MATERIAL AND EQUIPMENT STANDARD

FOR

PRESSURE INSTRUMENTS

CONTENTS :

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1. SCOPE

This standard covers the minimum requirements for pressure field instruments as well as pressure calibration instruments to be applied in Iranian 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 specfied 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 mutually agreed upon by the Company and the Vendor.

ANSI (AMERICAN NATIONAL STANDARD INSTITUTE)

ANSI/ASME B40.1	"Gages-Pressure Indicating Dial Type Elastic Element 1985"

ANSI/UL (AMERICAN NATIONAL STANDARD INSTITUTE/UNDERWRITER LABORATORIES)

ANSI/UL-1739	"Pilot Operated Pressure Control Valves for Fire Protection Service
ANSI-B 93.13	"Pneumatic, Industrial Type, Pressure Regulators"

ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

A193/A193M-78	"Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service"

BSI (BRITISH STANDARD INSTITUTION)

BS 1780-85	"Specification for Bourdon Tube Pressure and Vacuum Gages 1985"
BS 3127-85	"Specification for Ferrous and Non-Ferrous Bourdon Tubes 1985"
BS 6447-84	"Specification for Absolute and Gage Pressure Transmitters with Electrical Outputs 1984"
BS 6147-82	"Differential Pressure Transmitter with Electrical Outputs 1982"
BS 6134-81	"Specification for Pressure and Vacuum Switches 1981"
BS 3016	"Pressure Regulators (Liquid Petroleum Gases) 1983"

DIN (DEUTSCHES INSTITUTE FUR NORMUNG Ev.)

DIN 16005	"Accuracy Classes for Pressure Gages"
DIN 16064	"Classes 1.0, 1.6 and 2.5 Bourdon Tube Pressure Gages with 80 mm, 100 mm, 160 mm, and 250 mm Case Diameter; Dimensions and Nominal Ranges."
DIN 16123	"Indicating Ranges, Spacing of Scale Marks and Numbering of Pressure Gages; Summary of Graduation for Instruments Class 0.6, 0.3, 0.2."

CENELEC (EUROPEAN STANDARD COMMITTEE FOR ELECTRICAL APPARATUS)

EN-50.018	"Flameproof Enclosure (d)"

IEC (INTERNATIONAL ELECTROTECHNICAL COMMISSION)

IEC-529	"Ingress Protection for Electrical Apparatus"

ISA (INSTRUMENT SOCIETY OF AMERICA)

S37.3	"Specification and Test for Strain Gage Pressure Transducer"
S37.6	"Specification and Test for Potentiometric Pressure Transducers."

NEMA (NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION)

NACE (NATIONAL ASSOCIATION OF CORROSION ENGINEERS)

MR-0175	"Sulfide Stress Cracking Resistant Metallic Material for Oil Field Equipment"

NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)

# 70	"National Electrical Code (NEC)"

SAMA (SCIENTIFIC APPARATUS MAKERS ASSOCIATION)

PMC 33.1	"Electromagnetic Susceptibility of Process Control Instrumentation 1978"
PMC 31.1	"Generic Test Methods for the Testing and Evaluation of Process Control Instrumentation 1980"

UL (UNDER-WRITER LABORATORIES)

UL 204	"Standard for Indicating Pressure Gages 1979"
UL 404	"Indicating Pressure Gages for Compressed Gas 1979"

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-M-IN-100	"Material and Equipment Standard; General"

3. UNITS

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

All dimensions and ratings shall be metric. (See IPS-E-GN-100). Except for the temperature, which shall be in degrees celsius instead of kelvin, and for pipes and fittings threads, which shall be in inches of NPT.

4. PRESSURE GAGES

Pressure element for pressure gages shall be generally bourdon tube type and shall fulfil the requirements set forward in BS 3127-1985.

The tube for Ranges up to 40 bar may be covered by C type bourdon tubes whereas higher ranges may use suitable helical bourdon tubes.

All types of pressure gages shall generally meet the following requirements.

4.1 Pressure, Differential Pressure and Draft Dial Gages

4.1.1 Standard gages

4.1.1.1 Pressure gage dial sizes shall generally be 63/100/150 mm as specified in specific job requirements.

4.1.1.2 Guaranteed gage accuracy shall be within ±0.5% of the full scale.

For vacuum and compound gages, the vendor shall quote his standard high accuracy gages.

