence. Thus, a loop using analog voltage signals requires parallel wiring while a loop using analog current signals requires series wiring, but the diagram in both instances shall be drawn as though all the wiring were parallel. This will show the functional inter-relationships clearly while keeping their aspect of the flow diagram independent of the type of instrument system installed. The literal and correct wiring interconnections are expected to be shown on a suitable electric wiring diagram.

3.4.10 For process flow diagrams or other applications where it may be desired to depict only those instrumentation end-functions that are needed for the operation of the process, proper, the intermediate instrumentation and other details may be omitted, provided that this is done consistently for a given type of drawing throughout a project. Minor instruments and loop components, e.g., pressure gages, thermometers, transmitters, converters, may thus be eliminated from the diagrams.

3.4.11 It is common practice for mechanical flow diagrams to omit the symbols of interlock-hardware components that are actually necessary for a working system, particularly when symbolizing electric interlock systems. For example, a level switch may be shown as tripping a pump, or separate flow and pressure switches may be shown as actuating a solenoid valve or other interlock device. In both instances, auxiliary electrical relays and other components may also be required, but these additional components may be considered details to be shown elsewhere. By the same token, the current transformer shown under Section 5.8I will sometimes be omitted and its receiver shown connected directly to the process, in this case the electric motor.

*In some instances, the illustrations tend to apply more tagging balloons than are usually required. This has been done for clarity of illustration.

5.8T(8), etc.) Where the identity is ambiguous or not conveniently determined, then it is expected that the identity will be clarified by the addition of the tag number, with or without a balloon, adjacent to the symbol. In any event, the instrument shall bear a distinctive tag number in other documents and references.

- 3.4.4 A brief explanatory notation may be added adjacent to a symbol in order to clarify the function of an item.
- 3.4.5 The sizes of the tagging balloons and the miscellaneous symbols shown in Sections 5.2 and 5.7 are the sizes generally recommended; however, the optimum sizes may vary depending on whether the finished diagram is to be photographically reduced in size and on the number of characters that are expected in the instrument tagging designation. The sizes of the other symbols may be selected as appropriate to accompany the symbols of other equipment on a diagram.

4. REFERENCES AND BIBLIOGRAPHY

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4.2 Bibliography

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TABLE 1
MEANINGS OF IDENTIFICATION LETTERS

This table applies only to the functional identification of instruments. Numbers in table refer to notes following.

	FIRST LETTER		SUCCEEDING LETTERS (3)		
	MEASURED OR INITIATING VARIABLE (4)	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	Analysis (5)		Alarm		
B	Burner Flame		User's Choice(1)	User's Choice(1)	User's Choice(1)
C	Conductivity (Electrical)			Control (13)	
D	Density (Mass) or Specific Gravity	Differential (4)			
E	Voltage (EMF)		Primary Element		
F	Flow Rate	Ratio (Fraction) (4)			
G	Gaging (Dimensional)		Glass (9)		
H	Hand (Manually Initiated)				High (7, 15, 16)
I	Current (Electrical)		Indicate (10)		
J	Power	Scan (7)			
K	Time or Time-Schedule			Control Station	
L	Level		Light (Pilot) (11)		Low (7, 15, 16)
M	Moisture or Humidity				Middle or Intermediate (7, 15)
N (1)	User's Choice		User's Choice	User's Choice	User's Choice
O	User's Choice(1)		Orifice (Restriction)		
P	Pressure or Vacuum		Point (Test Connection)		
Q	Quantity or Event	Integrate or Totalize (4)			
R	Radioactivity		Record or Print		
S	Speed or Frequency	Safety (8)		Switch (13)	
T	Temperature			Transmit	
U	Multivariable (6)		Multifunction (12)	Multifunction (12)	Multifunction (12)
V	Viscosity			Valve, Damper, or Louver (13)	
W	Weight or Force		Well		
X (2)	Unclassified		Unclassified	Unclassified	Unclassified
Y	User's Choice(1)			Relay or Compute (13, 14)	
Z	Position			Drive, Actuate or Unclassified Final Control Element	

Note: Numbers in parentheses refer to specific explanatory notes on pages 13 and 14.

NOTES FOR TABLE 1 —
MEANINGS OF IDENTIFICATION LETTERS

1. A *user's choice* letter is intended to cover unlisted meanings that will be used repetitively in a particular project. If used, the letter may have one meaning as a first-letter and another meaning as a succeeding-letter. The meanings need be defined only once in a legend, or otherwise, for that project. For example, the letter *N* may be defined as *modulus of elasticity* as a first-letter and *oscilloscope* as a succeeding-letter.
2. The *unclassified* letter, *X*, is intended to cover unlisted meanings that will be used only once or to a limited extent. If used, the letter may have any number of meanings as a first-letter and any number of meanings as a succeeding-letter. Except for its use with distinctive symbols, it is expected that the meanings will be defined outside a tagging balloon on a flow diagram. For example, *XR-2* may be a *stress recorder*, *XR-3* may be a *vibration recorder*, and *XX-4* may be a *stress oscilloscope*.
3. The grammatical form of the succeeding-letter meanings may be modified as required. For example, *indicate* may be applied as *indicator* or *indicating*, *transmit* as *transmitter* or *transmitting*, etc.
4. Any first-letter, if used in combination with modifying letters *D* (differential), *F* (ratio), or *Q* (integrate or totalize), or any combination of them, shall be construed to represent a new and separate measured variable, and the combination shall be treated as a first-letter entity. Thus, instruments *TDI* and *TI* measure two different variables, namely, differential-temperature and temperature. These modifying letters shall be used when applicable.
5. First-letter *A* for *analysis* covers all analyses that are not listed in Table 1 and are not covered by a *user's choice* letter. It is expected that the type of analysis in each instance will be defined outside a tagging balloon on a flow diagram.†
6. Use of first-letter *U* for *multivariable* in lieu of a combination of first-letters is optional.
7. The use of modifying terms *high*, *low*, *middle* or *intermediate*, and *scan* is preferred, but optional.
8. The term *safety* shall apply only to emergency protective primary elements and emergency protective final control elements. Thus, a self-actuated valve that prevents operation of a fluid system at a higher-than-desired pressure by bleeding fluid from the system shall be a back-pressure-type *PCV*, even if the valve were not intended to be used normally. However, this valve shall be a *PSV* if it were intended to protect against emergency conditions -- i.e., conditions that are hazardous to personnel or equipment, or both and that are not expected to arise normally.

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.†

9. Passive function *glass* applies to instruments that provide an uncalibrated direct view of the process.
 10. The term *indicate* applies only to the readout of an actual measurement. It does not apply to a scale for manual adjustment of a variable if there is no measurement input to the scale.
 11. A *pilot light* that is part of an instrument loop shall be designated by a first-letter followed by succeeding-letter *L*. For example, a *pilot light* that indicates an expired time period may be tagged *KL*. However, if it is desired to tag a *pilot light* that is not part of a formal instrument loop, the *pilot light* may be designated in the same way or alternatively by a single letter *L*. For example, a running light for an electric motor may be tagged either *EL*, assuming that voltage is the appropriate measured variable, or *XL*, assuming that the light is actuated by auxiliary electric contacts of the motor starter, or simply *L*.
- The action of a *pilot light* may be accompanied by an audible signal.
12. Use of succeeding-letter *U* for *multifunction* instead of a combination of other functional letters is optional.
 13. A device that connects, disconnects, or transfers one or more circuits may be either a *switch*, a *relay*, an on-off *controller*, or a *control valve*, depending on the application.

If the device manipulates a fluid process stream and is not a hand-actuated on-off block valve, it shall be designated as a *control valve*. For all applications other than fluid process streams, the device shall be designated as follows:

A *switch*, if it is actuated by hand.

A *switch* or an on-off *controller* if it is automatic and is the first such device in a loop. The term *switch* is generally used if the device is used for alarm, pilot light, selection, interlock, or safety. The term *controller* is generally used if the device is used for normal operating control.

†For definitions of safety valve, relief valve, and safety relief valve, see Reference 1.

Note: Words italicized on pages 13 and 14 correspond to entries in Table 1.

†Readily recognized self-defining symbols such as pH, O₂, and CO have been used optionally in the past in place of first-letter A. This practice may cause confusion and misunderstanding particularly when the designations are printed by machines that use only upper-case letters.

A *relay*, if it is automatic and is not the first such device in a loop, i.e., it is actuated by a *switch* or an on-off *controller*.

14. It is expected that the functions associated with the use of succeeding-letter *Y* will be defined outside a balloon on a flow diagram when it is convenient to do so. This need not be done when the function is self-evident, as for a solenoid valve in a fluid signal line.
15. Use of modifying terms *high*, *low*, and *middle* or *intermediate* shall correspond to values of the measured variable, not of the signal, unless

otherwise noted. For example, a high-level alarm derived from a reverse-acting level transmitter signal shall be an *LAI* even though the alarm is actuated when the signal falls to a low value. The terms may be used in combinations as appropriate. (See Section 5.9 A.)

16. The terms *high* and *low*, when applied to positions of valves and other open-close devices, are defined as follows: *high* denotes that the valve is in or approaching the fully open position, and *low* denotes in or approaching the fully closed position.

TABLE 2
FUNCTION DESIGNATIONS FOR RELAYS
(Reference 3)

The function designations associated with relays may be used as follows, individually or in combination (see Table 1, note 14). The use of a box enclosing a symbol is optional; the box is intended to avoid confusion by setting off the symbol from other markings on a diagram (see Section 5.9Y).

SYMBOL	FUNCTION														
1. 1-0 or ON-OFF	Automatically connect, disconnect, or transfer one or more circuits provided that this is not the first such device in a loop (see Table 1, note 13).														
2. Σ or ADD	Add or totalize (add and subtract) †														
3. Δ or DIFF.	Subtract †														
4. \pm + } 	Bias*														
5. AVG.	Average														
6. % or 1:3 or 2:1 (typical)	Gain or attenuate (input:output)*														
7. x	Multiply †														
8. \div	Divide †														
9. √ or SQ. RT.	Extract square root														
10. x^n or $x^{1/n}$	Raise to power														
11. f (x)	Characterize														
12. 1:1	Boost														
13. ⊠ or HIGHEST (MEASURED VARIABLE)	High-select. Select highest (higher) measured variable (not signal, unless so noted).														
14. ⊡ or LOWEST (MEASURED VARIABLE)	Low-select. Select lowest (lower) measured variable (not signal, unless so noted).														
15. REV.	Reverse														
16.	Convert														
a. E/P or P/I (typical)	For input/output sequences of the following:														
	<table border="0"> <tr> <td style="text-align: center;">Designation</td> <td style="text-align: center;">Signal</td> </tr> <tr> <td style="text-align: center;">E</td> <td style="text-align: center;">Voltage</td> </tr> <tr> <td style="text-align: center;">H</td> <td style="text-align: center;">Hydraulic</td> </tr> <tr> <td style="text-align: center;">I</td> <td style="text-align: center;">Current (electrical)</td> </tr> <tr> <td style="text-align: center;">O</td> <td style="text-align: center;">Electromagnetic or sonic</td> </tr> <tr> <td style="text-align: center;">P</td> <td style="text-align: center;">Pneumatic</td> </tr> <tr> <td style="text-align: center;">R</td> <td style="text-align: center;">Resistance (electrical)</td> </tr> </table>	Designation	Signal	E	Voltage	H	Hydraulic	I	Current (electrical)	O	Electromagnetic or sonic	P	Pneumatic	R	Resistance (electrical)
Designation	Signal														
E	Voltage														
H	Hydraulic														
I	Current (electrical)														
O	Electromagnetic or sonic														
P	Pneumatic														
R	Resistance (electrical)														
b. A/D or D/A	For input/output sequences of the following:														
	<table border="0"> <tr> <td style="text-align: center;">A</td> <td style="text-align: center;">Analog</td> </tr> <tr> <td style="text-align: center;">D</td> <td style="text-align: center;">Digital</td> </tr> </table>	A	Analog	D	Digital										
A	Analog														
D	Digital														
17. \int	Integrate (time integral)														
18. D or d/dt	Derivative or rate														
19. 1/D	Inverse derivative														
20. As required	Unclassified														
* Used for single-input relay.															
† Used for relay with two or more inputs.															

TABLE 3

SUMMARY OF SPECIAL ABBREVIATIONS


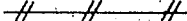


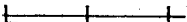

FOR ABBREVIATIONS OTHER THAN INSTRUMENT IDENTIFICATION LETTERS OF TABLE 1

ABBREVIATION	MEANING	SECTION REFERENCE
A	Analog signal	Table 2:16b
ADAPT.	Adaptive control mode	5.9C footnote
AS	Air supply	5.1 footnote
AVG.	Average	Table 2:5
C	Patchboard or matrix board connection	5.7(2)
D	{ Derivative control mode	5.9C footnote
	{ Digital signal	Table 2:16b
DIFF.	Subtract	Table 2:3
DIR.	Direct-acting	5.9C footnote
E	Voltage signal	Table 2:16a
ES	Electric supply	5.1 footnote
FC	Fail closed	5.6(2)
FI	Fail indeterminate	5.6(6)
FL	Fail locked	5.6(5)
FO	Fail open	5.6(1), (3), (4)
GS	Gas supply	5.1 footnote
H	Hydraulic signal	Table 2:16a
HS	Hydraulic supply	5.1 footnote
I	{ Current (electrical) signal	Table 2:16a
	{ Interlock	5.7(7)
M	Motor actuator	5.4(6)
MAX.	Maximizing control mode	5.9C footnote
MIN.	Minimizing control mode	5.9C footnote
NS	Nitrogen supply	5.1 footnote
O	Electromagnetic or sonic signal	Table 2:16a
OPT.	Optimizing control mode	5.9C footnote
P	{ Pneumatic signal	Table 2:16a
	{ Proportional control mode	5.9C footnote
	{ Purge or flushing device	5.7(3)
R	{ Automatic-reset control mode	5.9C footnote
	{ Reset of fail-locked device	5.7(4)
	{ Resistance (signal)	Table 2:16a
REV.	Reverse-acting	5.9C footnote
RTD.	Resistance (-type) temperature detector	Table 2:15
S	Solenoid actuator	5.8T(7)
S.P.	Set-point	5.4(16)
SQ.RT.	Square root	5.9C(3)
SS	Steam supply	Table 2:9
T	Trap	5.1 footnote
WS	Water supply	5.5(28), (29)
X	{ Multiply	5.1 footnote
	{ Unclassified actuator	Table 2:7
		5.4(15)

5. DRAWINGS

5.1 INSTRUMENT LINE SYMBOLS

All lines shall be fine in relation to process piping lines.

