

ENGINEERING STANDARD
FOR
PRESSURE INSTRUMENTS

CONTENTS :**PAGE No.**

1. SCOPE	2
2. REFERENCES	2
3. UNITS	2
4. PRESSURE CONTROL LOOP DESIGN CRITERIA.....	2
5. PRESSURE GAGES DESIGN CRITERIA	3
6. PRESSURE SWITCHES	6
7. PRESSURE TRANSMITTERS.....	6
8. LOCAL PRESSURE CONTROLLERS.....	7
9. DATA SHEETS AND DRAWINGS.....	7

APPENDICES :

APPENDIX A STANDARD SHEET FORMS AND DESCRIPTION	8
A.1 Differential Pressure Data Sheets	8
A.2 Pressure Gage Data Sheets	12
A.3 Pressure Switch Data Sheets	15
A.4 Pressure Instruments Data Sheets	17

1. SCOPE

This Pressure Instrument Engineering Standard recommends the general engineering practice to be considered in the project design as a minimum. The engineer in charge of design shall consider any further requirement deemed to be necessary by the engineering judgment.

The scope of this Standard covers application, specification, and installation engineering criteria of gages, switches, local controller and transmitters used for pressure measurement and control in Petroleum Industries.

2. REFERENCES

Throughout this Standard the following standards and codes are referred to. The editions of these standards and codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in standards and codes that occur after the date of this Standard shall be agreed upon by the Company and the consultant.

ISA (INSTRUMENT SOCIETY OF AMERICA)

S5.1 (1986)	"Instrumentation Symbols and Identification"
S5.4 (R1981)	"Instrument Loop Diagrams"
S5.5 (1986)	"Graphic Symbols for Process Control"

ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE)

Y 32.11	"Graphic Symbols for Process Display"
C 85-1 (1963)	"Terminology for Automatic Control"

API (AMERICAN PETROLEUM INSTITUTE)

RP 500 A/B/C	"Hazardous Area Classifications"
RP 550	"Section 4/ Pressure"

BSI (BRITISH STANDARDS INSTITUTION)

BS 1780 Part II	"Specification for Bourdon Tubes Pressure and Vacuum Gages"
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NACE (NATIONAL ASSOCIATION OF CORROSION ENGINEERS)

MR-0175 (1988)	"Standard Material Requirements/Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment"
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3. UNITS

International System of Units (SI) in accordance with IPS-E-GN-100 shall be used.

4. PRESSURE CONTROL LOOP DESIGN CRITERIA

4.1 Local Control Loops

4.1.1 In the following circumstances, preference shall be given to the utilization of local pneumatic control loops.

- When, there is no set-point adjustment or indication requirement.
- In very small plants with few controllers where central control is not justified.
- In remote applications, where there is no instrument air or energy source available except pressurized natural gas.
- Where, frequent intervention of operator in the loop is not necessary or recommended and where the distance of control point to the central control station is beyond the acceptable limit.

The local pressure controllers shall be of pneumatic type and the impulse line shall be connected directly to the controller (no transmitter shall be employed).

4.1.2 The process variable measurement point shall be as near as possible to the manipulation point to minimize the transfer lag and dead-time.

4.1.3 Field mounted controllers and control panels must be located in an area that is safe and convenient for the operators and maintenance technicians.

4.2 Centralized Control Loops

4.2.1 In general pressure control loop applications, centralized control shall be implemented and for other services than what specified in 4.1 hereabove.

4.2.2 The centralized controllers shall be specified as analog electronic, digital single loop, or shared display /DCS type. Pneumatic systems may be employed in special circumstances with the Company's prior approval.

4.2.3 Controllers may be specified as indicating, Manual/Auto and Remote set point type, as required in specific application.

4.2.4 Control modes shall normally be adjustable proportional band with automatic reset (PI).

4.2.5 Suppressed ranges shall be used on applicable controllers to obtain maximum accuracy and control.

5. PRESSURE GAGES DESIGN CRITERIA

5.1 Application

In the following paragraphs the recommended design criteria of pressure gages will be presented, but not limited to.

5.1.1 Pressure gages shall be considered for all pressure vessels. Either working under vacuum or pressure service conditions.

5.1.2 Headers and manifolds shall be provided with suitable pressure gages (Liquids, gases and steam applications).

5.1.3 Hand valves used for pressure control applications shall be equipped with pressure gages on upstream and/or down-stream piping of the valve.

5.1.4 Self-operated pressure regulating valves shall be equipped with a pressure gage on the down-stream piping.

5.1.5 All gas compressors shall be provided with a pressure gage on the suction and discharge piping.

5.1.6 A pressure gage shall be provided on discharge piping of all gas and air compressors.

5.1.7 All pumps shall be provided with pressure gages on suction and discharge piping, as near as possible to the pump skid.