4.1.1.3 Over-pressure protection

Pressure elements shall be capable of withstanding an intermittent over-ranging up to 1.3 times of the maximum scale reading for up to range 160 bar and 1.2 for other ranges, without shifting the calibration more than 1% of the scale range.

Over-range stops shall be provided for the above specified over-range limit.

4.1.1.4 Bourdons, sockets, and tips

Bourdon tubes shall be welded to the socket and tip, and shall be stress relieved as required. Unless otherwise specified, 316 stainless steel shall be used for bourdon, socket and tip material.

The measuring element shall be of bronze alloys for corrosive utilities.

For sea-water services, 316L stainless steel or monel shall be used for bourdon, socket, and tip material.

For other corrosive applications, reference shall be made to NACE-MR-0175.

4.1.1.5 Movements

Movement mechanism for all gages shall be made of (hardened) stainless steel.

4.1.1.6 Cases

Gages shall be solid front type with cast aluminum alloy or brass cases for bronze bourdon tubes, or with cast or stainless steel cases as specified in specific data sheets. The cases shall be screwed ring (face-plate) type and shall be vapor tight and weather-proof.

The glass shall be held in face-plate between gaskets by a screwed metal retainer ring and shall be shatter proof.

4.1.1.7 Blow-out protection

Gages shall have a blow-out disc and safety glass, and shall meet the following requirements:

a) Surface-mounted gages shall have a rubber grommet blow-out disc located in the lower side of the case.
b) Flush-mounted gages shall have a rubber grommet blow-out disc located in the back of the case.
c) Direct mounted gages shall have a rubber grommet blow-out disk located in the back of the case.

4.1.1.8 Calibration

All gages shall be equipped with screw driver slot type adjustment for calibration purposes.

4.1.1.9 Weep holes

Weep holes shall be provided on the case bottom for all gages located in humid areas, unless the case has already sufficient ventilation.

4.1.1.10 Dials

Dials shall be white, non-rusting metal or plastic, with black figures. Pointers shall be adjustable without removing them from their shafts.

4.1.1.11 Mounting and connections

a) Surface-mounted, direct connected gages shall have ½" NPT bottom connection, as requested in individual data sheets, with wrench flats, except for chemical seal type.

b) Flush-mounted direct connected gages shall have ½" NPT back connection, as requested in individual data sheets, with wrench flats.

4.1.1.12 Standard ranges

The standard ranges for the pressure gages are as follows:

a) Pressure

0-1, 0-1.6, 0-2.5, 0-4.0, 0-6, 0-10, 0-16, 0-25, 0-40, 0-60, 0-100, 0-160, 0-250, 0-400, 0-600, 0-1000 barg.

b) Vacuum

- 1.0 to 0.0 bar. g.

c) Compound

- 76 mm-Hg to 0.0 to +1.50 bar g
- 76 mm-Hg to 0.0 to +3.00 bar g
- 76 mm-Hg to 0.0 to +5.00 bar g
- 76 mm-Hg to 0.0 to +9.00 bar g

4.1.2 Absolute pressure gages

4.1.2.1 Item 4.1.1.1 through 4.1.1.11 shall be applied herein.

4.1.2.2 Accuracy

Guaranteed gage accuracy shall be better than ±0.5% of the full scale.

4.1.2.3 Pressure elements

Absolute pressure elements shall be automatically compensated for changes in barometric pressure.

4.1.3 Diaphragm-sealed pressure gages

4.1.3.1 Construction

The bottom section shall be removable for cleaning. The entire system above the diaphragm, including the element, shall be evacuated and entirely filled with an inert liquid.

Gages with diaphragm seals shall have capillary bleeder.

4.1.3.2 Items 4.1.1.1 through 4.1.1.12 with exception of 4.1.1.2 and 4.1.1.11 shall be applied herein as well.

4.1.3.3 Accuracy

Guaranteed gage accuracy shall be ± 0.5% or better.

4.1.3.4 Process connections

The process connections shall be ½" NPT screwed bottom connection.