- | | |
|---|---|
| (1) Connection to process, or mechanical link, or instrument supply* |  |
| (2) Pneumatic signal †, or undefined signal for process flow diagrams |  |
| (3) Electric signal |  |
| (4) Capillary tubing (filled system) |  |
| (5) Hydraulic signal |  |
| (6) Electromagnetic § or sonic signal (without wiring or tubing) |  |

Notes

*The following abbreviations are suggested to denote the types of power supply (see Section 3.4.7). These designations may also be applied for purge fluid supplies (see Section 5.10 (19), (20), (21), and (22).)


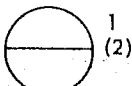


AS	Air Supply
ES	Electric Supply
GS	Gas Supply
HS	Hydraulic Supply
NS	Nitrogen Supply
SS	Steam Supply
WS	Water Supply

The power supply level may be added to the instrument supply line, e.g., AS 100, a 100-psig air supply; ES 24DC, a 24-volt direct current supply.


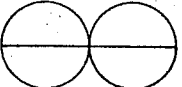
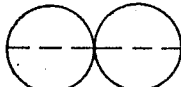
†The pneumatic signal symbol applies to a signal using any gas as the signal medium. If a gas other than air is used, the gas shall be identified by a note on the signal symbol or otherwise.

§Electromagnetic phenomena include heat, radio waves, nuclear radiation, and light.

5.2 GENERAL INSTRUMENT SYMBOLS - BALLOONS

<p>1)  APPROXIMATELY 7/16" DIAMETER</p> <p>LOCALLY MOUNTED</p>	<p>2)  1 (2)</p> <p>MOUNTED ON BOARD 1 (OR BOARD 2). BOARD 2 MAY ALTERNATIVELY BE DESIGNATED BY A DOUBLE HORIZONTAL LINE INSTEAD OF A SINGLE LINE, WITH THE DESIGNATION OUTSIDE THE BALLOON OMITTED.</p>	<p>3) </p> <p>MOUNTED BEHIND THE BOARD</p>	<p>4)  6TE 2584-23</p> <p>LOCALLY MOUNTED INSTRUMENT WITH LONG TAG NUMBER. (6 IS OPTIONAL AND IS PLANT NUMBER.) ALTERNATIVELY, A CLOSED CIRCLE MAY BE ENLARGED.</p>
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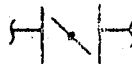

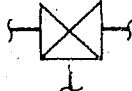
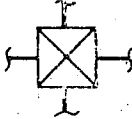
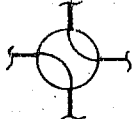
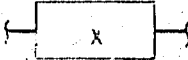
INSTRUMENT FOR SINGLE MEASURED VARIABLE * WITH ANY NUMBER OF FUNCTIONS

<p>5) </p> <p>LOCALLY MOUNTED</p>	<p>6) </p> <p>MOUNTED ON MAIN BOARD.</p>	<p>7)  AUX.</p> <p>MOUNTED BEHIND AUXILIARY BOARD. A DOUBLE HORIZONTAL LINE MAY BE USED AS IN SECTION 5.2 (2).</p>	<p>8)</p>
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INSTRUMENT FOR TWO MEASURED VARIABLES*. OPTIONALLY, SINGLE-VARIABLE INSTRUMENT WITH MORE THAN ONE FUNCTION. ADDITIONAL TANGENT BALLOONS MAY BE ADDED AS REQUIRED.

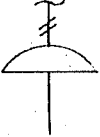

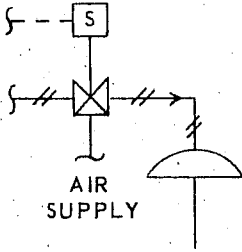
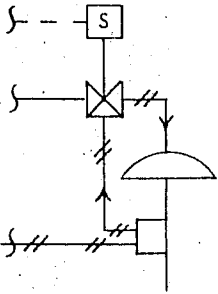
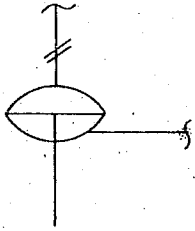
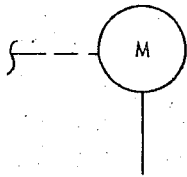
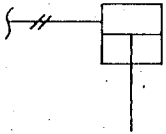
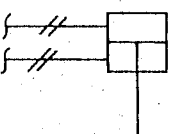
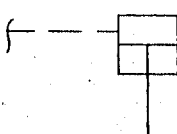
*Certain measured variables may have more than one input (see Table 1, note 4). An instrument that only indicates differential-pressure, for example, shall use only one balloon, tagged PDI, even though it has two inputs.

5.3 CONTROL VALVE BODY SYMBOLS*

<p>1)</p>  <p>GLOBE, GATE, OR OTHER IN-LINE TYPE NOT OTHERWISE IDENTIFIED</p>	<p>2)</p>  <p>ANGLE</p>	<p>3)</p>  <p>BUTTERFLY, DAMPER, OR LOUVER</p>	<p>4)</p>  <p>ROTARY PLUG OR BALL</p>
<p>5)</p>  <p>THREE-WAY</p>	<p>6)</p>  <p>ALTERNATIVE 1</p> <p>7)</p>  <p>ALTERNATIVE 2</p> <p style="text-align: center;">FOUR-WAY</p>		<p>8)</p>
<p>9)</p>  <p>UNCLASSIFIED. (IT IS EXPECTED THAT THE TYPE OF BODY WILL BE WRITTEN IN OR ADJACENT TO THE SYMBOL. OPTIONALLY, A NUMBER MAY BE SUFFIXED AFTER THE X; E.G., X-1 TO REFER TO ITEM NUMBER 1 IN A LIST OF SPECIFIC UNCLASSIFIED BODIES.)</p>			

* If special valve details are required for supplementary detailed instrument drawings (other than flow diagrams), then symbols may be taken from References 4 and 5. These symbols are not recommended for use on flow diagrams, in accordance with the statement of scope of this Standard. (See Section 1.3.2.)

5.4 ACTUATOR SYMBOLS* †

<p>1)</p>  <p>WITHOUT POSITIONER OR OTHER PILOT</p>	<p>2)</p>  <p>PREFERRED FOR DIAPHRAGM THAT IS ASSEMBLED WITH PILOT § SO THAT ASSEMBLY IS ACTUATED BY ONE CONTROLLED INPUT (SHOWN TYPICALLY WITH ELECTRIC INPUT TO ASSEMBLY)</p>	<p>3)</p>  <p>PREFERRED ALTERNATIVE</p>	<p>4)</p>  <p>OPTIONAL ALTERNATIVE</p>
<p>DIAPHRAGM, SPRING-OPOSED</p>		<p>DIAPHRAGM, SPRING-OPOSED, WITH POSITIONER ‡ AND OVERRIDING PILOT VALVE THAT PRESSURIZES DIAPHRAGM WHEN ACTUATED</p>	
<p>5)</p>  <p>DIAPHRAGM, PRESSURE-BALANCED</p>	<p>6)</p>  <p>ROTARY MOTOR (SHOWN TYPICALLY WITH ELECTRIC SIGNAL)</p>	<p>7)</p>	
<p>8)</p>  <p>SINGLE-ACTING</p>	<p>9)</p>  <p>DOUBLE-ACTING</p>	<p>10)</p>  <p>PREFERRED FOR ANY CYLINDER THAT IS ASSEMBLED WITH PILOT § SO THAT ASSEMBLY IS ACTUATED BY ONE CONTROLLED INPUT</p>	
<p>CYLINDER, WITHOUT POSITIONER OR OTHER PILOT</p>			

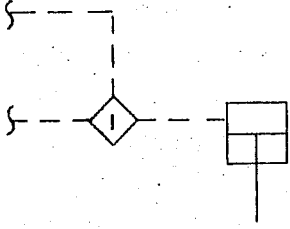
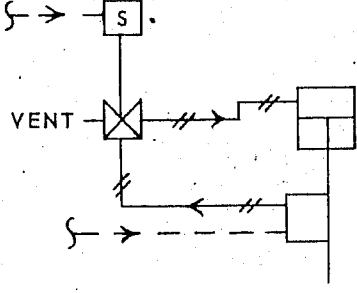
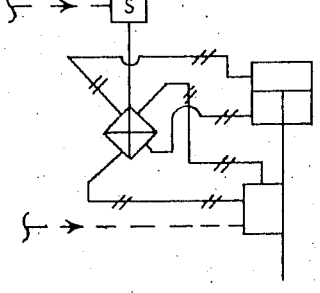

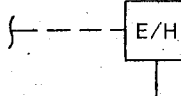
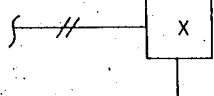
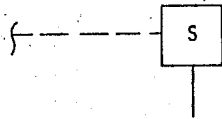
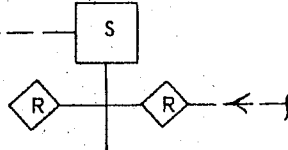
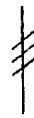
* See footnote, page 19.

† Normally, modes of control valve action will not be designated on a flow diagram. However, an on-off valve mode may be designated, if desired, by placing the symbol 1-0 or ON-OFF near the valve symbol.

§ Pilot may be positioner, solenoid valve, signal converter, etc.

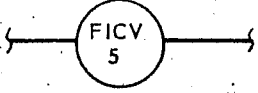
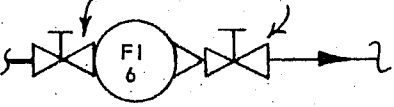
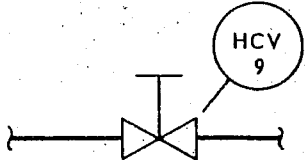
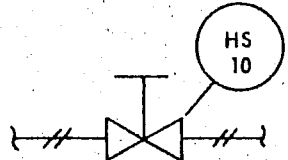
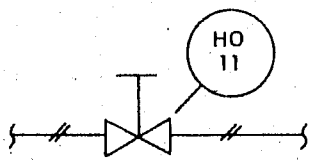
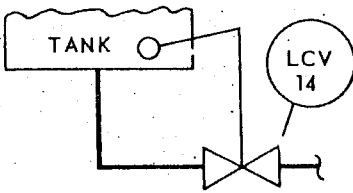
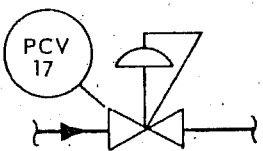
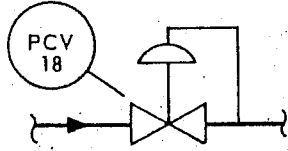
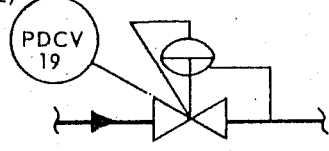
‡ The positioner shall preferably not be shown unless an intermediate device is on its output. The positioner tagging, ZC, shall preferably not be used even if the positioner is shown. The positioner symbol, a box drawn on the actuator shaft, is the same for all types of actuators. When the symbol is used, the type of instrument signal, i.e., pneumatic, electric, etc., shall be drawn as appropriate. If the positioner symbol is used and there is no intermediate device on its output, then the positioner output signal need not be shown.

5.4 ACTUATOR SYMBOLS (Contd.)

<p>11)</p>  <p>PREFERRED ALTERNATIVE. A BAL- LOON WITH INSTRUMENT TAGGING, E.G., TY-1, MAY BE USED INSTEAD OF THE INTERLOCK SYMBOL \diamond.</p>	<p>12)</p>  <p>SINGLE-ACTING CYLINDER</p>	<p>13)</p>  <p>DOUBLE-ACTING CYLINDER</p>
<p>OPTIONAL ALTERNATIVES</p> <p>CYLINDER WITH POSITIONER * AND OVERRIDING PILOT VALVE [SEE SECTION 5.10(12, 13, 14)]</p>		
<p>14)</p>  <p>HAND ACTUATOR (MOUNTED AT TOP, SIDE, OR BOTTOM OF ACTUATED DEVICE AS APPLICABLE)</p>	<p>15)</p>  <p>ELECTROHYDRAULIC</p>	<p>16)</p>  <p>UNCLASSIFIED (SHOWN TYPICALLY WITH PNEUMATIC SIGNAL. IT IS EXPECTED THAT THE TYPE OF ACTUATOR WILL BE WRITTEN IN OR ADJACENT TO THE SYMBOL)</p>
<p>17)</p>  <p>SOLENOID</p>	<p>18)</p>  <p>(MANUAL RESET) (REMOTE RESET)</p> <p>LATCH-TYPE ACTUATOR WITH RESET (SHOWN TYPICALLY FOR SOLENOID ACTUATOR AND TYPICALLY WITH ELECTRIC SIGNAL FOR REMOTE RE- SET, WITH MANUAL RESET ALTERNA- TIVE)</p>	<p>19)</p>  <p>FOR PRESSURE RELIEF OR SAFETY VALVES ONLY: DENOTES A SPRING, WEIGHT, OR INTEGRAL PILOT [SEE SECTION 5.5(16), ETC.]</p>

*See footnote § on page 20.

