MATERIAL AND EQUIPMENT STANDARD

FOR

RECEIVING INSTRUMENTS

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1. SCOPE

This Standard covers the general specifications required for the receiving instruments, such as controllers, recorders, indicators, integrators, etc., both pneumatic and electronic. It is intended to be used in oil, gas, and petro-chemical industries.

2. REFERENCES

Throughout this Standard the following standards and codes are referred to. The edition 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 mutually agreed upon by the Company and the Vendor/Consultant.

BSI (BRITISH STANDARDS INSTITUTION)

BS 1780:Part 2	"Bourdon Tube Pressure and Vacuum Gages"
BS 1794	"Chart Ranges for Temperature Recording Instruments"
BS 3693	"The Design of Scales and Indexes on Analogue Indicating Instruments"

ANSI (AMERICAN NATIONAL STANDARD INSTITUTE)

B 2.1	"Pipe Threads"
B 40.1-1974	"Gages: Pressure and Vacuum Indicating Dial Type Elastic Element"

DIN (DEUTSCHES INSTITUTE FÜR NORMUNG)

43 718	"Panel and Racks"

IEC (INTERNATIONAL ELECTROTECHNICAL COMMISSION)

IEC-297.1	"Dimensions of Mechanical Structures of the 482.6 mm (19 in) Series Racks" Part 1: Panels and Racks 3rd Edition-1986

IPS (IRANIAN PETROLEUM STANDARDS)

M-IN-100/1	"General-Factory Inspection and Testing of Instruments and Instrument Systems"
M-IN-120	"Material Standard for Temperature Instruments"

3. UNITS

This Standard is based on International System of Units (SI), except where otherwise specified.

4. CONTROLLERS AND CONTROL MODES

4.1 Receiver/controllers shall have a graduated set point which is accurate within ±0.5% of the scale range.

4.2 The number of control terms shall be appropriate to the application.

4.3 Controllers shall have an adjustable proportional action which should include the range of 1% and 500% of span.

4.4 When adjustable integral action time is provided, the adjustment shall include times from 0.01 to 50 minutes per repeat .

4.5 Integral action desaturation shall be provided, if required.

4.6 When derivative action is provided, the adjustment shall include, times from 0.01 to 50 minutes.

4.7 All controllers, shall include an automatic-to-manual facility accessible from the front of the instrument. This transfer should not upset the process.

4.8 Controllers shall have provision for the use of manual control facility to enable the controlling instrument to be removed without interrupting control of the process. The system shall be such that an indication of the process variable is available at all times.

4.9 When deviation type controllers are used on cascade service, the set-points of the controllers shall be continuously indicated .

4.10 On level/flow control cascade applications, the level controller shall feature proportional action adjustment in accordance with Clause 4.2, together with integral time adjustable up to 50 minutes and integral desaturation. Where the tank level sets the incoming flow line.

4.11 The control action of instruments shall be reversible without use of additional parts or special tools.

4.12 The controller output shall be continuously indicated.

4.13 Electronic controllers shall be of the "plug in" type. Reset and derivative functions shall have an "off" facility.

4.14 Pneumatic controllers shall be of the force balance type. Board controllers shall be of "plug-in" type integrally mounted to board instrumentation through a manifold. Field mounted controllers shall be of the force balance type, have subpanel with transfer switch and be weatherproof. Manifolds shall be provided, if necessary, so the controller can be removed for servicing without additional equipment or shut-off cocks while on manual control from the board. All controllers shall be provided with a 0-2 barg output air gage. In addition, field mounted controllers shall be supplied with a standard air filter-regulator set and 0-2 barg supply air gage.

4.15 Field controllers and their manifolds shall be rigidly mounted at a minimum distance from control valves.

4.16 One or more of the following control functions shall be specified for each controller. Values are approximate.

- **a)** Narrow proportional = Adjustable 1-50%.
- **b)** Normal proportional = Adjustable 1-150%.
- **c)** Wide proportional = Adjustable 10-500%.
- **d)** Fast reset = Adjustable 0.1-100 repeats per minute.
- **e)** Slow reset = Adjustable 0.05-10 repeats per minute.
- **f)** Derivative = Adjustable 0.01-50 repeats per minute.

4.17 Temperature controllers shall be furnished with adjustable proportional, reset and rate action.

4.18 All flow controllers shall be furnished with adjustable proportional and fast reset action.

4.19 Level controllers shall be furnished with adjustable proportional and reset action.

4.20 Pressure controllers shall be furnished with adjustable proportional and reset control action.

4.21 Controllers used for intermittent services such as anti-surge or minimum flow by-passes, shall have adjustable proportional control action only.