5.1.8 A pressure gage shall be considered for steam inlet piping of all ejector pumps.

5.1.9 Safety Relief valves shall be provided with a pressure gage near to relieving point.

- 5.1.10** Well-head pipelines shall be provided with a pressure gage adjacent to production facility.
- 5.1.11** Pipelines entering or leaving the compressor or pump stations shall be provided with suitable gages adjacent and inside the fence of the station.
- 5.1.12** Blind pneumatic or electronic transmitters shall be supplemented with a pressure gage connected directly to the process line.
- 5.1.13** In the following cases, pressure transmitter with receiving indicator shall be used instead of pressure gage.
- To prevent hazardous hydrocarbons or any other material entering the control room by piping them into the room.
 - Where long tubing of pressure gage causes problems or difficulties, i.e. where solid particles present in the process fluid may cause plugging difficulties or where difference in elevation could result in a liquid head problem.
 - When the fluid involved would freeze or solidify at low atmospheric pressure and therefore gage tubing requires insulation and heating.
- 5.1.14** Pressure gages shall be considered on piping locations for maintenance purposes in accordance with piping standard or as piping engineering requests.
- 5.1.15** Pressure gages shall be considered on piping locations for increased operational safety in accordance with process engineering requirements.
- 5.1.16** Glass tube manometer may be specified where required for low pressure or absolute pressure measurement, where design pressure is under 200 m.barg and the fluid encountered is not dangerous.
- 5.1.17** For general local measurement of pressure, bourdon tube type indicating pressure gages shall be used.
- 5.1.18** Measuring element shall be generally selected to be of bourdon tube type. Bellows or diaphragm type pressure gages may be specified for very low pressure applications exceptionally.
- 5.1.19** Oil filled type pressure gages to be specified for vibration services, such as; compressor, or other rotating machines.
- 5.1.20** Siphons shall be designed for all services containing steam with temperature higher than 100°C or liquid with temperature above 100°C. Gage siphons shall be of coiled type preferably.

5.2 Specification

The following clauses defines recommended practice for specifying pressure gages.

- 5.2.1** Range of the gage shall be specified in a manner that the pointer operate in the middle third of the scale at normal service condition and that the maximum working pressure (relief valve setting) does not exceed the range.
- 5.2.2** Case size shall be preferably specified as 63 /100/ 150 mm. for all standard gages.
- 5.2.3** Bourdon-tube pressure gages shall be specified for the ranges from 1 bar up to 1000 bar.
- 5.2.4** Diaphragm element pressure gages shall be specified for measuring pressures bellow 1 bar.
- 5.2.5** Sensing element of gages used in oil, gas, water and steam services shall be specified with stainless steel bourdon tube.

Brass, Beryllium -copper and phosphor bronze elements shall be used on air services.

It is recommended that all pressure gages used in a single plant to be specified for oil and gas service unless a substantial number of them are required for air service only. Pressure gages on sour service shall be of Monel-400 or Hastalloy C according to NACE MR-01 75.

5.2.6 Diaphragm seals shall be specified for corrosive process fluids, or in freezing climates or process fluids that will clog the pressure element. These gages shall also be specified with capillary bleeder.

5.2.7 Accuracy of the gage shall be better than ½ percent of scale span.

5.2.8 At locations where pressure instruments will be compensated for static head, the tag shall be specified to be clearly marked accordingly (by manufacturer).

5.2.9 Draft gages shall be stack, diaphragm type.

5.2.10 Pressure gages shall not have suppressed ranges.

5.2.11 Bellows shall be SS-316, Copper nickel-magnesium alloy or other materials of appropriate mechanical and corrosion resistance.

5.2.12 Diaphragm sealed gages shall not be specified for services above 200°C for direct application.

5.2.13 Pressure gage ranges shall be considered in accordance with BS-1780 part 2.

5.2.14 General purpose bourdon tube-type pressure gages should be specified where only indicating of pressure is required.

5.2.15 On equipment normally operating at pressure above atmospheric, but before plant operation may expose to vacuum because of air removal, a combined pressure/Vacuum range may be specified.

5.3 Installation Engineering

These clauses are practical recommendations to be considered in pressure instrument installation engineering and design.

5.3.1 Gages up to and including 150 mm. dial size may be supported by their own connections.

5.3.2 Vent valves shall be arranged with suitable drain lines to ensure safe operation of these valves without hazard creation.