5.5 SYMBOLS FOR SELF-ACTUATED REGULATORS, VALVES, AND OTHER DEVICES

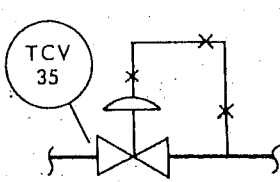
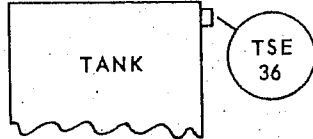
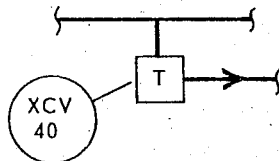
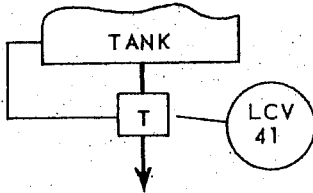
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">FLOW</p>	<p>1)</p>  <p>AUTOMATIC REGULATOR WITH INTEGRAL FLOW INDICATION. TAG REGULATOR FCV-5 IF IT DOES NOT HAVE INTEGRAL FLOW INDICATION.</p>	<p>2)</p> <p>(UPSTREAM ALTERNATIVE) (DOWNSTREAM ALTERNATIVE)</p>  <p>INDICATING ROTAMETER WITH INTEGRAL MANUAL THROTTLE VALVE</p>	<p>3)</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">HAND</p>	<p>4)</p>  <p>HAND CONTROL VALVE IN PROCESS LINE</p>	<p>5)</p>  <p>HAND-ACTUATED ON-OFF SWITCHING VALVE IN PNEUMATIC SIGNAL LINE</p>	<p>6)</p>  <p>MANUALLY ADJUSTABLE RESTRICTION ORIFICE IN SIGNAL LINE [SEE SECTION 5.8F (17)]</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">LEVEL</p> <p>[SEE SECTION 5.5 (29)]</p>	<p>7)</p>  <p>LEVEL REGULATOR WITH MECHANICAL LINKAGE</p>	<p>8)</p>	<p>9)</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">PRESSURE</p>	<p>10)</p>  <p>PRESSURE-REDUCING REGULATOR, SELF-CONTAINED</p>	<p>11)</p>  <p>PRESSURE-REDUCING REGULATOR WITH EXTERNAL PRESSURE TAP</p>	<p>12)</p>  <p>DIFFERENTIAL-PRESSURE-REDUCING REGULATOR WITH INTERNAL AND EXTERNAL PRESSURE TAPS</p>

5.5 SYMBOLS FOR SELF-ACTUATED REGULATORS, VALVES, AND OTHER DEVICES (Contd.)

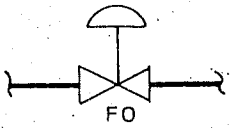
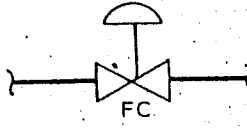
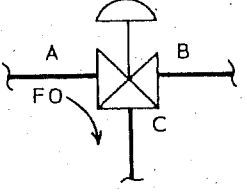
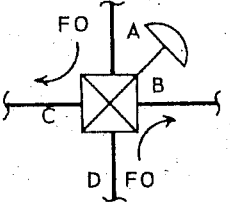
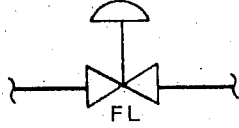
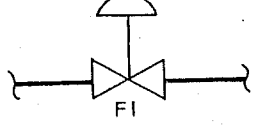
(Contd.) PRESSURE	13) BACKPRESSURE REGULATOR, SELF-CONTAINED	14) BACKPRESSURE REGULATOR WITH EXTERNAL PRESSURE TAP	15) PRESSURE-REDUCING REGULATOR WITH INTEGRAL OUTLET PRESSURE RELIEF VALVE, AND OPTIONAL PRESSURE INDICATOR (TYPICAL AIR SET)
	16) PRESSURE RELIEF OR SAFETY VALVE, ANGLE PATTERN, SPRING- OR WEIGHT-LOADED, OR WITH INTEGRAL PILOT	17) PRESSURE RELIEF OR SAFETY VALVE, STRAIGHT-THROUGH PATTERN, SPRING- OR WEIGHT-LOADED, OR WITH INTEGRAL PILOT	18) VACUUM RELIEF VALVE, ANGLE PATTERN, SPRING- OR WEIGHT-LOADED, OR WITH INTEGRAL PILOT
	19) PRESSURE AND VACUUM RELIEF VALVE, SPRING- OR WEIGHT-LOADED, OR WITH INTEGRAL PILOT	20) PRESSURE AND VACUUM RELIEF MANHOLE COVER	21) PRESSURE RELIEF OR SAFETY VALVE, ANGLE PATTERN, TRIPPED BY INTEGRAL SOLENOID*
	22) RUPTURE DISK OR SAFETY HEAD FOR PRESSURE RELIEF	23) RUPTURE DISK OR SAFETY HEAD FOR VACUUM RELIEF	24) RUPTURE DISK OR SAFETY HEAD FOR VACUUM RELIEF

*The solenoid-tripped pressure relief valve is one of the class of power-actuated relief valves and is grouped with the other types of relief valves, even though it is not entirely a self-actuated device.

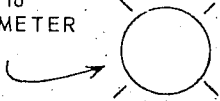
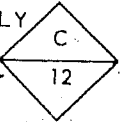






5.5 SYMBOLS FOR SELF-ACTUATED REGULATORS, VALVES, AND OTHER DEVICES (Contd.)

TEMPERATURE	<p>25)</p>  <p>TEMPERATURE REGULATOR, FILLED- SYSTEM TYPE</p>	<p>26)</p>  <p>FUSIBLE PLUG OR DISK</p>	<p>27)</p>
TRAPS	<p>28)</p>  <p>ALL TRAPS OTHER THAN BALL-FLOAT- TYPE CONTINUOUS DRAINERS</p>	<p>29)</p>  <p>CONTINUOUS DRAINER, BALL-FLOAT TYPE, WITH EQUALIZING CONNECTION</p>	<p>30)</p>

5.6 SYMBOLS FOR ACTUATOR ACTION IN EVENT OF ACTUATOR POWER FAILURE.
(SHOWN TYPICALLY FOR DIAPHRAGM-ACTUATED CONTROL VALVE)

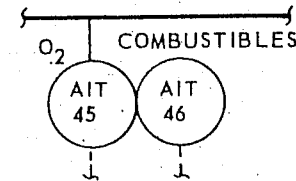
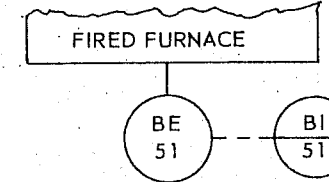
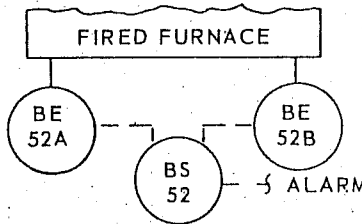
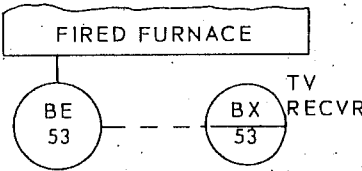
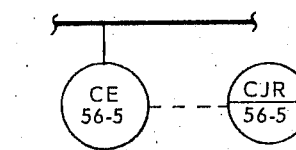
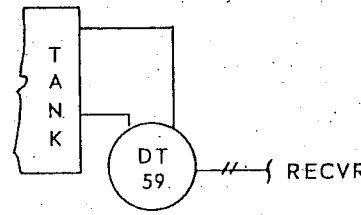
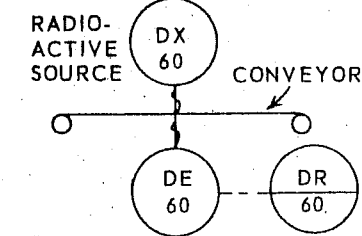
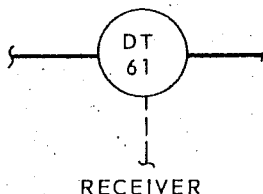
<p>1)</p>  <p>TWO-WAY VALVE, FAIL OPEN</p>	<p>2)</p>  <p>TWO-WAY VALVE, FAIL CLOSED</p>	<p>3)</p>  <p>THREE-WAY VALVE, FAIL OPEN TO PATH A-C</p>
<p>4)</p>  <p>FOUR-WAY VALVE, FAIL OPEN TO PATHS A-C AND D-B</p>	<p>5)</p>  <p>ANY VALVE, FAIL LOCKED (POSITION DOES NOT CHANGE)</p>	<p>6)</p>  <p>ANY VALVE, FAIL INDETERMINATE</p>

5.7 MISCELLANEOUS SYMBOLS

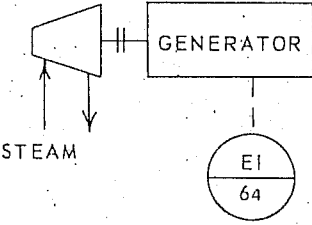
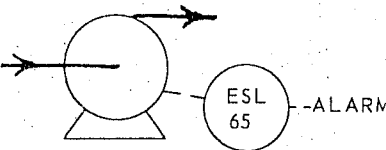
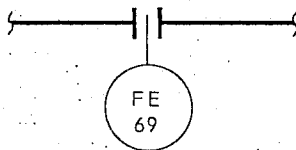
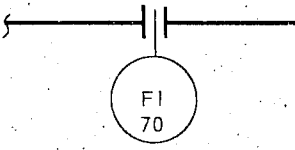
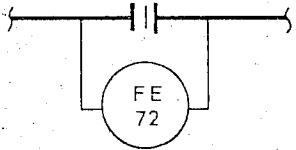
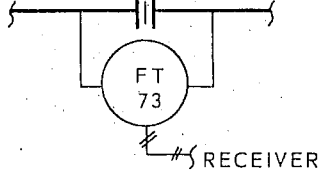
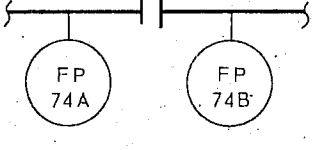
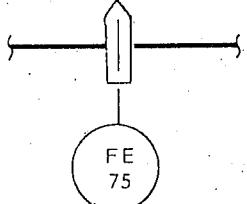
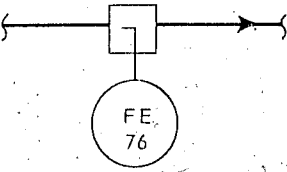
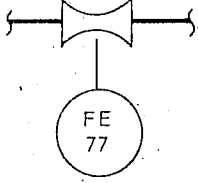
<p>1)</p> <p>APPROXIMATELY 7/16" DIAMETER</p>  <p>PILOT LIGHT</p>	<p>2)</p> <p>APPROXIMATELY 7/16" SQUARE</p>  <p>BOARD-MOUNTED PATCHBOARD OR MATRIX BOARD CONNECTION, NUMBER 12</p>	<p>3)</p> <p>APPROXIMATELY 1/4" SQUARE</p>  <p>PURGE OR FLUSHING DEVICE (MEANS OF REGULATING PURGE MAY BE SHOWN IN PLACE OF SYMBOL)</p>
<p>4)</p>  <p>RESET FOR LATCH-TYPE ACTUATOR</p>	<p>5)</p>  <p>CHEMICAL SEAL</p>	<p>6)</p>
<p>7)</p>  <p>GENERALIZED - FOR UNDEFINED OR COMPLEX INTERLOCK LOGIC</p>	<p>8)</p>  <p>INTERLOCK IS EFFECTIVE ONLY IF ALL INPUTS EXIST</p>	<p>9)</p>  <p>INTERLOCK IS EFFECTIVE IF ANY ONE OR MORE INPUTS EXIST</p>

INTERLOCK

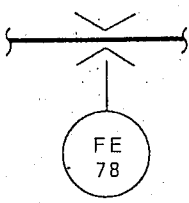
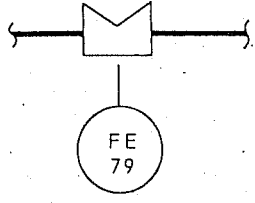
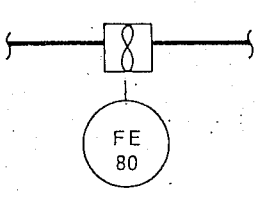
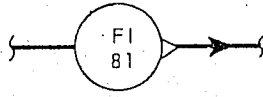
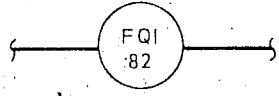
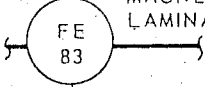
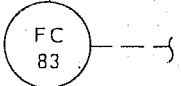
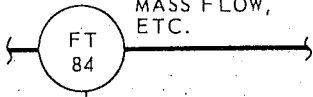
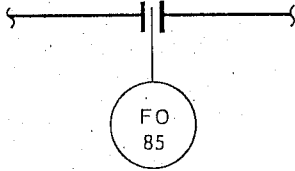
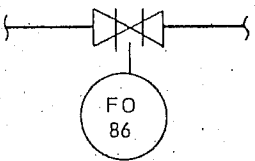
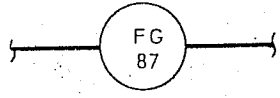
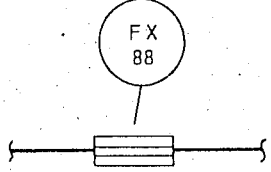
5.8 PRIMARY ELEMENT SYMBOLS