4.22 Panel mounted controllers shall be standard miniature type (nominal 72 × 144 mm) to DIN 43718. The controller shall have a scaled set point with a clearly identified off-normal display.

4.23 Pneumatic instrument system shall employ 0.2-1 barg transmission and control range.

4.24 Electronic instrument system shall employ 4-20 mA.dc. transmission and control range. The output load resistance shall be at least 0-600 ohms.

4.25 Cascade controls shall be provided with a control index mechanism capable of setting the control point over the entire scale. Adjustable limit stops shall be provided where desirable. The control point shall also be adjustable over the entire range by means of the manually set control point index. Bias stations shall be used wherever one controller sets more than one secondary loop, control loop.

4.26 It is permissible to record more than one variable on the same chart, but as far as possible the use of linear and square root traces on the same chart shall be avoided. Every effort shall be make to standardize charts for various services wherever practicable.

4.27 Tag plates shall be fitted by manufacturer, on front and rear of the instrument.

4.28 Micro processor-based controllers, shall perform traditional PID control, with automatic self-tuning, based on the actual and current process variables, in addition to achieving some calculation and computation functions, such as adding, subtracting, biasing, square, square root, logic gates, etc. They shall accept analog and digital signals. They may be equipped with computer compatible ports.

5. SCALES

5.1 Scales should be in accordance with the readability requirements of BS. 3693, "The Design of Scales and Indexes on Analogue Indicating Instruments".

5.2 With the exception of process levels and flows, scales shall be marked clearly, with the unit of quantity indicated, and be graduated in those units.

5.3 Flow rates shall be expressed 0-10 square root or 0-100 linear scale. In all such cases the appropriate multiplying factor shall be displayed.

5.4 When selecting ranges for temperature and pressure instruments, preference should be given to the ranges given in:

BS. 1794	"Chart Ranges for Temperature Recording Instruments"
BS. 1780:Part 2	"Bourdon Tube Pressure and Vacuum Gages"

6. INSTRUMENT CHARTS

6.1 General Requirements

6.1.1 An initial supply of charts shall be provided for two years of continuous operation.

6.1.2 All charts must revolve in a direction which leaves the trace immediately visible.

6.1.3 Charts shall be calibrated as follows:

Vacuum in mbar
Pressure in bar
Temperature in degree Celsius
Flow in 0-10 square root, or 0-100 linear
Level in Percentage level 0-100

(Double range instruments shall be provided with dual scale range charts.)

6.1.4 Circular charts shall revolve once in each 24 hour period unless specifically stated otherwise. Circular charts will normally be no less than 250 mm in diameter.

6.1.5 300 mm strip charts for temperature recorders shall normally advance 50 mm per hour.

6.1.6 Strip charts for miniature instruments shall advance 20-25 mm per hour. Strip charts for miniature instruments shall be 100 mm scale span.

6.1.7 All charts shall be manufactured from special paper not subject to excessive expansion and contraction due to atmospheric temperature and moisture variations. The instrument manufacturer shall supply a chart meeting these requirements.

6.1.8 No more than 3 traces are permitted on 100 mm span charts. In case of multi trace it is preferable to have the flow trace with red and pressure trace with blue inks.

6.1.9 Recorded accuracy shall be ±0.5% of the scale range or better.

6.1.10 If combination charts are used, scaled in two different units, the different variables shall be shown with graduations on alternate periods.

6.2 Recording Facilities

6.2.1 The number of records shall be kept to a minimum, consistent with effective operation of the plant, and shall be agreed with the user.

6.2.2 Multiple trend recorders should be provided in the ratio of one pen to three variables, and shall always be located on the same horizontal level as their associated instruments. Means of selection should be adjacent to the recorder.

6.2.3 Where continuous record is required not more than three variables shall be recorded on one chart.

7. INSTRUMENTS IN THE AUXILIARY ROOM

When applicable ancillary instruments in the auxiliary room, such as signal converters, switch/trip amplifiers, high or low signal selectors shall be of modular design and be suitable for mounting in standard 483 mm (19 in.) racks IEC-297.1.

Where conversion of electric signals (other than 4 to 20 mA) to pneumatic signals is required, these signals shall be first converted to 4 to 20 mA. All converters from 4 to 20 mA to pneumatic signals shall be of the same make and type.