5.3.3 All gages used in process applications shall be provided with a stop valve, at the pressure source. This valve shall not be less than 1 inch. Consideration shall be given to the use of approved ball valves where temperature condition permit. Exception will be permitted in the following cases:

- a) The pump or equipment physical size necessitates a smaller size stop valve. Anyhow, in no circumstances, the size of the valve shall be considered less than half inch unless specific approval obtained from the Company.
- b) When a gage is located at a distance of 2.5 m. or more from its pressure connection, an additional block valve in conjunction with a vent valve shall be considered adjacent to the gage.

5.3.4 In all cases the gage pressure source stop valve shall comply with piping standards. No other fittings between the stop valve and process pressure are permitted.

5.3.5 Snubbers or adjustable pulsation dampeners shall be specified to be fitted to all pressure gages that are subject to pulsation. Where blockage of the snubber may occur due to solids, a suitable globe valve may be used to snub the impulse. Liquid filled pressure gages are an acceptable alternative to snubbers.

5.3.6 Installation of indicating pressure gages shall conform with the Company Standard Drawings.

5.3.7 Surface mounted gages shall have back mounting cases with bottom process connection.

5.3.8 Panel mounted receiver gages shall have flush mounting cases with rear signal connection, the signal connection shall be screwed ¼" NPT/API standard male thread.

5.3.9 Pressure gages mounted above the take-off connection shall be protected from hot condensable vapors (with higher than 100°C) by means of a coiled syphon installation.

5.3.10 pressure instruments on gas and vapor service should be mounted above the pressure tappings wherever possible. The tapping shall be located on the top or side of the equipment.

5.3.11 Pressure instruments installed on a hydrocarbon service where an accumulation of condensate is possible, shall be mounted above the pressure tapping.

5.3.12 Pressure instruments on LPG service shall be fitted with an excess flow check valve, downstream of a block valve to prevent excessive flow in the event of fracture of the measuring element.

5.3.13 Gages for use on vessels shall be flange mounted type .The flange shall be 1½" # 300 Lb minimally.

6. PRESSURE SWITCHES

The following recommendations shall be considered in engineering and specifying the pressure switches in annunciating and logic protection applications.

6.1 Connection of the pressure switch shall normally considered to be ½" NPT to the process and ¼" NPT connection for pneumatic switch output signal.

6.2 Housing of the pressure switches shall meet the required climatic condition and electrical classification of the plant.

6.3 Alarm annunciator pressure switches shall be specified as single pole double throw (SPDT) type. The normally closed (NC) contact shall be utilized for normal operating condition in a manner that the abnormal condition opens the circuit.

6.4 The pressure switches may be specified as double pole double throw (DPDT) type switches.

6.5 Interlock and shut-down pressure switches may be specified either normally open or normally closed for normal operating conditions depending on type and reliability of power source and also on fail-safe requirements.

6.6 Integral switches provided in recording and controlling instruments shall not be used for interlocking purposes.

6.7 Alarms and logic system elements are preferable to be actuated from separate primary switches rather than single associated switch or transmitter switching signal.

6.8 Pressure switch measuring element may be; bourdon tube,bellows or diaphragm type depending upon the service and pressure encountered. The measuring element in process service shall be hardened type 316 stainless steel.

6.9 The mercury type pressure switches shall only be used in environments free from vibration and in applications which they can be installed in a leveled position.

6.10 The pressure switches may be selected of adjustable range or fixed range as applicable.

6.11 Irrespective of the pressure setting, the pressure switch shall be capable to withstand 1.3 times of the maximum service pressure.

6.12 Electrical entry shall be internally threaded type and shall be suitable for pg-13.5 conduits or M20 gland entrance.

7. PRESSURE TRANSMITTERS

7.1 Conventional electronic transmitters normally shall be specified for conventional and DCS control systems with 4-20 mA output signal.

7.2 Intelligent digital transmitters shall be used for remote or inaccessible applications to utilize their self calibration capability or DCS system when digital output signal is used in a manner to match the communication system of the DCS.

7.3 Application of pneumatic transmitters in pneumatic loops shall be considered according to the requirements mentioned in item 4 herebefore.

7.4 Pressure range of transmitters shall be selected so that, normal operating pressure will be within 50% and 85% of calibrated range.

7.5 Pressure instruments measuring elements may be; bourdon tube, spiral, helical, bellows or diaphragm type, depending upon the service and pressure. The measuring element shall be type 316 stainless steel, unless process fluid requires application of other materials, which in such cases, selection shall be made according to NACE MR-0175. Diaphragm seal elements may be provided in order to eliminate steam tracing, purging, winterizing and corrosion except for vacuum services.

7.6 Instruments shall be specified to have over-range protection equal to 1.2 times of maximum pressure to which they may be exposed.