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">ANALYSIS</p>	<p>1) </p> <p>RECEIVER RECEIVER</p> <p>DUAL ANALYSIS INDICATING TRANSMITTER FOR OXYGEN AND COMBUSTIBLES CONCENTRATIONS</p>	<p>2)</p>	<p>3)</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">BURNER FLAME</p>	<p>1) </p> <p>ONE BURNER FLAME DETECTOR CONNECTED TO ANALOG-TYPE FLAME INTENSITY INDICATOR</p>	<p>2) </p> <p>TWO BURNER FLAME SENSORS CONNECTED TO COMMON SWITCH</p>	<p>3) </p> <p>TELEVISION CAMERA AND RECEIVER TO VIEW BURNER FLAME</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">CONDUCTIVITY</p>	<p>1) </p> <p>CONDUCTIVITY CELL CONNECTED TO POINT 5 OF MULTIPOINT SCANNING CONDUCTIVITY RECORDER</p>	<p>2)</p>	<p>3)</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">DENSITY OR SPECIFIC GRAVITY</p>	<p>1) </p> <p>DENSITY TRANSMITTER, DIFFERENTIAL-PRESSURE TYPE, EXTERNALLY CONNECTED</p>	<p>2) </p> <p>RADIOACTIVE-TYPE DENSITY ELEMENT CONNECTED TO DENSITY RECORDER ON BOARD</p>	<p>3) </p> <p>SPECIFIC GRAVITY TRANSMITTER, THROUGH-FLOW TYPE</p>

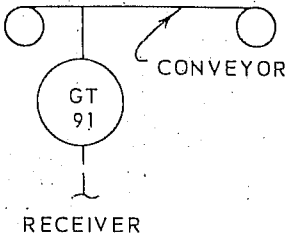
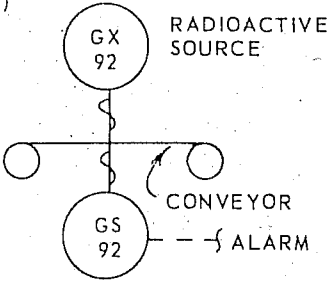
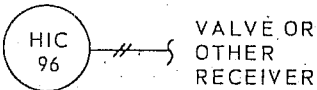
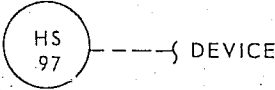
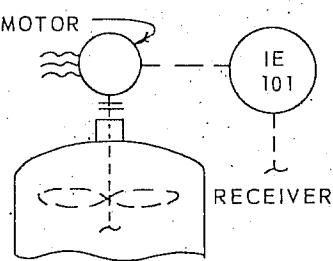
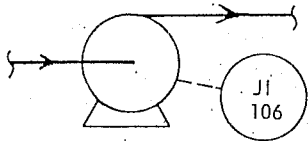
5.8 PRIMARY ELEMENT SYMBOLS (Contd.)

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">E</p> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">VOLTAGE</p>	<p>1)</p>  <p>INDICATING VOLTMETER CONNECTED TO TURBINE- GENERATOR</p>	<p>2)</p>  <p>LOW-VOLTAGE SWITCH CONNECTED TO PUMP MOTOR</p>	<p>3)</p>
	<p style="writing-mode: vertical-rl; transform: rotate(180deg);">F</p> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">FLOW RATE</p>	<p>1)</p>  <p>ORIFICE PLATE WITH FLANGE OR CORNER TAPS</p>	<p>2)</p>  <p>ORIFICE PLATE WITH FLANGE OR CORNER TAPS CONNECTED TO DIFFERENTIAL-PRESSURE- TYPE FLOW INDICATOR</p>
<p>4)</p>  <p>ORIFICE PLATE WITH VENA CONTRACTA, RADIUS, OR PIPE TAPS</p>		<p>5)</p>  <p>ORIFICE PLATE WITH VENA CONTRACTA, RADIUS, OR PIPE TAPS CONNECTED TO DIFFERENTIAL-PRESSURE- TYPE FLOW TRANSMITTER</p>	<p>6)</p>  <p>VENA CONTRACTA, RADIUS, OR PIPE TAP TEST CON- NECTIONS WITHOUT ORIFICE PLATE</p>
<p>7)</p>  <p>ORIFICE PLATE IN QUICK-CHANGE FITTING</p>		<p>8)</p>  <p>PITOT TUBE OR PITOT-VENTURI TUBE</p>	<p>9)</p>  <p>VENTURI TUBE OR FLOW NOZZLE</p>


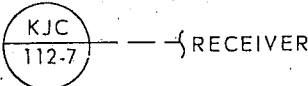
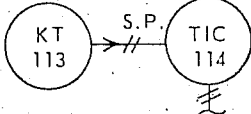
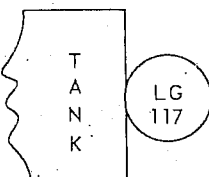
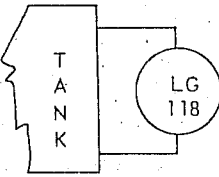
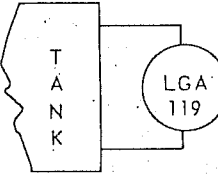
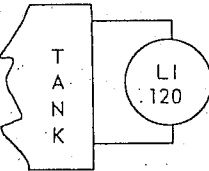
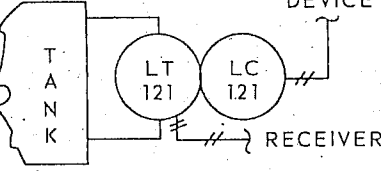
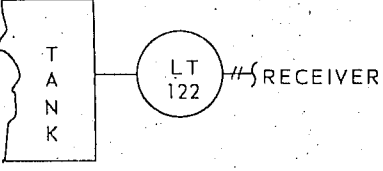
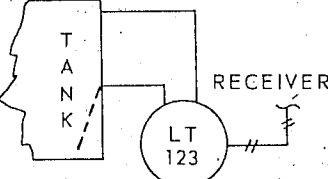
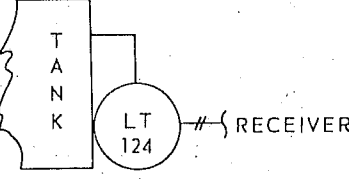
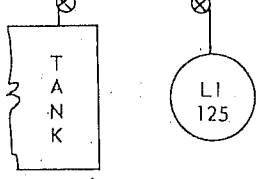
5.8 PRIMARY ELEMENT SYMBOLS (Contd.)

<p>F</p> <p>FLOW RATE (Contd.)</p>	<p>10)</p>  <p>FLUME</p>	<p>11)</p>  <p>WEIR</p>	<p>12)</p>  <p>TURBINE-OR PROPELLER-TYPE PRIMARY ELEMENT</p>	
	<p>13)</p>  <p>ROTAMETER-TYPE FLOW INDICATOR</p>	<p>14)</p>  <p>POSITIVE-DISPLACEMENT-TYPE FLOW TOTALIZING INDICATOR</p>	<p>15)</p>  <p>MAGNETIC OR LAMINAR FLOW, ETC.,</p>  <p>CONTROLLED ELEMENT</p> <p>UNCLASSIFIED PRIMARY FLOW ELEMENT WITH EXTERNAL CONNECTION TO FLOW CONTROLLER (FOR MAGNETIC OR LAMINAR FLOW ELEMENTS, ETC.)</p>	
	<p>16)</p>  <p>TARGET OR MASS FLOW, ETC.</p> <p>RECEIVER</p> <p>UNCLASSIFIED PRIMARY FLOW ELEMENT INTEGRAL WITH TRANSMITTER (FOR MASS-FLOW OR TARGET-TYPE FLOW TRANSMITTERS, ETC.)</p>	<p>17)</p>  <p>FIXED RESTRICTION ORIFICE (ORIFICE PLATE, CAPILLARY TUBE OR MULTI-STAGE TYPE, ETC.) IN PROCESS LINE [SEE SECTION 5.5 (6)]</p>	<p>18)</p>  <p>RESTRICTION ORIFICE DRILLED IN VALVE (INSTRUMENT TAG NUMBER MAY BE OMITTED IF VALVE IS OTHERWISE IDENTIFIED)</p>	
	<p>19)</p>  <p>FLOW SIGHT GLASS, PLAIN OR WITH PADDLE WHEEL, FLAPPER, ET AL.</p>	<p>20)</p>  <p>FLOW STRAIGHTENING VANES (USE OF TAG NUMBER IS OPTIONAL. THE LOOP NUMBER MAY BE THE SAME AS THAT OF THE ASSOCIATED PRIMARY ELEMENT.)</p>		
	<p>21)</p>			

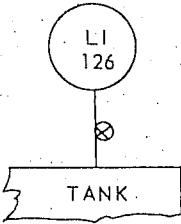
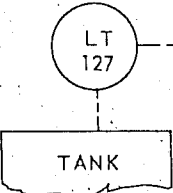
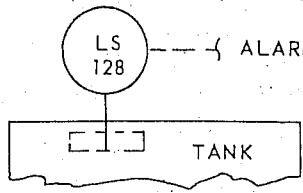
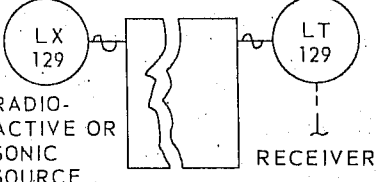
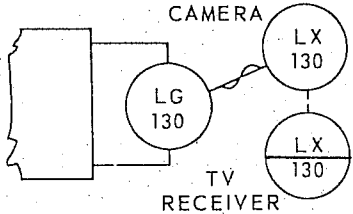
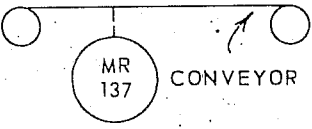
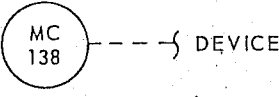
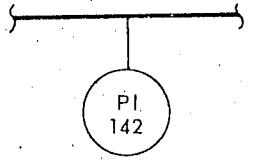
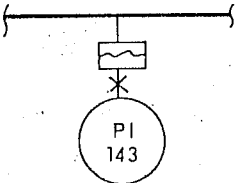
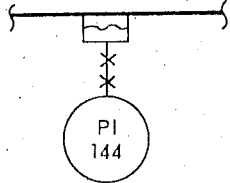
5.8 PRIMARY ELEMENT SYMBOLS (Contd.)

<p>G</p> <p>GAGING</p>	<p>1)</p>  <p>RECEIVER</p> <p>ROLL-THICKNESS TRANSMITTER</p>	<p>2)</p>  <p>RADIOACTIVE SOURCE</p> <p>CONVEYOR</p> <p>ALARM</p> <p>PLATING THICKNESS SWITCH, RADIOACTIVE TYPE</p>	<p>3)</p>
<p>H</p> <p>HAND</p>	<p>1)</p>  <p>VALVE OR OTHER RECEIVER</p> <p>MANUAL LOADING STATION WITH OUTPUT GAGE [SEE SECTION 5.10 (3).]</p>	<p>2)</p>  <p>DEVICE</p> <p>HAND-ACTUATED ELECTRIC SWITCH</p>	<p>3)</p>
<p>I</p> <p>CURRENT</p>	<p>1)</p>  <p>MOTOR</p> <p>RECEIVER</p> <p>CURRENT TRANSFORMER MEASURING CURRENT OF ELECTRIC MOTOR</p>	<p>2)</p>	<p>3)</p>
<p>J</p> <p>POWER</p>	<p>1)</p>  <p>INDICATING WATTMETER CONNECTED TO PUMP MOTOR</p>	<p>2)</p>	<p>3)</p>

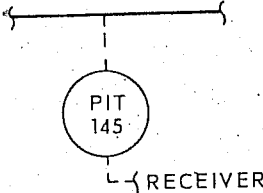
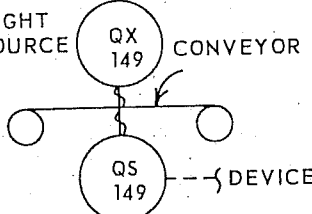
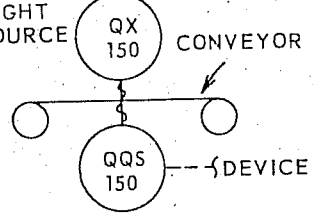
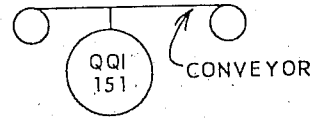
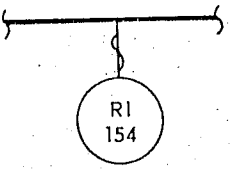
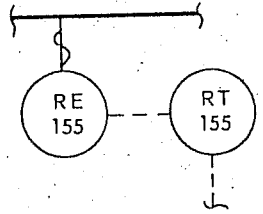
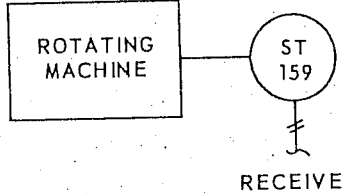
5.8 PRIMARY ELEMENT SYMBOLS (Contd.)