8. TYPICAL SPECIFICATIONS FOR RECEIVING INSTRUMENTS

8.1 Pneumatic Indicators (Receiving Gages)

Standard Features

Standard	Shall be in accordance with BS. 1780: Part 2 or ANSI. B40.1.
Dial Size	Nominal Diameter 100 mm.
Dial Materials	Double Anodised Aluminum.
Dial Colour	White with Black Graduations.
Scale Range	0-10 sq. Root. or 0-100 Linear.
Tube Range	0.2-1 barg (Marking on Dial).
Pressure Element	Bourdon Tube.
Element Material	Element and Socket 316 Stainless Steel, Unless Otherwise Specified.

Casing	Alumalife, or Cast Iron complete with Neoprene blow out disc, suitable for operation in a Humid Saliferous, Sulphurous Atmosphere,Weatherproof and Dustproof.
Mounting	Panel Mounted, or Surface.
Bezel Ring	Steel Ring held at top by Hinge Pin, at bottom by Clamp Screw. or Screw on, die cast aluminum with blind holes or face to suit pin spanner to facilitate removal and tighting.
Window	Plate glass (shatterproof) or toughened.
Retaining Ring	Metal.
Pointer	Balanced type, non ferrous material, black finish to have micrometer adjustment form front of case.
Movement	Material 316 stainless steel (Nylon gears and bushings are not acceptable).
Connection	Back connection screwed ¼ in. ANSI B2.1 NPT. Male to be provided with Hexagon Wrench Flats. Height of Wrench Flats to be not less than ½ in.
Ancillaries	Mounting Studs, Nuts and Washers Required.

Note:

Mounting Studs, Nuts and Washers shall be supplied with each gage.

8.2 Pneumatic Indicating, Miniature

Standard	Shall be in accordance with BS 1780, Part 2, or ANSI B 40.1.
Dimensions	Shall be standard miniature type (nominal 72 × 144 mm) to DIN 43718.
Scale Color	White with black graduations.
Scale Range	0-10 Sq. Root, or 0-100 Linear.
Measuring Element:	Bellows.
Element Range	0.2 -1 barg.
Element Material	316 stainless steel, unless otherwise specified.
Casing	Alumalife, or cast Iron.
Mounting	Panel.
Window	Plate glass (shatterproof) or toughened.
Pointer	Balanced type, nonferrous material, black finish.
Connection	Back connection, screwed ¼ in., ANSI B2.1 NPTM, to be provided with hexagon wrench flats. Height of wrench flats to be not less than ½ in.

8.3 Pneumatic Recording, Miniature

Standard Features

General	Flush mounted rectangular case with mounting fixtures of manufacturers standard finish. Indicating scales to have black numbers on white background. Individual nameplates to be supplied to read correctly when case door is either open or closed. Adjustable restriction is required in each separate input signal circuit for pulsation dampening.
Actuating Element	Bronze bellows (Phosphor Bronze and Neoprene).
Input Signal	Process variable 0.2 -1 barg.
Connection	Pneumatic, Screwed ¼ in. ANSI B2.1 NPT. Female. Electric, Screwed M20 × 1.5 Conduit Entry.
Case	Sheet Metal; Dust Tight Housing.
Chart	100 mm strip roll with standard re-roll, or scanfold.
Scale Range	0-10 square root, or 0-100 Linear.
Chart Speed	20 mm per hour.
Chart Drive	Electrical, 24 Voltes 50 Hz, unless otherwise specified.
Pen Type	Disposable fiber-tip pen.

Optional Features

Extra Recording	Two, or three pen recordings.

8.4 Pneumatic Controllers Indicating, Miniature

Standard Features

General	Rectangular, Flush Mounted and Panel Housed. Completely self contained with measurement and set point scales, set point adjustment, auto-manual transfer switch, output pressure indicator and manual adjustment located on front of instrument.
Air Supply	1.4 barg.
Element	Bronze bellows (Phosphor Bronze and Neoprene).
Connections	Element ¼ in. ANSI B2.1 NPT. Female. Supply and output ¼ in. ANSI B2.1 NPT. Female. Adaptor to be supplied if ¼ in is not available.
Housing	All steel housing and trim.
Indicating Scale	100 mm Vertical scale. Black figures on white background.
Scale Range	0-10 square root, or 0-100 Linear.
Control Mode	Proportional + Integral.
Proportional Band Range:	1-500%.

Control Signal	0.2-1 barg.
Integral Action	0.01 to 50 minutes/repeat.
Control Action	Increasing process variable increases output, reversible.
Set Point Signal	0.2-1 barg.
Set Point Adjustment:	Manually to position set point.