7.7 Electronic pressure transmitter may be specified as; force balance electronic, strain gage, capacitance or piezo electric type. Priority will be given to the system with better maintainability and reliability.

7.8 Pressure instrument shall be located so that the head of the liquid between the instrument and the lowest point of measurement does not exceed the ratio span of the instrument.

7.9 Differential pressure transmitters shall be used in applications such as indication of filter blockage, control of separator performance, etc.

8. LOCAL PRESSURE CONTROLLERS

8.1 Local pneumatic pressure controllers of indicating type or blind type may be used for applications where transmission to remote receivers is not required. The controller shall be considered with weatherproof case or housing, suitable for valve or free-stand mounting.

Convenient control point setting shall be provided in the controller.

In case of blind controllers a pressure gage shall be supplied to indicate the process pressure.

8.2 Direct connected self-actuated pressure regulators may be used for air and utility services where a deviation of ten percent from the control point can be tolerated.

9. DATA SHEETS AND DRAWINGS

9.1 General

9.1.1 P & I drawings shall be prepared using ISA-S 5.1 symbols and notations. Process equipment symbols may be according to ANSI Y 32.11

9.1.2 Generally, the drawing requirements shall be fully in accordance with general instrument engineering requirement stated in IPS-E-IN-100.

9.1.3 The pressure instruments data sheets shall be based on ISA S20 forms. The attached data sheets are recommended to be used for design purpose.

In case that the Company's consultant engineers prefer to use their own standard data sheets, then all informations required on the attached data sheets shall be included in theirs as well.

9.1.4 In case that the forms presented for pressure instruments contain information about controller/recorders or instruments covered under other titles, they only apply to local type instruments.

APPENDICES

**APPENDIX A
STANDARD DATA SHEET FORMS**

A) Instructions for Data Sheets (Pressure Instrument)

A.1 Differential Pressure Data Sheets

- Tag number shall be indicated on form E-IN-110 #1 for single item . For multiple listing of the instruments with the same specification, secondary sheets shall be used. (form E-IN-110 #2).

- Item 1 Shall be checked for all functions which apply to the instrument.
- Item 2 Nominal size refers to approximate front of case dimensions; width × height.
- Item 3 Yoke refers to bracket designed for mounting the instrument on a pipe stand. Surface refers to bracket designed for mounting the instrument on a surface (back-panel or wall mounting) Flush refers to mounting into the front-panel by means of withdrawable brackets.
- Item 4 Specify chart’s size (if applicable, N.A. to transmitters).
- Item 5 Specify chart range and number (if applicable, N.A. to transmitters).
- Item 6 The scale type may be SEGMENTAL, ECCENTRIC, or DIAL (CIRCULAR).
Space is provided for multiple ranges on the same scale. (not applicable to transmitters).
- Item 7 Specify the type of chart drive if applicable.
- Item 8 One rotation of chart takes usually 24 hour, other speed also exist and should be listed in hours or days per wind. If a spring wound clock is used, fill in number of hours or days it runs between windings (not applicable to transmitters).
- Item 9 Specify electrical , pneumatic or any other source of power to the entire instrument from an external source.

* N.A. ≡ Not Applicable

- Item 10 Enclosure class refers to composite of instrument, If electrical contacts are in the case they must meet the classification of the area inherently or by reasons of the enclosure. Use either NEMA or IEC identification system.
- Item 11 The type of transmitter shall be specified.
- Item 12 The transmitter output shall be specified.
- Item 13 Refers to pertaining receiver instrument data sheet.
- Item 14 The type of controller shall be specified (if applicable).
- Item 15 See explanation of terminology given hereunder. For further definition refer to ANSI-C85-1 (1963) "Terminology for Automatic Control ".
(not applicable to transmitters).

P = Proportional (gain)
I = Integral (Auto Reset)
D= Derivative (Rate)
index: s= slow, f = fast