4.1.4 Draft gages

4.1.4.1 Application

Draft gages shall be provided for the fired heaters' draft measurement or as specified in individual data sheets.

4.1.4.2 Construction

a) Draft gages shall be o-ring type and grouped into the manifold system for stream selection.
b) Draft gages shall be semi-flush mounting type.

4.1.4.3 Standard ranges

Unless otherwise specified in individual data sheets, the ranges of the draft gages shall be as follow:

- 25.0 to 0.0 + 25.0 mm-H_2O

4.1.4.4 Accuracy

Guaranteed gage accuracy shall be within 3% of the scale range.

4.1.4.5 Scale

Scale size shall be 55 mm by 273 mm or larger.

4.1.4.6 Marking

Scale markings shall be black numbers on white background.

4.1.4.7 Element

Elements shall be diaphragm type or equal.

4.1.4.8 Protection

Bezel glass shall be provided for draft gages' protection.

4.1.5 Receiver gages

4.1.5.1 Application and ranges

Pneumatic receiver gage elements shall be calibrated to read zero at 0.20 barg and full-scale at 1.0 barg.

Receiver dials for temperature and pressure shall be graduated to match with the ranges of the pertinent pneumatic transmitters.

Receiver gages for flow shall be scaled for 0-10 square and 0-100 linear.

Receiver gages for temperature, pressure and level shall be scaled 0 100 linear.

4.1.5.2 Local receiver gages shall be surface mounted type with dial size of 100 or 125 mm.

4.1.5.3 Pneumatic receiver gages shall have ¼" NPT bottom connection, with wrench flats.

4.1.5.4 Bronze bourdon and brass socket and tips shall be utilized for receiver gages.

4.1.5.5 Item 4.1.1.1, 4.1.1.2, 4.1.1.6 (b), 4.1.1.8 and 4.1.1.10 shall be applied herein as well.

4.1.6 Accessories

4.1.6.1 Gage siphons

a) Compact gage siphons shall be supplied by the vendor, where specified in individual data sheets.
b) Siphons shall be of ½" seamless schedule 80 (minimum) steel pipe, coiled siphon is preferable to pigtail type.

4.1.6.2 Pulsation dampeners

Dampeners shall have ½" NPT connections and shall be externally adjustable type. Body material shall be 316 stainless steel or as specified in individual data sheets.

4.1.6.3 Excess flow check valves

Excess-flow check valves shall have ½" NPT inlet and outlet connection to match the specified gage in individual data sheets.

Material of construction shall be 316 stainless steel for body, ball and retainer or as specified in individual data sheet.

4.1.7 Tag-plates

The tag-plates made of stainless steel shall be provided for the gages, fastened to them with stainless steel wires. The size of tagplates shall be 75 mm by 15 mm and details engraved on them shall be as follows:

- Tag-number
- Range limits
- Manufacturer model and serial number

4.2 Manometers

4.2.1 Construction

4.2.1.1 U-tube or cistern type manometers shall generally be mercury or water type.

4.2.1.2 the meter shall be made of U-shaped uniform calibrated glass, mounted on lacquered wood or steel painted panels, suitable for wall or panel mounting.

4.2.2 Scales

4.2.2.1 Scales shall be calibrated and marked in millimeters with central zero for U-tube or bottom zero for cistern type.

4.2.3 Adjustment

The zero adjustment shall be micrometer type provided on the meter assembly.

4.2.4 Range

The maximum range shall be 0-1500 mm unless otherwise specified. The manometer standard ranges shall be as follows:

0-100, 0-200, 0-300, 0-400, 0-600, 0-800, 0-1000, 0-1500 mm.

4.3 Standard Pressure Calibrator

4.3.1 Dead weight tester

Dead weight tester shall be of conventional type with handwheel operated pressure pump. Tester accuracy shall be better than +0.03% and the calibrating weighs range shall be suitable for pressure ranges in accordance with DIN 16123. The manufacturer standard weighs shall be provided with the instrument.

4.3.2 Hydraulic gage comparator tester

The hydraulic gage tester shall be portable and comprise of a screw-type plunger pump, and oil reservoir and two gage connections to compare the test gage with the gage under calibration. The tester shall be provided complete with all test gages in the ranges of 0-60 up to 0-1000 bar.g in accordance with BS 1780.