Optional Features

Alarm Switch	Alarm switches (max. of two PV or deviation snap acting SPDT Switches) adjustable over 0.2-1 barg range. Contact rating 7AMP (non-inductive) at 250 Volts a.c., or 30 Volts. d.c.
Signal Lights	Signal lights clear, red or green (two max.) for 24 Volt operation Process nameplate. Two rows of 15 characters max.
Model Variations	Cascade unit with integral control unit.
	Cascade unit for operating external controller.
	Automatic station for operating external controller.
	Remote controller.
Control Mode	For level instrument-proportional only-for temperature instrument-proportional + integral + derivative.
Derivative Action	0.01-50 minutes/repeat.

8.5 Pneumatic Controllers, Recording, Miniature

Standard Features

General	Flush mounted rectangular case with mounting fixture of manufacturers standard finish. Indicating scales to have black numbers on white background. Individual nameplates to be supplied to read correctly when case door is either open or closed. Adjustable restriction is required in each separate input signal circuit for pulsation damping.
Actuating Element	Bronze Bellows.
Connection	Pneumatic, screwed ¼ in. ANSI B.2.1 NPT. Electric, Screwed M20 × 1.5 Conduit Entry.
Case	Sheet Metal; Dust Tight Housing.
Chart	100 mm strip roll with standard re-roll, or scanfold.
Scale Range	0-10 square root, or 0-100 linear.
Chart Speed	20 mm per hour.
Chart Drive	Electrical, 24 Volts 50 Hz, unless otherwise specified.
Pen Type	Disposable fiber-tip pen.
Indicating Scale	Dual upper scale, horizontal 100 mm effective length, black figures on white background. Top scale, output signal. Bottom scale primary range.
Control Mode	Proportional + Integral.

Proportional Band Range:	1-500%.
Input Signal	Process variable 0.2-1 barg.
Control Signal	0.2-1 barg .
Integral Action	0.01 to 50 minutes/repeat.
Control Action	Increasing process variable increases output, reversible.
Set Point Signal	0.2-1 barg.
Set Point Adjustment:	position pointer, manually to position set point to controller. Integrally mounted.
Controller Location	At instrument and integrally mounted.
Auto-Manual Switch	Internal.

Optional Features

Controller and recorder combination:	Two records and one control.
Chart Drive	Pneumatic chart drive. Impulse from a master electro-pneumatic pulser.
Controller Location	Field mounted, complete with manifold.
Control Mode	For temperature instrument. Proportional + Integral +Derivative.
Derivative Action	0.01 To 50 minutes/repeat.
Scale Ranges	0-100 Linear for level instruments, and for pressure instruments according to pressure transmitters. For temperature instrument according to temperature transmitters.

8.6 Pneumatic Integrator

Standard Features

General	Force balance type capable of receiving input signal of 0.2-1 barg proportional to square of flow rate. Automatically extracts square root function. Continuously rotating air driven turbine varying its speed in proportion to square root of input air signal. Actuates counter in proportion to flow. Automatically provides running total of flow.
Body	Weatherproof, cast aluminum, gasketed cover.
Mounting	Integrator mechanism and six digit counter are integrally mounted. Unit installed on panel.
Air Supply	1.4 barg.
Connections	¼ in. ANSI B2.1 NPT.
Integral Brake Assembly	Eliminates counter errors due to "coasting" on batching operations and widely fluctuating flows.

8.7 Pneumatic Controllers, Recording, Local Mounting (with Receiver Element)

Standard Features

General	Control unit and recorder shall be mounted in rectangular case, pneumatic receiver type instru-ment actuated by air signal of 0.2-1 barg from pneumatic transmitter.
Receiver Element	Bronze bellows.
Accuracy	±0.5% of full scale.
Case	Universal rectangular, Die-Cast aluminum. Dust and weatherproof.
Window	Shatterproof Glass.
Mounting	Yoke for 2 in. pipe support.
Chart	300 mm circular.
Chart Range	0-10 square root, or 0-100 linear.
Chart speed	Two speed, 24 hours/7 days per revolution.
Chart Drive	Mechanical 7 day wind.
Pen Type	Disposable fiber-tip pen.
Air Supply	1.4 barg.
Connections	Air ¼ in. ANSI B2.1 NPT. Process ¼ in. ANSI B2.1 NPT.
Control Mode	Proportional + Integral Action.
Proportional Band Range	1-500%.
Integral Action	0.01 to 50 minutes/repeat.
Input Signal	0.2-1 barg.
Output Signal	0.2-1 barg.
Set Point Adjustment	Manually to position set point.
Transfer Switch	4 position (Automatic-manual-test-service).
Control Action	As specified. Increase in process variable increases/decreases output signal.