<p>K TIME OR TIME-SCHEDULE</p>	<p>1)  CLOCK</p>	<p>2)  MULTI POINT ON-OFF TIME-SEQUENCING PROGRAMMER POINT 7</p>	<p>3)  CONTROL DEVICE TIME-SCHEDULE CONTROLLER, ANALOG TYPE, OR SELF-CON- TAINED FUNCTION GENERATOR (FOR CHARACTERIZING RELAY, (SEE TABLE 2, SYMBOL 11)</p>
<p>L</p>	<p>1)  GAGE GLASS, INTEGRALLY MOUNTED ON TANK</p>	<p>2)  GAGE GLASS, EXTERNALLY CONNECTED</p>	<p>3)  WATER COLUMN WITH INTEGRAL GAGE GLASS AND ALARM WHISTLE</p>
<p>LEVEL</p>	<p>4)  LEVEL INDICATOR, MAGNETIC-WINDOW TYPE, OR FLOAT OR DISPLACER TYPE</p>	<p>5)  DUPLEX LEVEL TRANSMITTER- CONTROLLER, EXTERNAL- FLOAT OR EXTERNAL- DISPLACER TYPE</p>	<p>6)  LEVEL TRANSMITTER, INTERNAL FLOAT TYPE OR DISPLACER - TYPE, MOUNTED ON SIDE OF TANK</p>
	<p>7)  LEVEL TRANSMITTER, DIFFERENTIAL-PRESSURE TYPE, EXTERNALLY CON- NECTED, WITH DIP TUBE. [FOR METHOD OF DEPICT- ING PURGE, SEE SECTION 5.10 (20).]</p>	<p>8)  LEVEL TRANSMITTER, DIF- FERENTIAL-PRESSURE TYPE, MOUNTED ON TANK</p>	<p>9)  LEVEL INDICATOR, FLOAT TYPE, WITH GAGE BOARD OR TAPE INDICATOR MOUNTED BELOW TOP OF TANK</p>

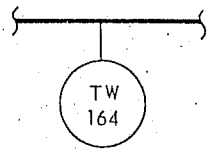
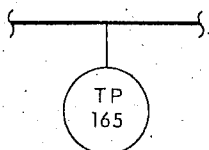
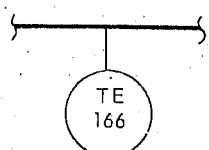
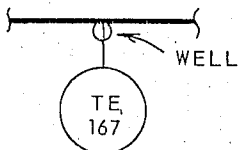
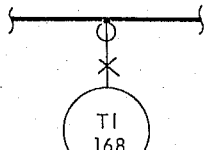
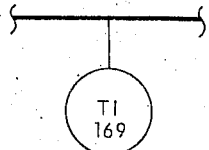
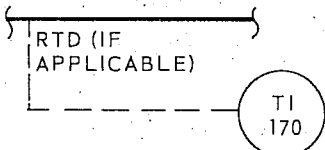
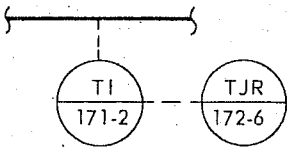
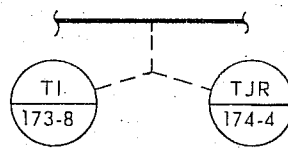
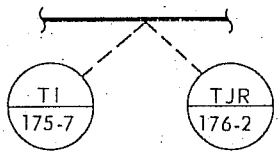
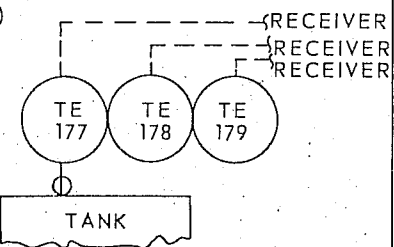
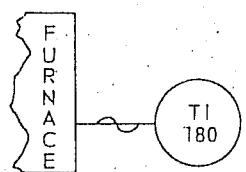
5.8 PRIMARY ELEMENT SYMBOLS (Contd.)

L LEVEL (Contd.)	10)	 <p>LEVEL INDICATOR, FLOAT TYPE, WITH GAGE BOARD OR TAPE INDICATOR MOUNTED ABOVE TANK.</p>	11)	 <p>CAPACITANCE-OR DIELECTRIC-TYPE LEVEL ELEMENT CONNECTED TO LEVEL TRANSMITTER. (TAG LEVEL ELEMENT LE-127)</p>	12)	 <p>LEVEL SWITCH, PADDLE-WHEEL OR LEVER TYPE, TO MEASURE LEVEL OF SOLIDS.</p>
	13)	 <p>RADIOACTIVE OR SONIC SOURCE</p> <p>RECEIVER</p> <p>RADIOACTIVE-OR SONIC-TYPE LEVEL TRANSMITTER WITH INTEGRAL SENSOR</p>	14)	 <p>REMOTE VIEWING OF GAGE GLASS BY USE OF TELEVISION CAMERA AND RECEIVER</p>	15)	
M MOISTURE OR HUMIDITY	1)	 <p>MOISTURE RECORDER (IF THERE IS A SEPARATE PRIMARY ELEMENT, IT SHALL BE TAGGED ME-137)</p>	2)	 <p>SELF-CONTAINED HUMIDITY CONTROLLER IN ROOM</p>	3)	
	1)	 <p>PRESSURE INDICATOR, DIRECT-CONNECTED</p>	2)	 <p>WITH PRESSURE LEAD LINE</p>	3)	 <p>LINE-MOUNTED</p>
P PRESSURE OR VACUUM		<p>PRESSURE INDICATOR CONNECTED TO CHEMICAL PROTECTOR WITH FILLED SYSTEM</p>				

5.8 PRIMARY ELEMENT SYMBOLS (Contd.)

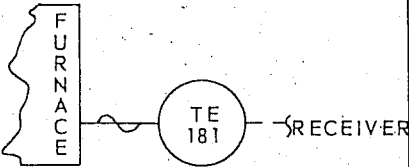
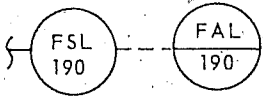
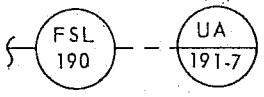
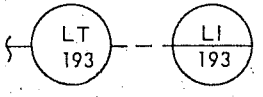
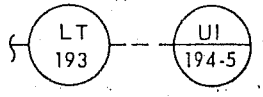
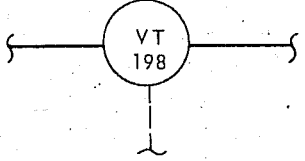
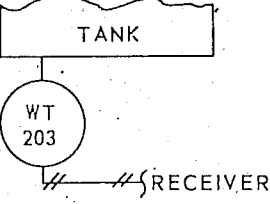
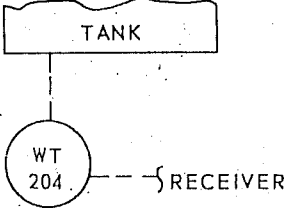
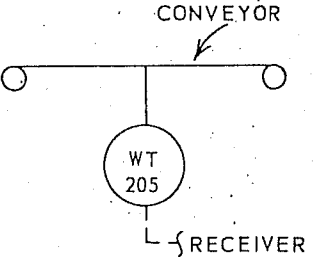
<p>P PRESSURE OR VACUUM (Contd.)</p>	<p>4)</p>  <p>PIT 145</p> <p>RECEIVER</p> <p>PRESSURE ELEMENT, STRAIN-GAGE TYPE, CON- NECTED TO PRESSURE INDICATING TRANSMITTER (TAG STRAIN GAGE PE-145.)</p>	<p>5)</p>	<p>6)</p>
<p>Q QUANTITY OR EVENT (SEE SECTION 5.9 Q)</p>	<p>1)</p>  <p>LIGHT SOURCE QX 149 CONVEYOR</p> <p>QS 149 DEVICE</p> <p>COUNTING SWITCH, PHOTO- ELECTRIC TYPE, WITH SWITCH ACTION FOR EACH EVENT</p>	<p>2)</p>  <p>LIGHT SOURCE QX 150 CONVEYOR</p> <p>QQS 150 DEVICE</p> <p>COUNTING SWITCH, PHOTO- ELECTRIC TYPE, WITH SWITCH ACTION BASED ON CUMULA- TIVE TOTAL</p>	<p>3)</p>  <p>QQI 151 CONVEYOR</p> <p>INDICATING COUNTER, MECHANICAL TYPE</p>
<p>R RADIOACTIVITY</p>	<p>1)</p>  <p>RI 154</p> <p>RADIOACTIVITY INDICATOR</p>	<p>2)</p>  <p>RE 155 RT 155</p> <p>RECEIVER</p> <p>RADIOACTIVITY MEASURING ELEMENT AND TRANSMITTER</p>	<p>3)</p>
<p>S SPEED OR FREQUENCY</p>	<p>1)</p>  <p>ROTATING MACHINE ST 159</p> <p>RECEIVER</p> <p>SPEED TRANSMITTER</p>	<p>2)</p>	<p>3)</p>

5.8 PRIMARY ELEMENT SYMBOLS (Contd.)

TEMPERATURE	1)		2)		3)	
	TEMPERATURE TEST CONNECTION WITH WELL	TEMPERATURE TEST CONNECTION WITHOUT WELL	TEMPERATURE ELEMENT WITHOUT WELL (ELEMENT NOT CONNECTED TO SECONDARY INSTRUMENT)			
	4)		5)		6)	
	TEMPERATURE ELEMENT WITH WELL* (ELEMENT NOT CONNECTED TO SECONDARY INSTRUMENT)	FILLED-SYSTEM-TYPE TEMPERATURE INDICATOR WITH WELL*	BIMETALLIC-TYPE THERMOMETER, GLASS THERMOMETER, OR OTHER LOCAL UNCLASSIFIED TEMPERATURE INDICATOR.			
	7)		8)		9)	
	THERMOCOUPLE OR RESISTANCE BULB (RTD) TEMPERATURE ELEMENT CONNECTED TO TEMPERATURE INDICATOR (TAG ELEMENT TE-170)	SINGLE THERMOCOUPLE CONNECTED TO MULTIPOINT TEMPERATURE INDICATOR HAVING INTEGRAL SWITCH TO PERMIT RECORDING ON MULTIPOINT SCANNING TEMPERATURE RECORDER (TAG TEMPERATURE ELEMENT TE-171-2)	SINGLE THERMOCOUPLE PARALLEL-WIRED TO MULTIPOINT TEMPERATURE INDICATOR AND MULTIPOINT SCANNING TEMPERATURE RECORDER (TAG TEMPERATURE ELEMENT TE-173-8/174-4)			
	10)		11)		12)	
	DUAL OR DUPLEX THERMOCOUPLE CONNECTED TO MULTIPOINT TEMPERATURE INDICATOR AND MULTIPOINT TEMPERATURE SCANNING RECORDER (TAG TEMPERATURE ELEMENT TE-175-7/176-2)	MULTI-ELEMENT THERMOCOUPLE FOR DIFFERENT ELEMENTATIONS, WITH WELL* IN TANK	THERMAL-RADIATION-TYPE TEMPERATURE INDICATOR, SELF-CONTAINED			

*Use of the thermowell symbol is optional. However, use or omission of the symbol shall be consistent throughout a project.

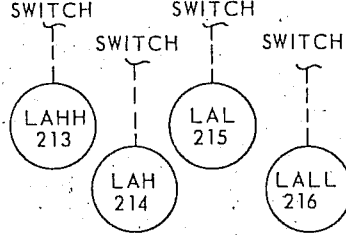
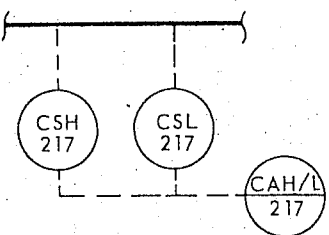
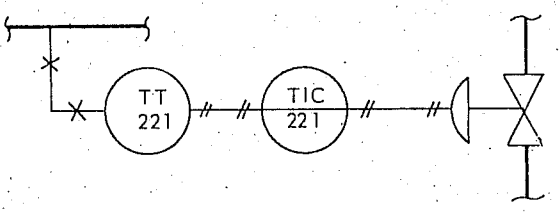
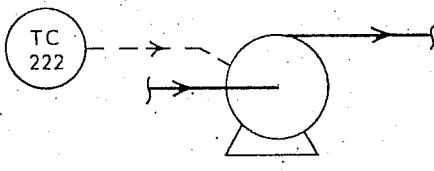
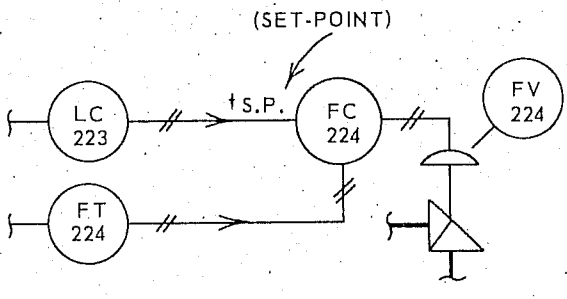
5.8 PRIMARY ELEMENT SYMBOLS (Contd.)

<p>TEMPERATURE (Contd.) T</p>	<p>13)</p>  <p>THERMAL-RADIATION-TYPE TEMPERATURE ELEMENT</p>	<p>14)</p>	<p>15)</p>	
<p>MULTIVARIABLE C</p>	<p>1)</p>  <p>ALTERNATIVE 1</p>	<p>2)</p>  <p>ALTERNATIVE 2</p>	<p>3)</p>  <p>ALTERNATIVE 1</p>	<p>4)</p>  <p>ALTERNATIVE 2</p>
<p>VISCOSITY V</p>	<p>1)</p>  <p>RECEIVER</p> <p>VISCOSITY TRANSMITTER, THROUGH-FLOW TYPE</p>	<p>2)</p>	<p>3)</p>	
<p>WEIGHT OR FORCE W</p>	<p>1)</p>  <p>WEIGHT TRANSMITTER, DIRECT-CONNECTED</p>	<p>2)</p>  <p>STRAIN GAGE CONNECTED TO SEPARATE WEIGHT TRANSMITTER (TAG STRAIN GAGE WE-204.)</p>	<p>3)</p>  <p>WEIGHT-BELT SCALE TRANSMITTER</p>	

5.8 PRIMARY ELEMENT SYMBOLS (Contd.)

Z POSITION	1) <p>LIMIT SWITCH THAT IS ACTUATED WHEN VALVE CLOSES TO A PREDETERMINED POSITION</p>	2) <p>TURBINE SHELL/ROTOR DIFFERENTIAL-EXPANSION TRANSMITTER (TAG PRIMARY ELEMENT ZDE-209.)</p>	3)

5.9 FUNCTION SYMBOLS

<p>A</p> <p>ALARM</p>	<p>1) SWITCH SWITCH SWITCH SWITCH</p>  <p>SEPARATE ALARMS FOR AB-NORMAL LEVEL - VERY HIGH, HIGH, LOW, AND VERY LOW</p>	<p>2)</p>  <p>COMMON ALARM ANNUNCIATOR FOR HIGH- AND LOW-CONDUCTIVITY</p>	<p>3)</p>
<p>C*</p>	<p>1)</p>  <p>TEMPERATURE INDICATING CONTROLLER THAT IS EITHER SELF-CONTAINED OR A CONTROL STATION/PLUG-IN CONTROLLER COMBINATION (SEE SECTION 5.9K)</p>	<p>2)</p>  <p>SELF-CONTAINED ON-OFF ROOM THERMOSTAT ACTUATING CIRCULATING PUMP MOTOR</p>	
<p>CONTROL (SEE SECTION 5.5)</p>	<p>3)</p>  <p>CASCADE CONTROL: FLOW CONTROLLER RESET BY LEVEL CONTROLLER</p>	<p>4)</p>	

* It is expected that control modes will not be designated on a diagram. However, the following designations may be used outside the controller symbol, if desired, in combinations such as %, \int , D.