- Item 16 Specific ranges of control modes shall be listed here to, if applicable.
- Item 17 Shall be specified, if applicable.
- Item 18 For multiple items, the "Action" shall be specified on 3rd sheet prepared for controllers.
- Item 19 If standard auto-manual switching is not known or not adequate, number of positions shall be specified. (N.A. to transmitters).
- Item 20 - Remote set-point adjustment assumes full adjustment range. Specify limits if required. (Remote means usually set-point transmitted by a process control computer)
- Internal set-point adjustment refers to cascade controllers reside in a single control unit (i.e. digital controllers).
- External set point adjustment refers to cascade control strategy and shall be specified for secondary cascade controllers. Manual refers to usual controllers and shall be specified for all type of controllers. (N.A. to transmitters).
- Item 21 Shall be checked for cascade control strategy. The type of primary controller output shall also be specified (N.A. to transmitter).
- Item 22 Ratio setting shall be specified fixed or adjustable for ratio control strategy. In such circumstances, item 16 shall be marked as ratio control. In case that the ratio setting is specified as adjustable, the ratio band shall be specified under this item. (N.A. to transmitters).
- Item 23 Shall be specified if set-point adjustment is other than above mentioned types (N.A. to transmitters).
- Item 24 The function of differential pressure transmitter shall be checked.
- Item 25 Type of measuring element shall be checked.
- Item 26 Body and measuring element shall be specified.
- Item 27 Elevation or suppression requirement for the transmitter shall be checked.
- Item 28 Body rating of the transmitter shall be specified.
- Item 29 Differential range of the transmitter shall be specified.
- Item 30 Differential pressure transmitter impulse piping connection shall be specified. special flanged connections and extended diaphragms for level applications shall be described after "OTHER".
- Item 31 Overrange protection refers to maximum differential pressure that the instrument can withstand without a shift in calibration.
- Item 32 Differential range shall be checked as adjustable in suppression or elevation range applications. The amount of zero elevation or suppression shall be specified accordingly.
- Item 33 Shall be marked as many accessories as required to be supplied by the instrument vendor.
- thru 42
- Item 43 Switch form shall be checked accordingly. Rating refers to electrical rating of switch or contact in Amps. The alarm actuation shall be specified to be actuated by means of deviation from controller set point or measured variable. contact action shall be given if the switch is of SPST form type. (N.A. to transmitters).
- Item 44 Process data affecting meter selection must be given. Flow elements such as orifice plates are specified on separate data sheet forms discussed under flow instrument title.
- thru 48

Amendment sheets (E-IN-110 #2) - may be used for multiple instrument listing to list all instruments of the same type which are specified on the primary sheet , with all variations shown on amended sheet. The column marked as "Notes" refer to notes listed by number at the bottom of the sheet.

TAG. No.	CLIENT			SHEET No.	REV
	PROJECT			DATE	CONTRACT No.
	No.	BY DATE	REVISION	MANUFACTURER	
	Δ				
	Δ			P.o.	No.
	Δ				
	Δ			BY	CHK'D

DIFFERENTIAL PRESSURE INSTRUMENTS DATA SHEET	
<p>GENERAL</p> <p>1 FUNCTION RECORDER b INDICATOR b BLIND b CONTROLLER b TRANSMITTER b</p> <p>2 CASE TYPE MFR. STD. b MFR. COLOR b OTHER _____ NOM. SIZE _____ COLOR BLACK b OTHER _____</p> <p>3 MOUNTING FLUSH b SURFACE b YOKE b OTHER _____</p> <p>4 CHART SIZE 12 CIRC. b OTHER _____</p> <p>5 CHART RANGE _____ NUMBER _____</p> <p>6 SCALE RANGE _____ TYPE _____</p> <p>7 CHART DRIVE SPRING b ELECTRIC b OTHER b</p> <p>8 CHART SPEED _____ WIND _____</p> <p>9 V _____ D.C. _____ HZ./P.N b AIR PRESS. _____ OTHER _____</p> <p>10 ENCLOSURE CLASS GENERAL PURPOSE b I.S. b WEATHER PROOF b EX. PROOF b CLASS _____</p>	<p>STEPOINT ADJUSTMENTS</p> <p>20 MANUAL b INTERNAL b EXTERNAL b REMOTE b</p> <p>21 AUTO-SET b PNEUMATIC b ELECTRIC b</p> <p>22 BAND _____ FIXED b ADJUSTABLE b</p> <p>23 OTHER _____</p> <p>DIFFERENTIAL UNIT</p> <p>24 FLOW b LEVEL b DIFF. PRESSURE b</p> <p>25 MERCURY b BELLOWS b DIAPHRAGM b OTHERS _____ RANGE _____</p> <p>26 MATERIAL BODY _____ ELEMENT _____</p> <p>27 ELEVATION _____ SUPPRESSION _____</p> <p>28 BODY RATING bar (ga) _____ @°15 C</p> <p>29 DIFFERENTIAL RANGE _____</p> <p>30 DIFFERENTIAL CONN. NPT ¼ b ½ b OTHER _____</p> <p>31 OVERRANGE _____</p> <p>32 DIFF. RANGE FIXED b ADJ. RANGE _____ SETAT _____</p> <p>ACCESSORIES</p> <p>33 FILTER & REGULATOR _____</p> <p>34 AIR SUPPLY GAGE _____</p> <p>35 LOCAL INDICATOR _____</p> <p>36 CHARTS & INKSET _____</p> <p>37 MOUNTING YOKE _____</p> <p>38 PULSATION DAMPENOR _____</p> <p>39 MERCURY _____</p> <p>40 ISO. VALVE _____</p> <p>41 INTEGRATOR _____</p> <p>42 PRIMARY MEASURING ELEMENT _____ TYPE _____</p> <p>43 ALARM SWITCH OTY. _____ RATING _____ HERMETICALLY SEALED b SPST b DPDT b OTHER _____ FUNCTION MEAS VAR. b DEVIATION b CONTACT TO _____ ON INC. MEAS _____</p> <p>SERVICE CONDITIONS</p> <p>44 OPERATING PRESS bar (ga) _____ TEMP. _____ °C</p> <p>45 SPEC. GRAV/DENSITY @ 15°C _____ & _____ 1bar (abs)</p> <p>46 SEAL FLUID OR PURGE _____</p> <p>47 SPEC. GRAV/DENSITY @ F.T _____ & _____ bar (abs)</p> <p>48 FLANGE RATING & FACING _____</p>
<p>TRANSMITTER</p> <p>11 TYPE PNEUMATIC b ELECTRIC b INTELLIGENT b</p> <p>12 OUT PUT 0.2-1 bar b 4-20 mA b 30.50 mA. b OTHER _____</p> <p>13 RECEIVERS ON SHEET No. _____</p>	<p>CONTROLLER</p> <p>14 TYPE PNEUMATIC b ELECTRIC b DIGITAL b</p> <p>15 CONTROL MODE If b Df b P b Pi b PDb PDb Is b Ds b OTHER _____</p> <p>16 PB _____ % AUTO-RESET _____ RATE-ACTION _____ OTHER _____</p> <p>17 OUT PUT 0.2-1 bar b 4-20 mA b OTHER _____</p> <p>18 ON MEASUREMENT INCREASE OUT PUT: INCREASES b DECREASES b</p> <p>AUTO-MANUAL SWITCH</p> <p>19 No. POSITIONS _____ MFR. STD. b NONE b</p>
NOTES:	