Optional Features

Transfer Switch	3 position type (Automatic-manual-service) 2 positions type (Automatic-manual).
Pen	Two or three pens.
Cascade Control	Pneumatic set controller. Set point positioned pneumatically. Full span or adjustable span ás specified.
Control Mode	For temperature instrument, Proportional + Integral + Derivative Derivative Action : 0.01 to 50 minutes/repeat.

Notes:

1) Type of chart markings, 24 hours or 7 days as specified at time of ordering.

2) For limit stops to be provided on pneumatic set scale, with high and low settings, as specified.

8.8 Pneumatic Recording, Local Mounting

Standard Features

General	Recorder for connecting direct to process. Element converts pressure changes to mechanical motion thus positioning pen.	
Element	Compound range	: -1 barg to 0-1 barg. [bellows 316 ss].
	Normal ranges	: 0-1 barg to 16 barg [spiral 316 ss].
		: 0-16 barg to 400 barg [helical 316 ss].
Accuracy	± 0.5% full scale.	
Overrange protection	manufacturer's standard.	
Process connections	¼ in. ANSI B2.1 NPT. Female.	
mounting	Yoke for 2 in pipe support.	
Case	Die-Cast aluminum, rectangular, dust and weatherproof.	
window	Shatterproof glass.	
chart	Circular, 300 mm nominal size 0-100 linear.	
Scale Range	As Specified.	
Chart Speed	Two speed. 24 hours/7 days per revolution.	
Chart Drive	Mechanical 7 days wind.	
Pen Type	Disposable fiber-tip pen.	

Optional Features

Pen	Two or three pens.

Notes:

1) Type of chart markings, 24 hours or 7 days, to be specified at time of ordering.

2) When process connections required are not of manufacturer's standard then manufacturer should be requested to supply an adapter to meet user requirements.

8.9 Pneumatic Controllers, Indicating, Local Mounting

Standard Features

General	Control unit and indicator mounted in rectangular case. Instrument direct-connected to process with indicator pointer directly positioned by motion from measuring element. Control unit to transmit corrective pneumatic 0.2-1 barg signal to final control element.	
Element	Compound range	: -1 barg to 0-1 barg [bellows 316 ss].
	Normal ranges	: 0-1 barg to 16 barg [spiral 316 ss].
		: 0-16 barg to 400 barg [helical 316 ss].

Accuracy	±0.5% full scale or better.
Overrange Protection:	Manufacturer'sstandard.
Process Connections:	Screwed ¼ in. ANSI B2.1 NPT. Female for pressures up to 140 bar (ga) and ½ in. ANSI B2.1 NPT. Male for pressures from 140 barg to 400 barg.
Mounting	Yoke for 2 in. pipe support.
Case & Door	Fibreglass reinforced grey polyester moulding case. Hinged door in fibreglass re-inforced phenylene oxide, with blue polyurethane finish. Enclosure classification NEMA 3 weatherproof.
Window	Clear shatterproof. Ultra violet resistant polycarbonate.
Indication	Sector (eccentric) scale. White with black graduations and numerals and red pointer. Effective length 127 mm.
Scale Range	As specified.
Control Mode	Proportional.
Proportional Band	1-500% of scale range. Adjustable Range.
Set Point Adjustment:	Manually to position set-point. Set point external.
Control Action	Direct. Increase in process variable increases output signal, reversible.
Output Signal	0.2-1 barg.
Air Supply	1.4 barg.
Air Supply Connections:	1.4 in. ANSI B2.1 NPT. Female.

Optional Features

Control Mode	Proportional plus Integral (0.01 to 50 minutes/repeat).
Set Point	Internal.
Set Point Adjustment:	Remote pneumatic set point.
Auto/Manual Switching:	Internal bumpless auto/manual transfer system comprising balanced tube with regulator and 2 positioned switches.

8.10 Pneumatic Controllers, Recording, Local Mounting (Directly Connected to Process)

Standard Features

General	Control unit and recorder mounted in rectangular case. Instrument direct-connected to process with recorder pen directly positioned by motion from measuring elements. Control unit to transmit corrective pneumatic 0.2-1 barg signal to final control element.