The test gage accuracies shall be 0-1% of full scale.

The dial gages diameter shall not be less than 150 mm.

5. PRESSURE TRANSMITTERS

5.1 Pneumatic Pressure Transmitters

5.1.1 Pneumatic pressure transmitters shall normally be force-balance type. Motion balance type may be considered in special cases with Company approval.

5.1.2 Wetted parts material including pressure elements shall normally be made of ANSI 316 stainless steel unless otherwise specified in related data sheet. Instrument case and cover shall be made of high resistance materials.

5.1.3 The transmitter accuracy shall not exceed ± 0.5% of span of the instrument.

5.1.4 Repeatability of the transmitter shall be better than 0.1% of the span.

5.1.5 The operating temperature range of the transmitter shall be -40°C to 120°C.

5.1.6 Enclosure classification shall meet minimally IEC 529, IP-53 or NEMA Type 3.

5.1.7 The supply and output connection of the transmitter shall be ¼" NPT.

5.1.8 The output signal of the transmitter shall be in 0.2 to 1 barg range.

5.1.9 Range shall be adjustable between 0-800 bar by means of replacing range element.

5.1.10 The process connection shall be ½" NPT.

5.1.11 The transmitter shall be supplied with a stainless steel nameplate fastened to the casing by stainless steel screws. The following information shall be engraved on the nameplate:

- Company's assigned tag-number
- Manufacturer's name, model and serial number
- Maximum working pressure
- Operating range limits

5.1.12 The transmitter mounting shall be implemented by means of DN50 (2") vertical or horizontal pipe bracket. All mounting accessories shall be provided with the instrument.

5.2 Electronic Pressure Transmitters

5.2.1 Electronic pressure transmitters shall be solid state electronic type preferably using capacitance pick-up cells for measurement.

5.2.2 Wetted parts including sensing elements shall normally be of AISI 316 stainless steel except where the process condition requires other materials as specified in data sheets. The material employed in special services may be selected according to the application from; SS-316L, Tantalum, Monel, Hastelloy C, or Cobalt-nickel-chrome alloys according to NACE MR-0175.

5.2.3 The transmitter accuracy shall be better than 0.4% of the span of instrument.

5.2.4 Repeatability of the transmitter shall be better than 0.1% of the span.

5.2.5 The operating temperature range of transmitter shall be -40°C to +85°C.

5.2.6 Enclosure classification shall meet IEC 529, IP 65 or NEMA type 4X for Non-classified areas. For classified applications, the instrument shall be certified for relevant area classification by U.L, BASEEFA, FM, CSA, PTB according to CENELEC EN-50.018 'd' or NEC as may be applicable.

5.2.7 Transmitter drift shall be less than 0.1% of span over a 6 month period.

5.2.8 Sensor fill fluid shall be silicon oil. Fluorinert may be used for special services when specified in individual data sheets.

5.2.9 The electrical entrance to the transmitter shall be made by means of threaded conduit or glands. The entrances shall be suitable for PG-13.5 conduits or M20 gland.

5.2.10 The output signal of the transmitter shall be 4-20 mA. d.c.

5.2.11 Instrument case and cover shall be made of high resistance materials.

5.2.12 Process connection of the transmitter shall be ½" NPT unless flange connections are specified in data sheets.

5.2.13 Transmitter shall be equipped with an integral indicating gage. The indicator shall read the whole span of the instrument with ± 2% FSD accuracy.

5.2.14 The electrical connection to the transmitter shall be made by means of high quality screw terminals, suitable to accept up to 2.5 mm^2 wires.

5.2.15 The transmitter shall be equipped with suitable test jack to measure the loop current for on-line calibration.

5.2.16 Drainage facility shall be provided on the body of the instrument.

5.2.17 The transmitter shall generally fulfil the requirements set forward in BS 6147 and BS 6447 (latest edition).

5.2.18 Mounting shall be implemented by means of DN50 (2") vertical or horizontal pipe bracket. All mounting accessories shall be provided with the instrument.

5.3 Intelligent (Smart) Pressure Transmitters

5.3.1 Intelligent pressure transmitters shall be micro-processor based electronic device using conventional capacitance pick-up cell sensors preferably.