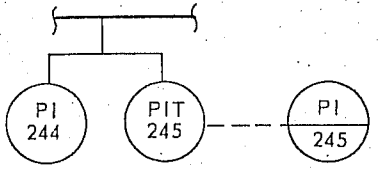
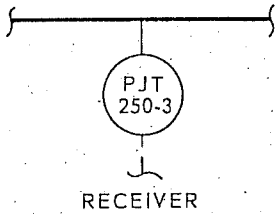
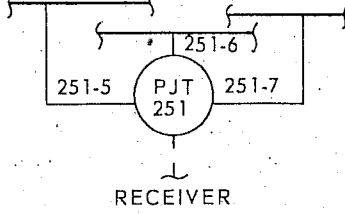
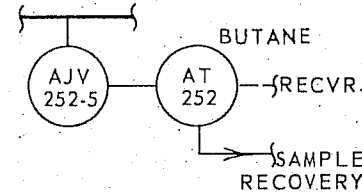
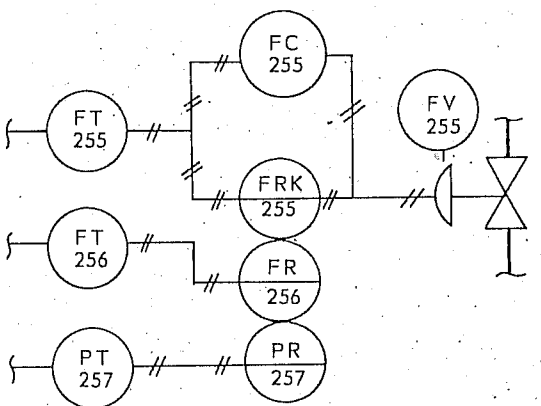
CONTROL MODE	DESIGNATION	CONTROL MODE	DESIGNATION
ON-OFF	1-0 OR ON-OFF	INVERSE DERIVATIVE	1/D
DIFFERENTIAL-GAP, TWO-POSITION	Δ 1-0 OR Δ ON-OFF	OPTIMIZING	OPT. OR MAX. OR MIN. (as applicable)
PROPORTIONAL	% OR P	ADAPTIVE	ADAPT.
AUTOMATIC RESET, FLOATING, OR INTEGRAL	\int OR I	UNCLASSIFIED	AS REQUIRED
DERIVATIVE OR RATE	D OR d/dt	DIRECT ACTING	DIR.
		REVERSE ACTING	REV.

† A controller is understood to have integral manual set-point adjustment unless means of remote adjustment is indicated.

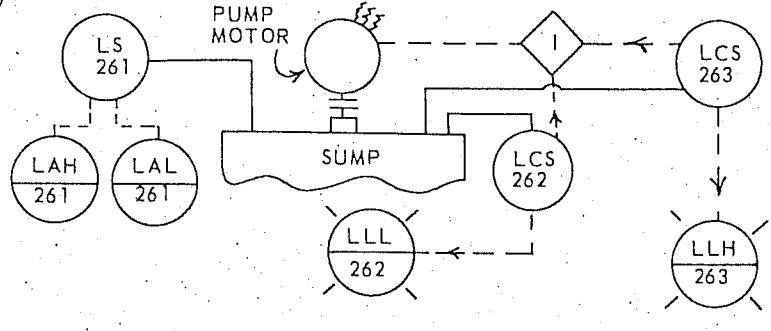
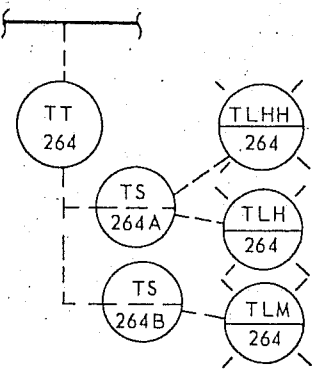
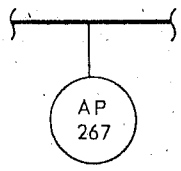
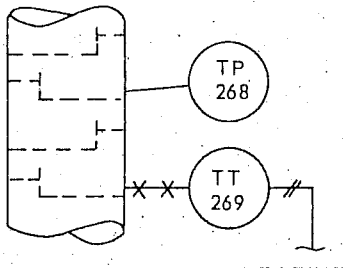
5.9 FUNCTION SYMBOLS (Contd.)

<p>D</p> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">DIFFERENTIAL</p>	<p>1)</p> <p>DIFFERENTIAL-TEMPERATURE INDICATOR</p>	<p>2)</p> <p>HIGH-DIFFERENTIAL-PRESSURE SWITCH</p>	<p>3)</p>
<p>PRI-MARY ELEMENT</p>	<p>SEE SECTION 5.8</p>		
<p>F</p> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">RATIO</p>	<p>1)</p> <p>FLOW-RATIO CONTROLLER WITH TWO PENS TO RECORD FLOW</p>	<p>2)</p> <p>FLOW-RATIO CONTROLLER WITH ONE PEN TO RECORD FLOW-RATIO</p>	
<p>RATIO</p>	<p>3)</p> <p>DIRECT-CONNECTED COMPRESSION-RATIO RECORDER</p>	<p>4)</p>	
<p>G</p> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">GLASS (SEE SECTION 5.8)</p>	<p>1)</p> <p>SIGHT GLASS FOR INTERNAL VIEWING</p>	<p>2)</p>	<p>3)</p>

5.9 FUNCTION SYMBOLS (Contd.)

H	SEE SECTION 5.9 A, L		
INDICATE	<p>1)</p>  <p>LOCAL PRESSURE INDICATOR AND PRESSURE INDICATING TRANSMITTER WITH COMMON TAP, AND BOARD-MOUNTED PRESSURE RECEIVER INDICATOR</p>	2)	
SCAN (SEE SECTIONS 5.8T AND 5.9R)	<p>1)</p>  <p>PRESSURE-SCANNING TRANSMITTER CONNECTED TO PROCESS POINT 3</p>	<p>2)</p>  <p>PRESSURE-SCANNING TRANSMITTER CONNECTED TO PROCESS POINTS 5, 6, 7</p>	<p>3)</p>  <p>SAMPLE LINE CONNECTED TO BUTANE-CONCENTRATION TRANSMITTER THROUGH EXTERNAL SAMPLE-SCANNING VALVE</p>
CONTROL STATION	<p>1)</p>  <p>RECORDING FLOW CONTROL STATION, BOARD MOUNTED, WITH ADDITIONAL FLOW AND PRESSURE PENS, AND LOCAL CONTROLLER</p> <p>2)</p>		

5.9 FUNCTION SYMBOLS (Contd.)

<p>L LIGHT OR LOW</p>	<p>1)</p>  <p>DIFFERENTIAL-GAP CONTROL OF SUMP LEVEL THROUGH STARTING AND STOPPING SUMP PUMP BY LCS-262 AND LCS-263 THAT ALSO ACTUATE HIGH- AND LOW- LEVEL ALARMS ARE ACTUATED BY LS-261</p>	<p>2)</p>  <p>PILOT LIGHTS TO SIGNAL THAT TEMPERATURE HAS RISEN AS PLANNED TO GIVEN INTER-MEDIATE, HIGH, AND VERY HIGH VALUES.</p>	
<p>MIDDLE OR INTER-MEDIATE</p>	<p>SEE SECTION 5.9 L (2)</p>		
<p>ORIFICE (RESTRICTION)</p>	<p>SEE SECTIONS 5.5 (6) AND 5.8F (17) AND (18)</p>		
<p>P POINT</p>	<p>1)</p>  <p>ANALYSIS TEST SAMPLE POINT</p>	<p>2)</p>  <p>DISTILLATION COLUMN WITH CONNECTION FOR ALTERNATIVE LOCATION OF SENSOR OF TEMPERATURE TRANSMITTER</p>	<p>3)</p>

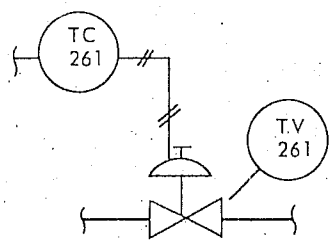
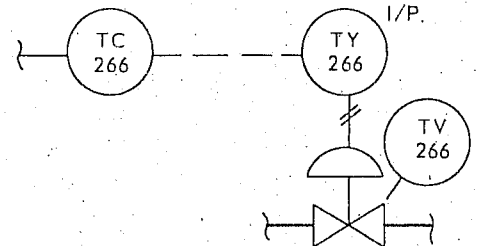
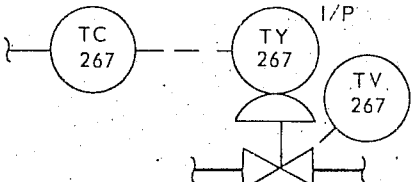
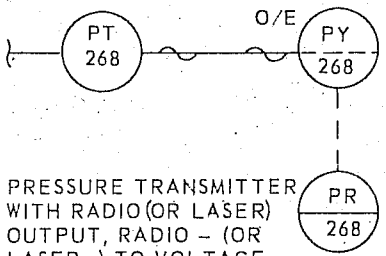
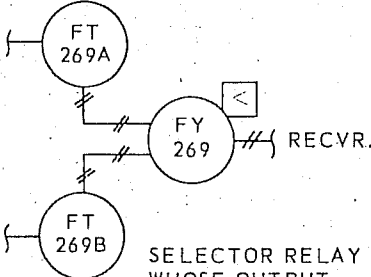
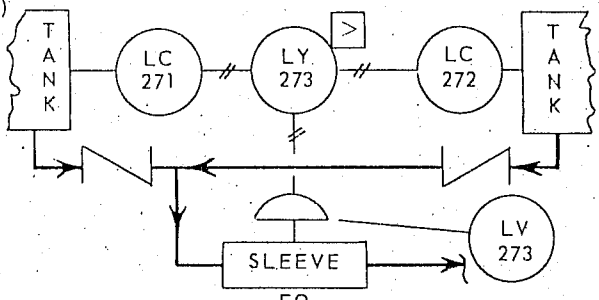
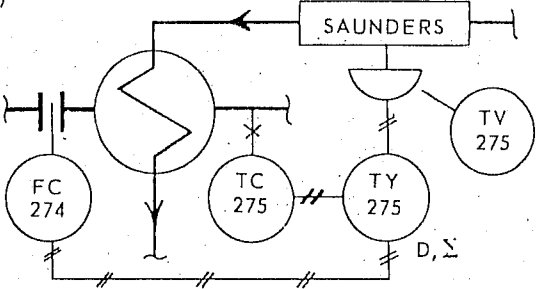
5.9 FUNCTION SYMBOLS (Contd.)

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">INTEGRATE OR TOTALIZE (SEE SECTION 5.8Q)</p>	<p>1)</p> <p>DIFFERENTIAL-PRESSURE-TYPE FLOW METER WITH (1) RECORDING OF FLOW RATE, (2) INDICATION OF INTEGRATED FLOW, AND (3) SWITCH ACTUATED BY INTEGRATED FLOW.</p>	<p>2)</p> <p>DIFFERENTIAL-PRESSURE-TYPE FLOW METER WITH (1) RECORDING OF FLOW RATE, (2) INDICATION OF INTEGRATED FLOW, AND (3) SWITCH ACTUATED BY FLOW RATE.</p>	<p>3)</p> <p>RUNNING-TIME TOTALIZER CONNECTED TO PUMP MOTOR</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">RECORD OR PRINT (SEE SECTION 5.8R)</p>	<p>1)</p> <p>MULTIPOINT MULTI-VARIABLE DATA LOGGER, UJR-240, WITH SWITCH FOR POINT 7.</p>	<p>2)</p> <p>LEVEL SIGNAL TO ONE PEN OF TWO-PEN RECORDER. BOTH PENS RECORD CONTINUOUSLY. LEVEL PEN HAS SWITCH THAT ACTUATES TWO SOLENOID VALVES ON HIGH LEVEL.</p>	<p>3)</p> <p>LEVEL SIGNAL TO POINT 1 OF TWO-POINT LEVEL RECORDER. POINTS RECORD ALTERNATELY. POINT 1 HAS SWITCH THAT ACTUATES TWO SOLENOID VALVES ON HIGH LEVEL.</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">SWITCH OR SAFETY (SEE SECTION 5.5 PRESSURE AND TEMPERATURE)</p>	<p>1)</p> <p>LOW-TEMPERATURE SWITCH WITH ONE OUTPUT FOR ALARM AND TRIP.</p>	<p>2)</p> <p>ALTERNATIVE 1</p> <p>LOW-TEMPERATURE SWITCH WITH TWO OUTPUTS FOR ALARM AND TRIP.</p>	<p>3)</p> <p>ALTERNATIVE 2</p>
<p>4)</p> <p>RECEIVER-TYPE FLOW SWITCH ACTUATING LOW-FLOW ALARM.</p>	<p>5)</p> <p>ALTERNATIVE 1</p> <p>MULTIPOINT TEMPERATURE RECORDER WITH INTEGRAL HIGH-TEMPERATURE SWITCH FOR POINT 4.</p>	<p>6)</p> <p>ALTERNATIVE 2</p>	