Element	Compound range	: -1 barg to 0-1 barg. [bellows 316 ss].
	Normal ranges	: 0-1 barg to 16 barg [spiral 316 ss].
		: 0-16 barg to 400 barg [helical 316 ss].
Accuracy	±0.5% of full scale, or better.	
Overrange Protection:	Manufacturer's standard or as specified.	
Process Connections:	Screwed ¼ in. ANSI B2.1 NPT. Female for pressures upto 0-140 barg and ½ in. ANSI B2.1 NPT. Male for pressures from 0-140 to 0-400 barg.	
Mounting	Yoke for 2 in. pipe support.	
Case	Die-cast aluminum. Dust and weatherproof, unless otherwise specified.	
Window	Shatterproof glass.	
Chart	Circular, 300 mm nominal size 0-100 linear.	
Range	As specified.	
Chart Speed	Two speed. 24 hours/ 7 days per revolution.	
Chart Drive	Mechanical 7-days wind.	
Pen Type	Disposable fiber-tip pen.	
Control Mode	Proportional + Integral Action.	
Proportional Band Range	1 to 500%.	
Integral Action	0.01 to 50 minutes/repeate.	
Set Point Adjustment	Manually to position set point. Inside of case.	
Control Action	Direct. Increases in process variable increases output signal, reversible.	
Output Signal	0.2-1 barg.	
Air Supply	1.4 barg.	
Air Supply Connections	¼ in. ANSI B2.1 NPT. Female.	
Transfer Switch	Four positions, auto-manual-test-service.	

Optional Features

Cascade Control	Pneumatic set controller. Set point pneumatically positioned. Specify either full span or adjustable span.
Additional Pens	Two or three pens.

Notes:

1) Type of chart markings, 24 hours or 7 days, as specified at time of ordering.

2) For limit stops to be provided on pneumatic set scale with high and low settings.

8.11 Electronic Indicators, Analogue & Numerical

Standard Features

General	Horizontal or vertical scale servo-operated indicator single pointer (red), or LCD display.
Panel Case	Steel (with aluminum alloy bezel)-Plastic window.
Indicating Scale	Manufacturer standard length. Black markings on white background_ (for analogue indicators only).
Input	4-20 mA (1-5V at instrument).
Scale Range	0-10 square root, or 0-100 linear (for analogue indicators only).
Electric Power Supply	24V dc. ±0.5 V.
Ambient Temperature Limits:	0-50°C (for field mounted indicators this range shall be wider to cover at least -15 to 85°C).
Electrical Classification	General purpose, unless otherwise specified.
Electrical Protection	Instrument to be individually fused.
Mounting	Panel, pipe or surface, as specified.
Window	Shatterproof.

Optional Features

Extra Pointer	Two pointers (red and green)
Combination	Three pointers (red, green and blue)

for analogue indicators only.

Alarms	Lamps only (24 V, 40 mA). 1PV Monitor Switch plus Lamps. 2PV Monitor Switch plus Lamps.

8.12 Electronic Controller, Indicating

Standard Features

General	Rectangular flush mounted and panel housed with measured variable, out put and set point scales. Set point adjustment auto manual transfer switch manual adjustment located on front of instrument. Individual nameplates to be supplied.
Panel Case	Steel (with aluminum alloy bezel)-Plastic window.
Instrument Case	Steel.
Indicating Scale	Manufacturer standard long. Black marking on white background.
Scale Range	0-10 square root, or 0-100 linear.
Control Mode	Proportional + Integral.
Proportional Band	1-500%.

Integral Action Time	0.01 to 50 minutes/repeat.
Control Action	Increase/decrease in process variable increases output.
Controller out put	4-20 mA (1-5V).
Set Point Adjustment	Manually to set position.
Electric Power Supply	24 V dc. ±0.5 V.
Mounting	Panel.
Ambient Temperature Limits:	0-50°C.
Calibration Facility	Built-in Calibration Jack.
Electrical Classification	General purpose, unless otherwise specified.
Auto Manual Switch	Integral.

Optional Features

Control Mode	Proportional + Integral + Derivative or Proportional only.
Derivative Action	0 to 10 mins. continuously adjustable + off Time.
Cascade Control	Local/Remote set point with set point tracking. Local/Remote set point without set point tracking.
Override Control	To prevent reset accumulation in override control applications.
Feed Forward Control	Provides second PV function.
Communication	Intercom Jack.
Alarms	Lamps only (24 V, 40 mA). 1PV Monitor Switch plus Lamps. 2PV Monitor Switch plus Lamps.