A.2 Pressure Gage Data Sheets

- Item 1 When receiver gages are checked, the "Range" in the tabulation refers to the dial range.
- Item 2 Mounting style shall be checked accordingly.
- Item 3 Dial diameter shall be specified.
- Item 4 Dial color generally shall be specified to be white unless requirement dictates other colors.
- Item 5 Select case material and check appropriate box accordingly.
- Item 6 Specify the ring style.
- Item 7 Blow-out protection shall be specified. "Back" refers to a back gage blow-out. "DISC" refers to disc blow-out protection located in the back or side of the gage case.
- Item 8 Lens material shall be selected and checked accordingly.
- Item 9 Options:
- Type and Model number of snubbers shall be specified if required.
 - Material of the syphon shall be specified if required.
 - Movement dampening type shall be specified if required.
- Item 10 Check the appropriate element type or specify the type after "OTHER".
- Item 11 Check the appropriate element material or specify the required material. In case that stainless steel is required, the type shall be specified.
- Item 12 The socket material (wetted part) shall be checked among boxes or specified.
- Item 13 Connection size and type shall be specified.
- Item 14 Movement mechanism material shall be specified.
- Item 15 Nominal accuracy shall be checked as %, if better accuracy is required, then percentage shall be specified.
- Item 16 The type of diaphragm seal shall be specified, if required.
- Item 17 Make and model number in addition to manufacturer's name shall be specified based on completed specification sheets by vendor.

A.3 Pressure Switch Data Sheets

- Item 1 Tag number shall be specified. The form can be used for five switches with different tag numbers.
- Item 2 Type of function shall be specified as pressure, vacuum, compound or differential pressure .
- Item 3 Pressure setting shall be specified to be internal,external or dial adjustment type.
- Item 4 Service fluid shall be specified to be used for selecting wetted parts material.
- Item 5 Range of pressure element shall be specified.
- Item 6 Mounting to be specified.
- Item 7 Type of element shall be specified. The type may be Diaphragm, Bourdon, Bellows or other systems depending upon range and service condition.
- Item 8 Element material shall be specified either Bronze, Stainless steel, Alloy steel or other composite materials as applies to the process fluid and service condition.
- Item 9 Process connection size shall be specified. Connection type to be specified as either bottom or back connection.
- Item 10 Switch type shall be specified to be Mercury , snap action or other type as required.
- Item 11 Number of switches shall be specified as single or dual switches. Form of switch or switches shall be specified to be SPST, SPDT or DPDT form , in case of selecting snap action type.
- Item 12 Enclosure type shall be specified.
- Item 13 Number of electrical connection holes in the enclosure, size of entry and type shall be specified.
- Item 14&15 Voltage, type, current rating shall be specified for the switch.
- Item 16 Load type shall be specified to be inductive , resistive or capacitive .
- Item 17 Minimum Dead Band (Minimum differential) shall be specified.
- Item 18 Dead Band shall be specified to be fixed or adjustable.
- Item 19 Dead Band adjustment shall be specified to be either internally or externally adjustable.
- Item 20 Contact open or close shall be specified to be actuated by pressure increment or decrement.
- Item 21 thru 24 Service condition of the switch shall be specified.