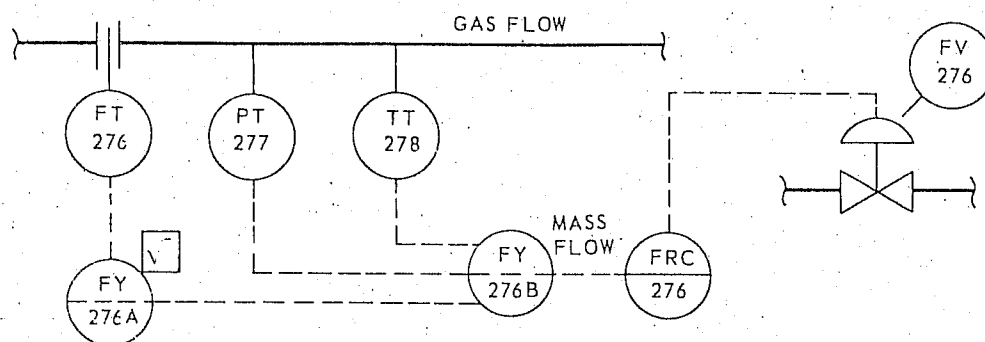
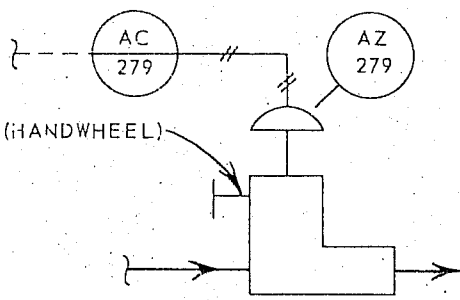
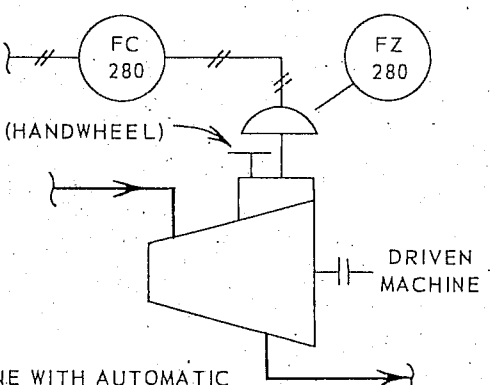
5.9 FUNCTION SYMBOLS (Contd.)

S	<p>7)</p> <p>ONE-POINT TEMPERATURE INDICATOR WITH SEPARATE MANUAL SELECTOR SWITCH.</p>	<p>8)</p>	<p>9)</p>
T	<p>1)</p> <p>TRANSMITTER WITH THERMO-COUPLE INPUT AND ELECTRIC OUTPUT.</p>	<p>2)</p> <p>TRANSMITTER WITH PNEUMATIC OUTPUT</p>	<p>3)</p>
U	<p>1)</p> <p>ALTERNATIVE 1</p> <p>2)</p> <p>ALTERNATIVE 2</p>		<p>FLOW MEASUREMENT RECEIVED BY REACTOR BOARD INSTRUMENT THAT INDICATES AND RECORDS FLOW, HAS SWITCH TO ACTUATE LOW-FLOW ALARM ON REACTOR BOARD, HAS A CONTROLLER TO ACTUATE A CONTROL VALVE, RETRANSMITS THE MEASUREMENT TO A RECORDER ON MAIN BOARD, INTEGRATES THE FLOW, INDICATES THE INTEGRATED FLOW, HAS A SWITCH TO ACTUATE A SOLENOID VALVE AFTER A GIVEN INTEGRATED FLOW HAS PASSED, AND HAS ANOTHER SWITCH TO ACTUATE A PILOT LIGHT AFTER A GREATER INTEGRATED FLOW HAS PASSED.</p>

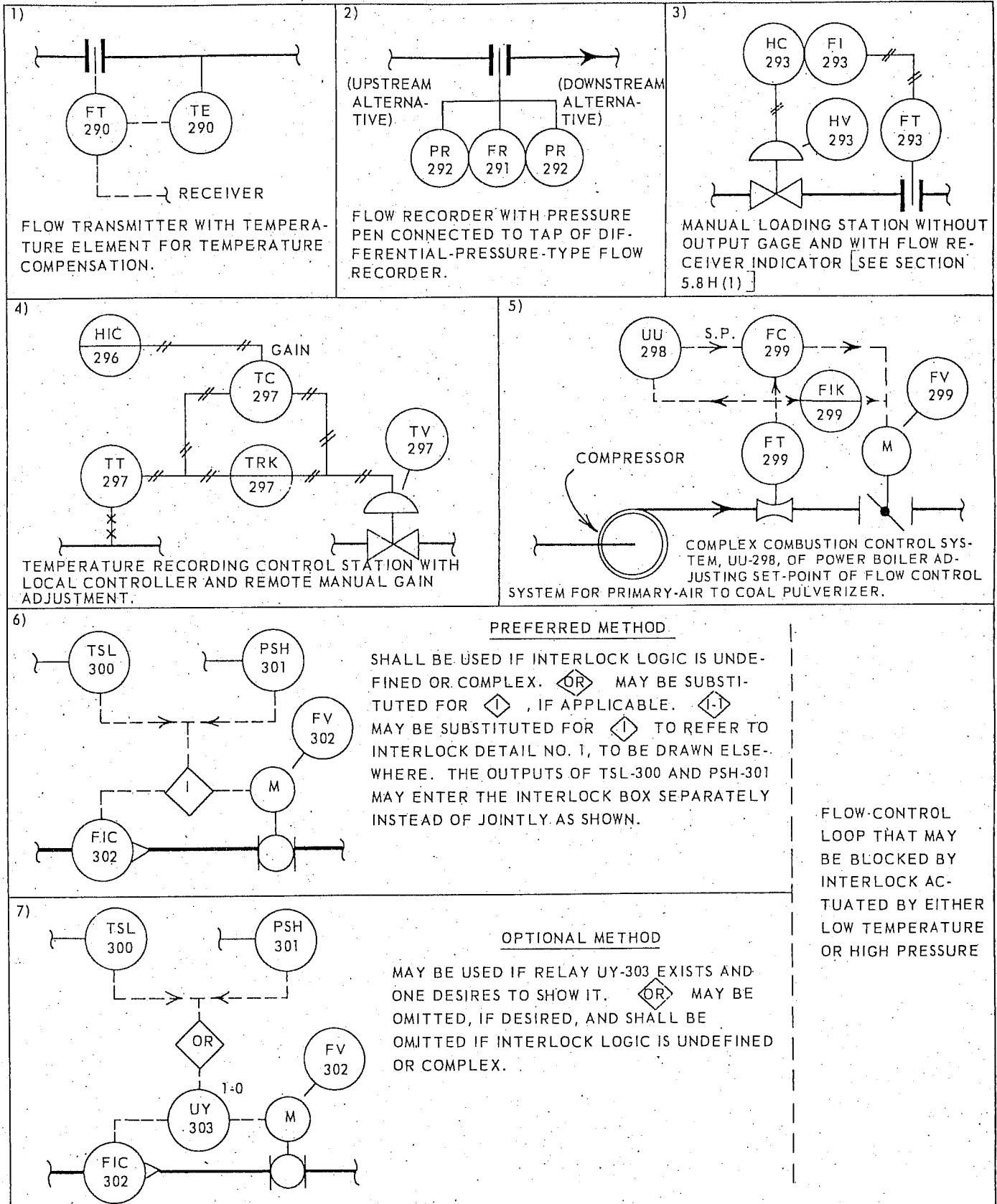
5.9 FUNCTION SYMBOLS (Contd.)

<p>V VALVE, DAMPER, OR LOUVER</p>	<p>1)</p>  <p>CONTROL VALVE WITH TOP-MOUNTED HANDJACK</p>	<p>2)</p>	<p>3)</p>
<p>WELL W</p>	<p>SEE SECTION 5.9T</p>		
<p>Y</p>	<p>1)</p>  <p>ELECTRIC CURRENT SIGNAL ACTUATING PNEUMATIC CONTROL VALVE WITH SEPARATELY MOUNTED ELECTRO-PNEUMATIC CONVERTER.</p>	<p>2)</p>  <p>ELECTRIC CURRENT SIGNAL TO PNEUMATIC CONTROL VALVE FURNISHED WITH ATTACHED ELECTRO-PNEUMATIC SIGNAL CONVERTER. PREFERABLY, THE CONVERTER SYMBOL SHALL BE OMITTED [SEE SECTION 5.4 (2)]</p>	
<p>RELAY OR COMPUTE</p>	<p>3)</p>  <p>PRESSURE TRANSMITTER WITH RADIO (OR LASER) OUTPUT, RADIO - (OR LASER-) TO-VOLTAGE CONVERTER, AND PRESSURE RECORDER.</p>	<p>4)</p>  <p>SELECTOR RELAY WHOSE OUTPUT REPRESENTS LOWER FLOW OF FT-269A AND FT-269B.</p>	<p>5)</p>
	<p>6)</p>  <p>TANK OUTLET VALVE TO OPEN AS REQUIRED BY THE HIGHER OF TWO LEVELS.</p>	<p>7)</p>  <p>TEMPERATURE CONTROL WITH FLOW-ANTICIPATING RELAY.</p>	

5.9 FUNCTION SYMBOLS (Contd.)

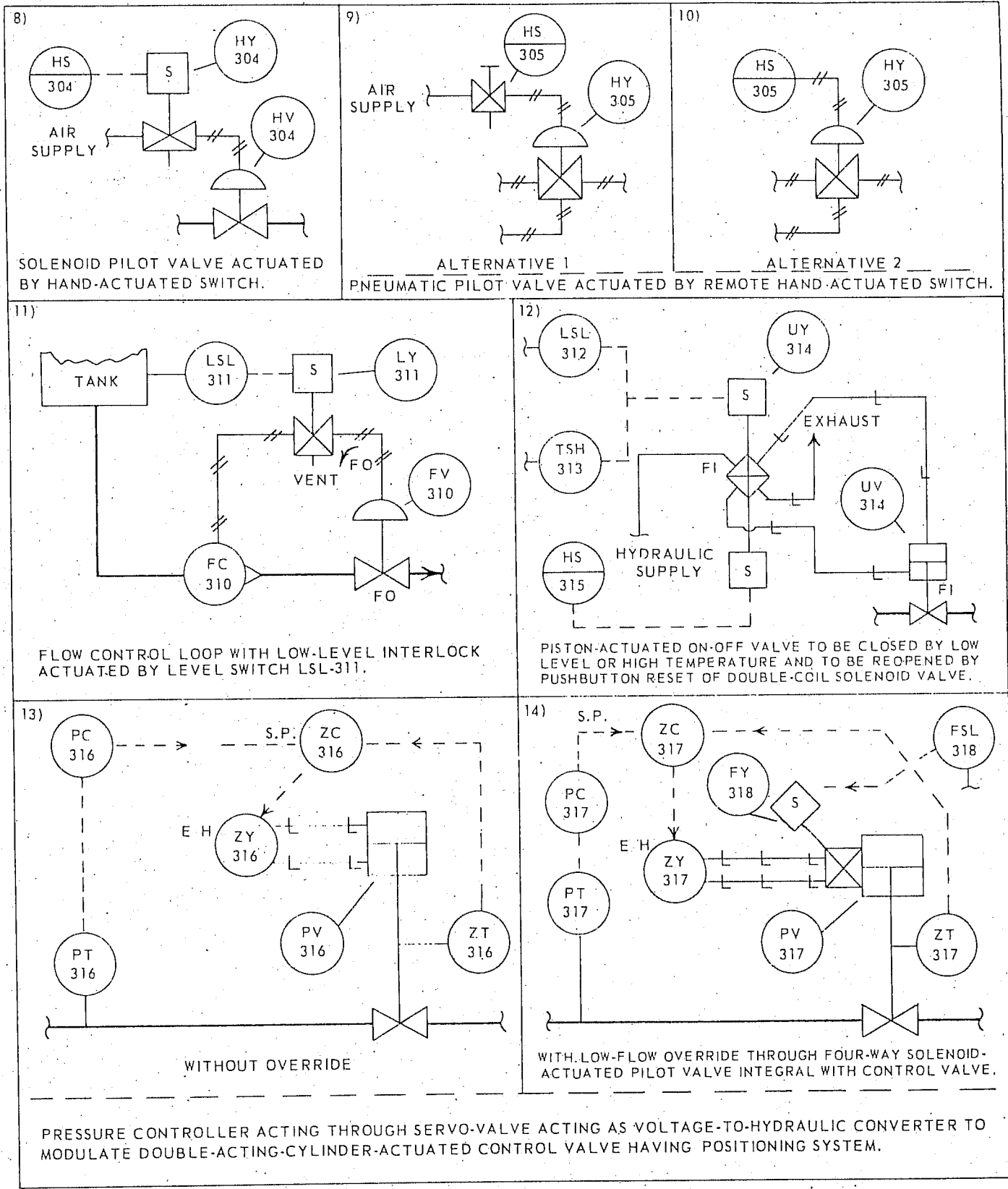
<p>RELAY OR COMPUTE (Contd.)</p> <p>Y</p>	<p>8)</p>  <p>MASS-FLOW COMPUTATION PERFORMED BY MASS-FLOW COMPUTING RELAY FY-276B HAVING LINEAR INPUTS OF UNCOMPENSATED FLOW, PRESSURE, AND TEMPERATURE</p>
<p>DRIVE, ACTUATE, OR UNCLASSIFIED FINAL CONTROL ELEMENT</p> <p>Z</p>	<p>1)</p>  <p>PROPORTIONING PUMP WITH AUTOMATIC AND MANUAL STROKÉ CONTROL</p> <p>2)</p>  <p>TURBINE WITH AUTOMATIC AND MANUAL SPEED CHANGER</p>