5.3.2 The digital technology used in the transmitter shall be of a type and make to ensure good performance and reliability and shall be of a design to be simply convertible to conventional transmitter.

5.3.3 The transmitter shall provide remote communication capability with adequate interface between the field and control room.

5.3.4 In addition to remote calibration feature by means of remote transmitter interface device, the transmitter shall be equipped with local span and zero push buttons for convenient re-ranging of the transmitter at site.

5.3.5 The output signal of the transmitter shall be 4-20 mA. d.c. with other data super-imposed on 4-20 mA. d.c. signal for control system interface. The internal impedance of the transmitter shall meet the requirements specified in individual data sheets.

5.3.6 The intelligent (smart) transmitter shall be capable to receive super-imposed digital communication signal on the 4-20 mA line for interrogation and diagnostics without interruption of the transmitter's signal to the control system.

5.3.7 The transmitter shall be capable to be remotely interrogated, tested, or reconfigured from the control room by means of remote transmitter interface device, or the control system transmitter interface dedicated console.

5.3.8 The transmitter digital electronics shall have a non-volatile EEPROM memory to be used for storing the configuration data and sensor linearization data. This data must be retained in the transmitter when power is interrupted so that the transmitter to be functional upon power-up.

5.3.9 The process variable shall be stored as digital data in the transmitter, enabling precise corrections and engineering unit conversion made in the transmitter by digital electronic circuitry.

5.3.10 The communication protocol of the transmitter shall be compatible with control system employed in the plant to provide full capability of the transmitter to the system.

5.3.11 The turn-down ratio of the transmitter shall be at least 6:1.

5.3.12 The transmitter shall be of self-diagnostics type to detect transmitter failure, the default situation should be alerted to the control system by driving analog signal either bellow 4 mA. d.c. or above 20 mA. d.c.

5.3.13 The turn-on time of the transmitter shall be less than 2.0 seconds after power-up of the instrument.

5.3.14 The pressure element shall be AISI 316 stainless steel unless otherwise specified in data sheets.

5.3.15 Drainage facility shall be provided on the body of the instrument.

5.3.16 Process flanges and adapters of the transmitter (if specified with flange mounting in data sheets) shall be of AISI 316 stainless steel material.

5.3.17 Sensing element fill-fluid shall be silicon oil. Flourinert fluid may be used for special services when specified in individual data sheets.

5.3.18 The transmitter accuracy shall be better than 0.4% of calibrated span including the effects of linearity, hystersis, and repeatability.

5.3.19 Output drift of the transmitter shall be better than 0.5% of upper range limit measured over a period of 6 mounths.

5.3.20 The transmitter shall be equipped with an integral indicator.

5.3.21 Vibration effect shall be better than 0.1% of upper range per G up to 200 Hz in any axis, in accordance with SAMA PMC 31.1.

5.3.22 EMI/RFI effect for interferences shall be 1% of span in accordance with SAMA PMC 33.1 standard. (in the range of 20 to 1000 MHz with field strength upto 30 V/m).

5.3.23 The operating temperature range of the transmitter shall be -40°C to +85°C.

5.3.24 Enclosure housing (electronics) shall conform with IEC 529/IP 65 and NEMA type 4X minimally for non-classified areas. Enclosure for classified area applications shall be of certified type suitable for relevant electrical classification by UL, BASEEFA, FM, CSA, PTB, JIS according to CENELEC-EN 50.018 'd' or NEC as may be applicable.

5.3.25 Instrument case and cover shall be made of high resistance materials such as low-copper die-cast aluminum.

5.3.26 Operational humidity limit for the transmitter shall meet the requirement set forward in SAMA PMC 31.1 (Section 5.2).

5.3.27 Output of the transmitter shall be equipped with suitable damping system to adjust the step response time of the transmitter between 0 up to 20 seconds. The normal time constant of the transmitter shall be better than 0.4 seconds.

5.3.28 Process connection of the transmitter shall be ½" NPT unless flange connection is specified in data sheets.

5.3.29 Electrical entrance to the transmitter shall be made by means of PG-13.5 threaded conduits or M20 glands.

5.3.30 Electrical connection to the transmitter shall be made by means of high quality screw terminals suitable to accept 2.5 mm^2 wires.