8.13 Electronic Recorder/Controller

Standard Features

General	Single pen recording controller, rectangular flush mounted and panel housed. With measured variable (red pointer) white scale-black graduations set point pointer (green). Set point adjustment, auto manual transfer switch, manual adjustment located on front of instrument. Single pen (red). Controller integrally mounted. Inividual nameplates to be supplied.
Panel Case	Steel (with aluminum alloy or plastic bezel).
Input	4-20 mA (1-5 V at instrument).
Chart	100 mm strip roll with standard re-roll.
Scale Range	0-10 square root, or 0-100 linear.
Chart Speed	20 mm per hour.

Chart Drive	24 V, 50 Hz.
Pen Type	Disposable Fiber-tip pen.
Indicating Scale	100 mm long, Black figures on white background.
Control Mode	Proportional + Integral.
Proportional Band	1-500%.
Integral Action Time	0.01 to 50 minutes/repeat.
Control Action	Increase/decrease in process variable increases output.
Set Point Adjustment	Manually to position set point.
Controller Location	At instrument (integrally mounted).
Controller output	4-20 mA.
Control Mode Actuation	Auto/manual switch.
Control signal Indication	Integral output meter.
Ambient Temperature Limits	0-50°C.
Electrical Power Supply	24 V d.c. ±0.5 V.
Mounting	Panel.
Calibration Facility	Built-in calibration Jack.
Electrical Classification	General purpose.

Optional Features

Controller and Recorder Combination:	Two or three records (red, blue & green) and one control.
Control Mode	Proportional + Integral + Derivative.
Cascade Control	Local/remote set point (without set point tracking) Local/remote set point (with set point tracking).
Alarms	Lamps only (24V, 40 mA). 1 PV monitor switch plus lamps. 2 PV monitor switch plus lamps.

8.14 Electronic Recorder (Pen Writing)

Standard Features

General	Rectangular flush mounted and panel housed with white scale and black graduations. Single pen (red). Individual nameplates to be supplied.
Input Signal	4-20 mA (1-5 V at instrument).
Electrical Power Supply	24 V d.c.
Mounting	Panel.

Scale Range	0-10 square root. or 0-100 linear.
Accuracy	0.5% of span or better.
Chart	100 mm strip roll with standard re-roll, or scan-fold, as specified.
Chart Speed	20 mm per hour.
Chart Drive	24 V, 50 Hz.
Pen Type	Disposable fiber-tip pen.
Ambient Temperature Limits	0-50°C.
Calibration facility	Built-in calibration jack.
Electrical Classification	General Purpose (ordinary) locations.

Optional Features

Extra Recording Combination	Two pens recording (red & blue), Three pens recording (red, blue & green).
Alarms	Lamps only (24 V, 40 mA)- upto 3 sets. 1 PV monitor switch plus lamps. 2 PV monitor switch plus lamps.

8.15 Electronic Dot Printing Recorder

Standard Features

General	Rectangular flush mounted and panel housed with white scale and black graduations, 3-points, 6-points, and 12-points dot printing recorders. Individual nameplates to be supplied.
Input Signal	4-20 mA, 1-5 V d.c., thermocouples, and RTD.
Mounting	Panel.
Scale Range	As specified.
Accuracy	±0.5% of span, or better.
Chart	100 mm strip roll with standard re-roll, or scan-fold, as specified.
Chart Speed	20 mm per hour.
Chart Drive	24 V, 50 Hz.
Dot Printing Head	Disposable print head with fiber tip marker, and built-in ink cartridge.
Point Printing Interval (Cycle)	Not more than 5 sec.
Ink Colors	Manufacturer standard.
Ambient Temperature Limits	0-50°C.
Electrical Classification	General purpose (ordinary) locations.

Optional Features

Thermocouple Burnout Protection:	Open-circuitry of input, causes indicator to drive upscale or downscale, as specified.
Microswitch Alarms	One/Two SPDT microswitch for high/low alarm.