	CLIENT			SHEET No.	REV
	PROJECT			DATE	CONTRACT No.
	No.	BY DATE	REVISION	MANUFACTURER	
	Δ				
	Δ			P.o.	No.
	Δ				
	Δ			BY	CHK'D

PRESSURE SWITCHES DATA SHEET									
GENEREL									
1	TAG. No.								
2	TYPE								
3	SETTING								
4	SERVICE								
5	RANGE								
6	MOUNTING								
PRESSURE ELEMENT									
7	TYPE								
8	MATERIAL								
9	CONN. SIZE	CONN. TYPE							
SWITCH									
10	TYPE								
11	QUANTITY	FORM	SINGLE DUAL						
12	ENCLOSURE	TYPE							
13	ELECTERICAL CONN SIZE & TYPE								
14	RATING: VOLTS	Hz OR	D.C						
15	AMPS	WATTS	KW						
16	LOAD TYPE								
17	MINIMUM DIFERENTIAL								
18	DIFF: FIXED	ADJUST.							
19	ADJUSTMENT: INT	EXT							
20	CON. TACTS:	OPEN CLOSE	ON PROC.	INCR DECR.					
SERVICE CONDITIONS									
21	TEMP: OPER.	MAX.							
22	PRESS: OPER.	MAX.							
23	TRIP POINT								
24	MANUFACTURERS MODEL No.								
NOTES:									

A.4 Pressure Instruments Data Sheets

- Tag number shall be specified for single item on form E-IN-110 # 7. For multiple listing of the instruments with the same specification, secondary sheets may be used (form E-IN-110 # 8).

- Item 1 Shall be checked for all functions which apply to the instrument.
- Item 2 Nominal size refers to approximate front of case dimensions; width × height. Type & color of the case shall also be specified.
- Item 3 Mounting:
- Yoke refers to bracket designed for mounting the instrument on a pipe stand.

- Surface refers to bracket designed for mounting the instrument on a surface (back-panel or wall mounting).

- Flush refers to mounting into the front panel by means of withdrawable brackets.
- Item 4 Number of points recording or indicating shall be specified for all local controllers and/or recorders. (if applicable).
- Item 5 Chart type shall be specified for local recorders. (if applicable)
- Item 6 Chart ranges for different recording pens shall be specified according to the recording channel number . (if applicable)
- Item 7 Scale ranges and type of scale shall be specified. Type of scale may be selected among SEGMENTAL , ECCENTRIC ,or DIAL (CIRCULAR) type. (if applicable)
- Item 8 Specify the type of recorder drive if applicable.
- Item 9 One rotation of chart takes usually 24 hours, other speeds also exist and shall be specified in hours or days per wind.
If a spring wound clock is used, fill in number of hours or days it runs between windings.
- Item 10 Specify electrical, pneumatic or any other source of power to the entire instrument from an external source.
- Item 11 Enclosure class refers to composite of instrument. If electrical contacts are in the case , they must meet the classification of the area inherently or by reasons of the enclosure. Use either NEMA or IEC identification system.
- Item 12 Type of transmitter shall be specified according to the design criteria.
- Item 13 The transmitter output shall be specified.
- Item 14 Refers to pertaining receiver instrument data sheet.
- Item 15 Type of local controller shall be specified.
- Item 16 Specific ranges of control modes shall be specified, if applicable.
- Item 17 Local controller output shall be specified.
- Item 18 Local controller "ACTION" shall be specified. For multiple items , it can be specified on a separate sheet.
- Item 19 If standard Auto-Manual switching is not known or not adequate , then number of positions shall be specified (if applicable).
- Item 20 - Remote set-point, shall be marked where the set-point signal arrives remotely.

Specify limits if required. (Remote means usually set-point transmitted by a process control computer).

- Internal, refers to the set-point knob located inside instrument enclosure.
- External, refers to the set-point knob located on outside surface of the enclosure.
- Manual, refers to manual set-point adjustment knob to be specified for all controllers except for cascade (Auto-set) type.

Item 21 Shall be checked for cascade control strategy . The type of primary controller output shall also be specified.