5.3.31 Mounting of the transmitter shall be implemented by means of DN50 (2") vertical or horizontal pipe bracket. All mounting accessories shall be provided with the instrument.

5.3.32 Transmitter shall be equipped with suitable test jack for online measurement of current loop.

5.3.33 The internal impedance of the transmitter shall be in accordance with the pertinent data sheet requirements.

5.3.34 The transmitter shall be supplied with a stainless steel nameplate fastened to the instrument by S.S.-316 screws. The following information shall be engraved on the nameplate:

- Company's assigned tag-number.
- Manufacturer's name, model and serial number.
- Pressure rating of pressure holding parts.
- Electrical classification certificate code and certifying organization.
- Operating range.
- Calibrated range.

5.3.35 All obligations set forward in item 10 herein including supply of hand held calibrator shall be foreseen in vendor's proposal.

6. DIFFERENTIAL PRESSURE TRANSMITTERS

6.1 Pneumatic Transmitters

6.1.1 The following items shall be applied herein as well:

5.1.1. through 5.1.15 with exception of 5.1.12.

6.1.2 Hystersis of the transmitter shall be better than 0.1% of span.

6.1.3 Range shall meet the requirements of data sheets. The vendor shall quote his standard ranges with his bid proposal/quotation.

6.2 Electronic Differential Pressure Transmitters

6.2.1 The following items shall be applied herein as well:

5.2.1 through 5.2.17 and 6.1.2 and 6.1.3.

6.2.2 The transmitter shall generally comply with BS 6147.

6.3 Smart Differential Pressure Transmitters

6.3.1 The following items shall be applied herein as well:

5.3.1 through 5.3.29 with exception of 5.3.11, 5.3.16 and 5.3.19

6.3.2 The temperature drift due to ambient variations shall be limited within 0.4% of span per 28°C.

7. PRESSURE SWITCHES

7.1 Pressure/vacuum Switches

The switch assembly shall generally comply with BS 6134.

7.1.1 The pressure and vacuum switches shall be of bourdon tube, bellows, piston-actuated or diaphragm type depending upon the service and pressure as specified in data sheets.

7.1.2 Unless otherwise specified in data sheets, all wetted parts of the switch shall be made of AISI 316 stainless steel.

7.1.3 The pressure set-point of the switch shall be adjustable over the range of instrument preferably by means of an adjusting nut, with locking provision.

7.1.4 Calibration scale shall be provided in the switch to indicate exact set-point setting of the switch.

7.1.5 The switch enclosure shall be made of high resistance materials such as die-cast aluminum conforming to IP 65 (IEC 529) and NEMA 4X for non-classified area applications.

7.1.6 The switch enclosure for classified area application shall be of certified type, suitable for relevant electrical classification by one of the following agencies as may be applicable:

UL, BASEEFA, FM, CSA, JIS, PTB.

7.1.7 Process connection of the switch shall be ½" NPT with internal tapered pipe thread, unless otherwise specified in data sheets.

7.1.8 The accuracy of the pressure switch assembly shall be better than 1.0% of the calibrated span.

7.1.9 Vibration shall have no effect on the pressure switch action at 5g (30 to 500 Hz) according to SAMA PMC 31.1, if applicable.

7.1.10 The switch type shall generally be DPDT with 10A rating at 110 V a.c. unless otherwise specified in data sheets.

7.1.11 The electrical entrance to the instrument shall be made by means of PG 13.5 conduits or M20 glands, internally threaded. The termination shall be made by means of high quality screw terminals suitable to accept two 2.5 mm^2 wires in each slot.

7.1.12 Mounting of the switch in the field shall be implemented either by DN50 (2") pipe bracket or wall mounting case with bottom pressure connection as specified in data sheets.

All mounting accessories shall be provided with instrument.

7.1.13 Operating temperature range of the switch assembly shall be -40°C to +85°C unless otherwise specified in data sheets.