5.10 MISCELLANEOUS SYSTEMS

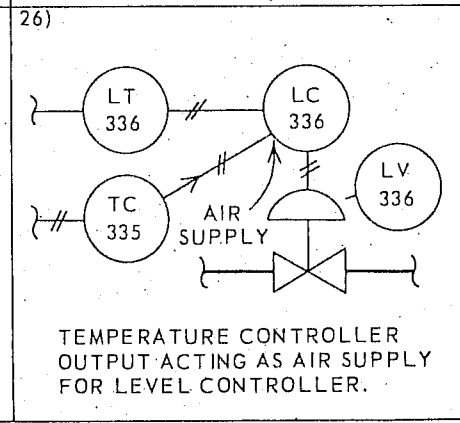
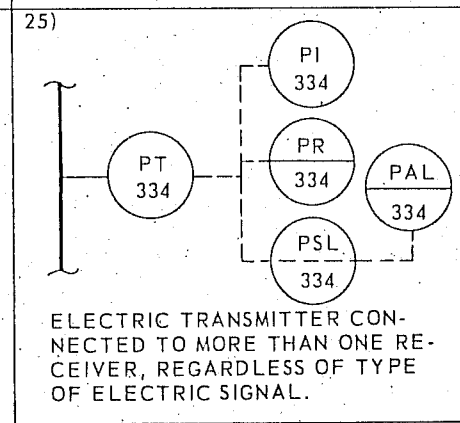
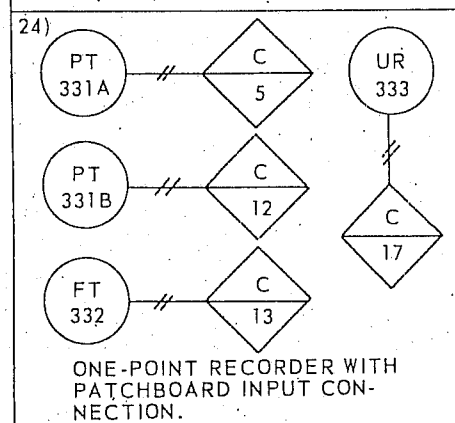
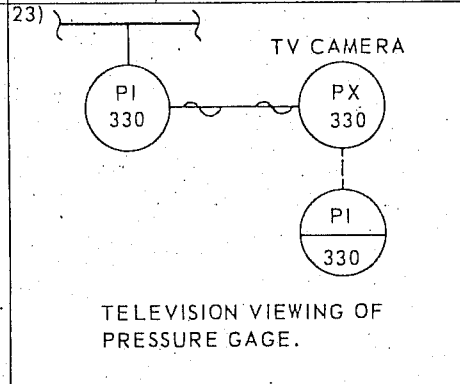
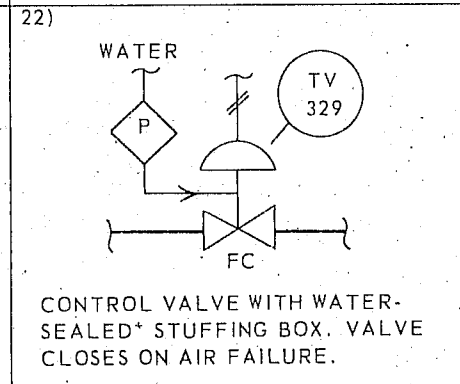
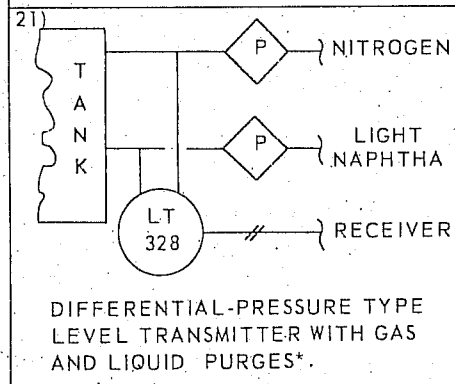
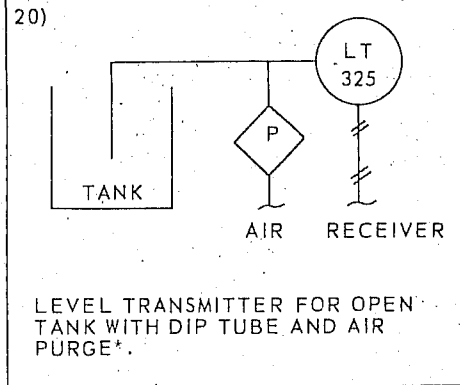
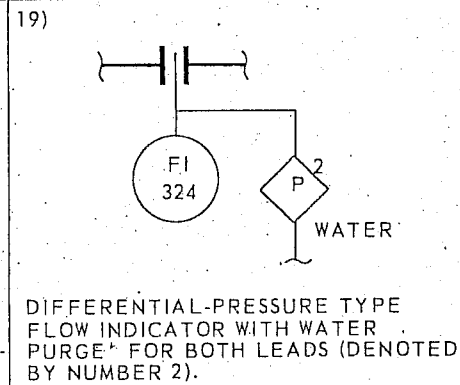
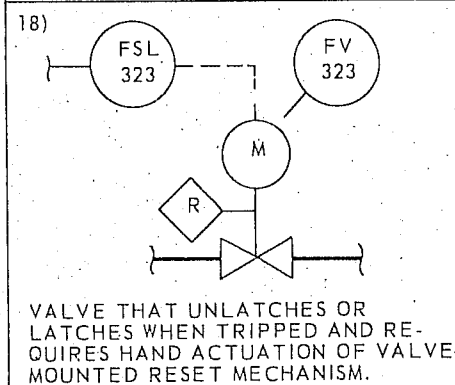
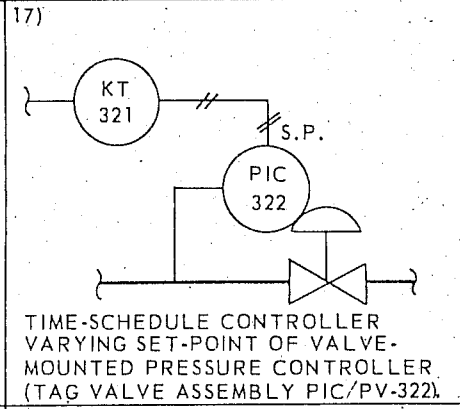
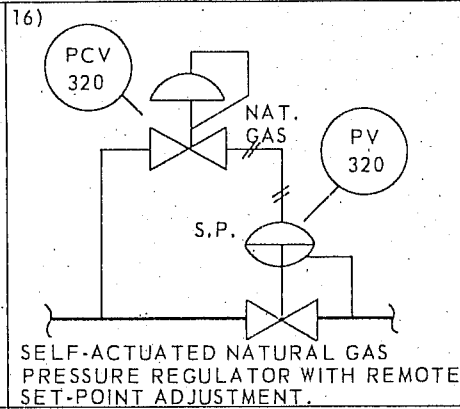
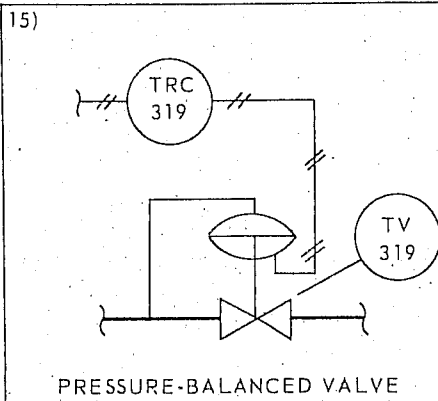


FLOW-CONTROL LOOP THAT MAY BE BLOCKED BY INTERLOCK ACTUATED BY EITHER LOW TEMPERATURE OR HIGH PRESSURE

5.10 MISCELLANEOUS SYSTEMS (Contd.)



5.10 MISCELLANEOUS SYSTEMS (Contd.)



*The purge fluid supplies may optionally use the same abbreviations as for instrument power supplies. See Section 5.1, footnote†.

APPENDIX METHOD FOR FUNCTIONAL DIAGRAMS

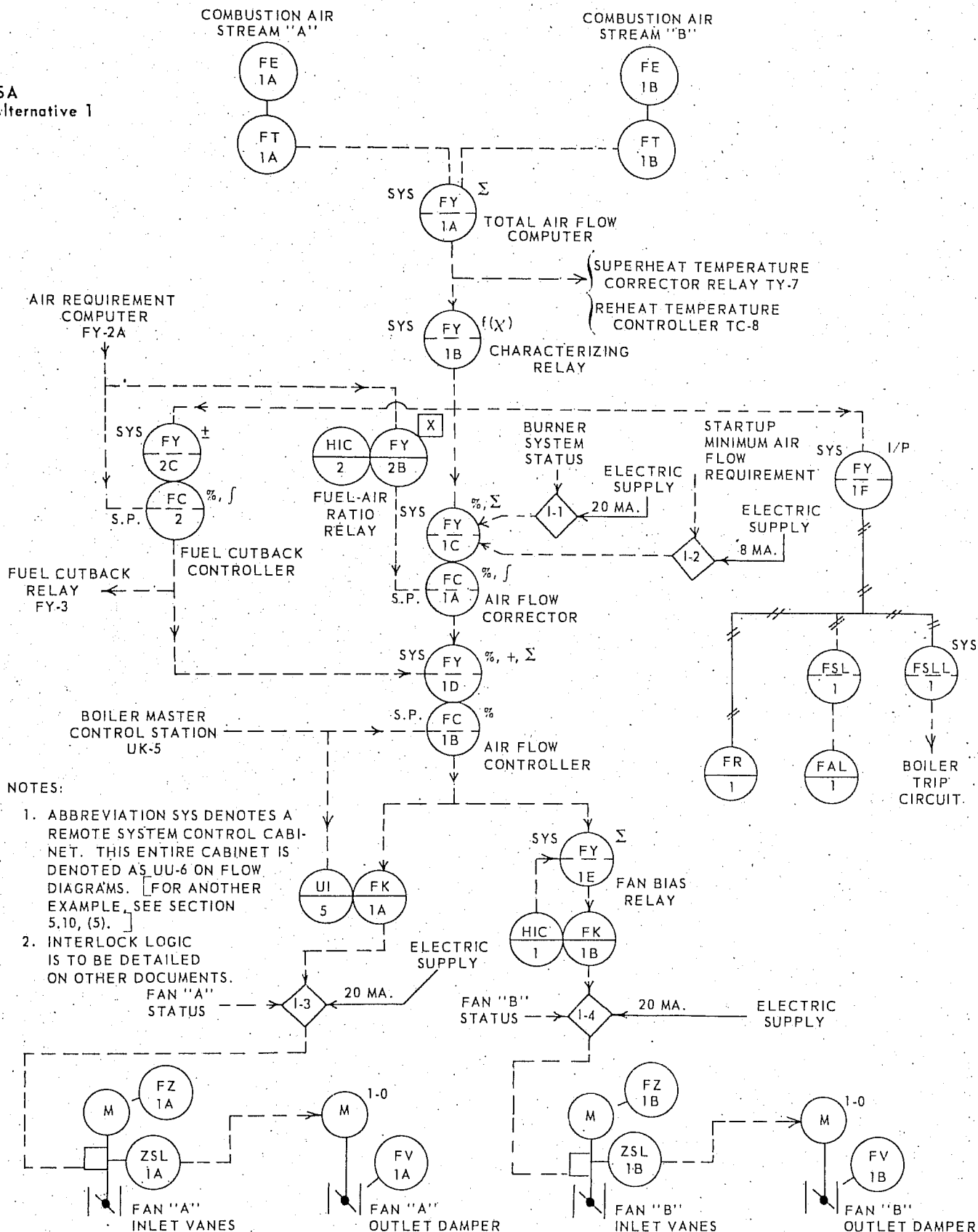
There are systems that are too complex to be shown with all their components on a flow diagram. Such a complex system may make use of an over-all instrument designation; e.g. *UU-298*, on the flow diagram (See Section 5.10(5).) The operation of the system may be shown on a separate functional loop diagram that may also serve as the basis for subsequent development of a hardware diagram.

Following are two alternatives of a method that is intended for functional analog diagrams that go beyond the usual flow diagrams in completeness and the

amount of detail shown. The method is modified from Scientific Apparatus Makers Association Standard RC22-11-1966, "Functional Diagramming of Instrument and Control Systems;" however, the method uses the symbols and designations of this Standard.

Alternative 1, below, uses conventional tagging for all components of the system. Alternative 2 may be used if it is desired that the components mounted within the system cabinet not be tagged as usual. Other variations of the method may be devised as required.

ISA
Alternative 1



NOTES:

1. ABBREVIATION SYS DENOTES A REMOTE SYSTEM CONTROL CABINET. THIS ENTIRE CABINET IS DENOTED AS UU-6 ON FLOW DIAGRAMS. [FOR ANOTHER EXAMPLE, SEE SECTION 5.10, (5).]
2. INTERLOCK LOGIC IS TO BE DETAILED ON OTHER DOCUMENTS.

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- H -			Moisture or Humidity graphic symbol identification letter	5.8 T1	32 12
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identification letter	T1	12	Multivariable graphic symbol identification letter	5.8 T1	35 12
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Instrumentation	2	7	Point (Test Connection) graphic symbol identification letter	5.9 T1	40 12
Instrument Line Symbols	5.1	17	Position graphic symbol identification letter	5.8 T1	36 12
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