Item 22 Proportional band shall be specified as fixed or adjustable.

Item 23 See explanation of terminology given hereunder. For further definition refer to ANSI C85 -1 (1963), "Terminology for Automatic Control".

- P = Proportional (Gain)
- I = Integral (Auto-Reset)
- D = Derivative (Rate)

index: s = slow f= fast

Item 24 Element type shall be specified according to the service pressure and temperature.

Item 25 Element material shall be specified according to the standard requirements.

Item 26 Absolute pressure measuring requirement shall be specified for transmitters if applicable.

Item 27 Suppression range requirement shall be specified with quantity of static head compensation.

Item 28 Range of element shall be specified.

Item 29 Process connection of the instrument shall be checked.

Item 30 Body material and pressure rating shall be specified.

Item 31 thru 38 Required accessories to be supplied by the instrument vendor shall be specified.

Item 39 Service condition of the instrument shall be specified.

TAG No.	CLIENT			SHEET No.	REV	
	PROJECT			DATE	CONTRACT No.	
	No.	BY	REVISION	MANUFACTURER		
	Δ	DATE				
	Δ			P.o.	No.	
	Δ					
	Δ			BY	CHK'D	APPR'D
	Δ					

PRESSURE INSTRUMENTS DATA SHEET			
<u>GENERAL</u>		<u>PRESSURE ELEMENT</u>	
1	DESCRIPTION RECORDER b INDICATOR b BLIND b CONTROLLER b TRANSMITTER b	24	TYPE SPIRAL b BELLOWS b BOURDON b DIAPHRAGM b HELICAL b OTHER _____
2	CASE RECTANGULAR b CIRCULAR b OTHER _____	25	MATERIAL BRONZE b STAINLESS b STEEL b OTHER _____
3	COLOR BLACK b OTHER _____ MOUNTING FLUSH b SURFACE b YOKE b OTHER _____	26	ABSOLUTE PRESS. COMPENSATION _____
4	No. PTS. RECORDING _____ INDICATING _____	27	STATIC HEAD COMPENSATION _____ HEAD _____
5	CHART TYPE SIZE _____	28	RANGE _____ bar (ga) b mbar VAC. b bar (abs) b OTHER _____
6	CHART RANGE _____ NUMBER _____	29	CONNECTION HPT 1/4" b 1/2 b BACK b BOTTOM b OTHER _____
7	SCALE RANGE _____ TYPE _____	30	BODY MATERIAL _____ RATING _____
8	CHART DRIVE SPRING b ELECTRIC b PNEUM. b	<u>ACCESSORIES</u>	
9	CHART SPEED _____ WIND _____	31	FILTER & REGULATOR _____
10	V _____ EX. PRF. b AIR PRESS. _____ OTHER _____	32	AIR SUPPLY GAGE _____
11	ENCLOSURE; GEN PURP. b WEATHER-PROOF b EX. PROOF b PRESSURIZE b OTHER _____	33	LOCAL INDICATOR _____
<u>TRANSMITTER</u>		34	CHARTS & INKSET _____
12	TYPE PNEUMATIC b ELECTRIC b INTELLIGENT b	35	MOUNTING YOKE _____
13	OUT PUT 0.2-1 bar b 4-20 mA b 10-50 mA b OTHER _____	36	PULSATING DAMPENER _____
14	RECEIVERS ON SHEET No. _____	37	SYPHON _____
<u>CONTROL</u>		38	ALARM SWITCH _____ HERMETICALLY SEALED b EXPLOSION-PROOF b GENERAL-PURPOSE b
15	TYPE PNEUMATIC b ELECTRIC b DIGITAL b OTHER _____	<u>OPERATING CONDITIONS</u>	
16	PB _____ % AUTO-RESET _____ RATE ACTION _____ OTHER _____	39	PRESSURE, NORMAL _____ MAX. _____
17	OUT PUT Q 2-1 bar b 4-20 mA. OTHER _____		TEMPERATURE: NORMAL _____ MAX. _____
18	ON MEASUREMENT INCREASE OUTPUT: INCREASES b DECREASES b		FLUID _____
<u>AUTO MANUAL SWITCH</u>			SEAL FLUID _____ S.G. @ 15° C _____
19	No. POSITIONS _____ MFR. STD. b NONE b		
<u>SETPOINT ADJUSTMENTS</u>			
20	MANUAL b INTERNAL b EXTERNAL b REMOTE b		
21	AUTO-SET b PNEUMATIC b ELECTRIC b		
22	BAND _____ FIXED b ADJUSTABLE b OTHERS _____		
23	CONTROL MODE If b Df b P b PI b PD b PID b Is b Ds b OTHER _____		
NOTES:			