7.1.14 The pressure/vacuum switch shall be provided with a stainless steel nameplate permanently fastened to the instrument. The following information shall be engraved on the nameplate:

- Company's assigned tag-number.
- Manufacturer's name, model, and serial number.
- Maximum working pressure.
- Operating range.
- Contact ratings.
- Materials of parts exposed to process fluid.
- Electrical classification and certification agency name and code.

7.2 Differential Pressure Switches

7.2.1 The differential pressure switches shall be of opposing sealed diaphragm or piston type.

7.2.2 All wetted parts of the switch shall be made of AISI 316 stainless steel unless otherwise specified in data sheets.

7.2.3 The pressure set-point of the switch shall be adjustable over the range of instrument preferably by means of an adjusting nut. The adjustment mechanism shall be equipped with suitable locking device.

7.2.4 Calibration scale shall be provided in the switch to indicate exact set-point setting of the switch.

7.2.5 The switch enclosure shall be made of high resistance materials such as die-cast aluminum conforming to IP 65 (IEC 529) or NEMA 4X for non-classified area application.

7.2.6 The switch enclosure for classified area application shall be of certified type, suitable for relevant electrical classification by one of the following agencies as may be applicable:

UL, BASEEFA, FM, CSA, PTB, JIS.

7.2.7 Process connection of the switch shall be ½" NPT with internal tapered pipe thread, unless otherwise specified in data sheets.

7.2.8 The accuracy of the differential pressure switch assembly shall be better than 1.0% of the calibrated span.

7.2.9 Vibration shall have no effect on the differential pressure switch action at 5G (30 to 500 Hz) according to SAMA PMC 31.1.

7.2.10 The switch type shall be DPDT with 10 Amp. rating at 110 V a.c.

7.2.11 The electrical entrance to the instrument shall be made by means of PG 13.5 conduits or M20 glands, internally threaded. The termination shall be made by means of high quality screw terminal suitable to accept two 2.5 mm^2 wires in each slot.

7.2.12 Mounting of the switch in the field shall be implemented either by DN50 (2") pipe bracket or wall mounting case. All mounting accessories shall be provided with the instrument.

7.2.13 The operating temperature range of the switch assembly shall be -40°C to +85°C unless otherwise specified in data sheets.

7.2.14 The differential pressure switch shall be provided with a stainless steel nameplate permanently fastened to the instrument. The following information shall be engraved on the nameplate:

- Company's assigned tag-number.
- Manufacturer's name, model, and serial number.
- Maximum working pressure.
- Operating range.
- Contact ratings.
- Materials of parts exposed to process fluid.
- Electrical classification and certification agency name and code.

8. PNEUMATIC LOCAL PRESSURE CONTROLLERS

8.1 Pneumatic local controllers shall be preferably of force balance type with direct connection to the process variable.

8.2 The controller shall be equipped with an internal bumpless Auto/Manual transfer switch mounted preferably inside the enclosure.

8.3 All controllers shall be easily reversible and have manufacturer's standard range of control functions nearest to those specified in data sheets.

8.4 A set-point adjustment knob shall be mounted inside the case of the controller.

8.5 Pressure instrument measuring elements shall be bourdon tube, spiral, helix, bellows, or diaphragm type depending upon the service and pressure as specified in data sheets.

8.6 Measuring element shall be hardened type AISI 316 stainless steel unless otherwise specified in data sheets according to process fluid requirement.

8.7 The controller shall provide the following control modes as specified in data sheets:

- On / Off.
- Proportional with at least 4 to 400% proportional band range.
- Proportional-plus-derivative with at least 0.05 to 50 minutes per cycle derivative time.
- Proportional-plus-integral (reset) with at least 0.01 to, 50 minutes per cycle integral time.
- Proportional-plus-integral-plus-derivative.
- Differential gap with 1 to 100% gap range.
- Anti reset wind-up.

8.8 Ambient temperature limits of the controller shall be in the range of -40°C to +85°C.

8.9 The accuracy of the controller shall be better than 1% of calibrated span.

8.10 The repeatability of the controller shall be better than 0.2% of span.

8.11 The enclosure shall be of case and door type and shall be made of superior corrosion resistance materials suitable for shock resistance existing in the plant environments. The door shall have a shatterproof polycarbonate window (to observe process variable, setpoint, etc.) not damaging by ultra-violet radiations. The door shall be equipped with a tamper proof door knob. The overall construction of the enclosure shall be weatherproof meeting IP54 (IEC 529) and shall provide environmental protection according to NEMA Type 4.

8.12 The controller scale shall be of 150 mm length preferably and shall have black markings on a white background.

8.13 The accuracy of the controller shall be unaffected by mounting.

8.14 The controller measuring element mounting shall be from bottom. The process connection shall be ½" NPT internally threaded. The air connection for supply and output shall be ¼" NPT (F).

8.15 The controller shall be suitable to be mounted on panel, surface, stand pipe, yoke, vertically. Pipe and yoke mounting will be implemented by means of DN50 (2") pipe. All mounting accessories shall be provided with the controller for the installation as specified in data sheets.

8.16 The local pressure controller shall be provided with a stainless steel nameplate permanently fastened to instrument. The following information shall be engraved on the nameplate:

- Company's assigned tag-number.
- Manufacturer's name, model, and serial number.
- Controller action.
- Controller mode.
- Maximum working pressure.

8.17 The controller shall be equipped with supply and output pressure gage with accuracy of ±2% of the range.

8.18 Following optional apparatus may be supplied with controller according to the requirements in data sheets.

- Air set (filter/regulator).
- Remote set point facility.

9. PNEUMATIC FILTER/REGULATORS

The pressure regulators shall generally fulfil the requirements set forward in BS 3016 and ANSI/UL 144, as applicable.

9.1 Pneumatic filter regulators shall be small volume regulators providing constant reduced pressure to pneumatic instrumentation or any other equipment.

9.2 Body size and end connection shall be ¼" NPT(F).

9.3 The regulator shall have a body side connection suitable to accept an outlet pressure gage. The connection shall be ¼" NPT.

9.4 The outlet pressure of the regulator shall be adjustable by means of an adjustable spring with an adjusting knob or screw.

9.5 The maximum inlet pressure of the regulator shall be in the range of 17 bar. g.

9.6 The outlet pressure range of the regulator shall be 0.2 to 7.0 bar. g.

9.7 The body and spring case of the regulator shall be made of diecast aluminum as specified in individual data sheets.

9.8 The regulator shall be suitable for vertical installation and should have drainage valve for removal of entrapped liquid.

10. SHOP TESTS

The instruments specified herein shall be subject to shop tests as outlined in test and inspection standard IPS-M-IN-100 and any specific project requirements, as specified.

11. SPARE PARTS AND SPECIAL TOOLS

The instruments ordered under this Standard Specification shall fulfil the following requirements:

11.1 Spare Parts

11.1.1 Construction, precommissioning and commissioning spare parts will be purchased together with the equipment. Vendor shall recommend item and quantities of spare parts in his bid proposal/quotation.

11.2 Special Tools

The vendor shall supply all special tools necessary for the main and auxiliary equipment for installation, precommissioning, commissioning and maintenance.

12. INDIVIDUAL DATA SHEETS

The vendor is requested to complete the data marked as "by-vendor" in the data sheets. The vendor shall submit the completed data sheets with his bid proposal/quotation.

13. SCHEDULE OF TECHNICAL INFORMATIONS

Documents listed below shall be supplied in the quantities indicated herein or as defined in the order and contract. Anyhow the quantities indicated here shall be considered as minimum.

DESCRIPTION	WITH BID	WITH ORDER
DESCRIPTIVE LITERATURE	YES (3 COPIES)	___
COMPLETED DATA SHEETS	YES "	___
PARTS LIST	YES "	10 COPIES
SPARE PARTS LIST	YES "	___
ERECTION MANUAL	___	10 COPIES
OPERATING MANUAL	___	10 COPIES
MAINTENANCE MANUAL	___	10 COPIES
ELECTRICAL CERTIFICATES	YES	6 COPIES
CODE COMPLIANCE CERTIFICATES	___	6 COPIES
TEST CERTIFICATE	___	* 6 COPIES
MATERIAL ANALYSIS CERTIFICATE		* 6 COPIES

*** Items marked will be provided two weeks after positive testing.**

14. PACKAGING

Packaging shall be in accordance with packaging, handling, storage standards (Standard No. IPS-M-IN-100).