8.16 Single Station Microprocessor-Based Controller

General	This type of controllers are microprocessor-based controllers, perform traditional PID control, with automatic self-tuning, based on the actual and current process variables, in addition to achieving some calculation and computation functions such as adding, subtracting, biasing, square, square root, logic gates, etc. They accept analog and digital signals. They are equipped with computer compatable ports. The front of the controller has display consisting of graphics and alphanumeric characters.
Input Signal	4-20 mA, 1-5 V d.c., Frequency, T/C, or RTD. One or two contact or transistor switch.
Output Signal	4-20 mA. 1-5 V d.c. Two open collector transistor (NPN) switches.
Supply Voltage	24 V dc., +20%, -10% at 1 A maximum unless otherwise specified.
Transmitter Power	Controller should provide power supply for two 4 to 20 mA transmitters.
Alarms	-Two absolute alarms for the measurement signal, and one absolute alarm for the output signal. -Deviation alarm for sensing the difference between the setpoint and measurement (error signal). -Alarm status is indicated by a combination of alphanumeric display, the bar graphs, and the contact output. -Alarm dead band is adjustable between 0 and 10% of span.
Front Panel	The controller shall be configured and operated entirely from the front panel with/without external equipment. By using the keypad and the display, complete process information can be read, and all controller settings can be changed.
Environmental Operating Limits:	Temperature 5 and 50°C Humidity 5 and 95%
Memory	All configuration and operating parameters are stored in a nonvolatile memory. Should a power failure occure, essential control settings and last operating conditions are save indefinitely.
Control Adjustments	P.B. : 1 to 8000%. I : 0.014 to 200 minutes/repeat. D : 0 to 100 minutes.
Other Control Adjustments:	- Automatic self tuning. - Ratio 0 to 5.

- Calculations (each input can have a gain and/or bias, and can be combined together in a variety of mathematical equations).

- Logic (AND, NAND, OR, XOR, NOR and NOT).

- Signal conditioning, square, square root, characterizer, RTD and thermocouple (TC) linearizing.

Accuracy	Shall be as specified by user.
Mounting:	Shall be shelf mounting, unless otherwise specified.

8.17 Microprocessor-Based Recorder

Standard Features

General	Flush mounted and panel housed-microprocessor-based instrument, provide upto three pens for recording on a 100 mm (4 in.) strip chart. It also provides both analog and numerical display of the measured input signals.
Input Signals	4-20 mA, 1-5 V d.c., thermocouples, and RTD.
Mounting	Panel (single or multipack).
Digital Display	Input data is displayed numerically on three channels of five characters, back illuminated LCD's.
Accuracy	0.25% of span, or better.
Chart	100 mm strip chart.
Chart Speed	Adjustable between 1 mm/hr to 1500 mm/hr.
Power Supply	24 V, 50 Hz.
Analog Recording	Fiber-Tip pen system.
Digital Recording	Fiber-Tip pen plotter system.
Fixed Time Recording	Year, month, and day are printed upon turning on the power.
Ink Colors	Red, blue & green.
Ambient Temperature Limits:	0-50°C
Electrical Classification	General purpose (ordinary) locations

Optional Features

Power supply:

- To power up to three external transmitters.
- Square root extractor.
- Three additional alarm outputs: Normally closed and normally open.
- RS-485/422/232 communications interface: It permits the recorder to be connected to personal computer.

Note:

For multipoint digital temperature recorders refer to IPS-M-IN-120 "Material Standard for Temperature Instruments".

9. DOCUMENTATION/LITERATURE

1) AT Quotation Stage

Suppliers are to provide the followings in the numbers requested at the time of quotation:

a) Comprehensive descriptive literature.
b) List of recommended commissioning spares with prices.
c) Details of any special tools required with prices.

2) At Ordering Stage

Suppliers are to provide the followings in quantities and at times as detailed on the order:

a) List of recommended spares for two years continuous operation.
b) Illustrated comprehensive spare parts manual with part numbers suitable for warehouse stocking.
c) Illustrated installation and operating instructions.
d) Maintenance manuals.
e) List of interchangability and Sub-suppliers parts shall be provided.

Note:

The above shall include identification of all proprietary items.

All drawings and literature shall be in English language and show all dimensions, capacities, etc., in metric units.

The order number must be prominently shown on all documents. Drawings are to be properly protected and packed and negatives must be dispatched in a strong cardboard cylinder. Drawings must be rolled not folded.

10. INSPECTION AND TEST

- Inspection by appointed representative will consist of but not necessarily be confied to:

  1) Visual and dimensional checks.
  2) Hydraulic and functional tests where applicable.

- Certified test reports shall be provided for each instrument.

- The user reserves the right to reject individual instrument for bad workmanship or defects.

- Detailed inspection requirements are specified in IPS-E-IN-100 "Factory Inspection for Instruments and Instruments Systems".

11. PACKING AND SHIPPING

Equipment must be carefully protected and packed to provide adequate protection during transit to destination and shall be in accordance with any special provision contained in the specification or order.

Special attention must be given to protection against corrosion during transit.

All bright and machined parts must be painted with a rust preventative.

Ancillary items forming an integral part of the equipment should be packed preferably in a separate container if the equipment is normally cased or crated. Alternatively the ancillary items should be fixed securely to the equipment and adequate precaution taken to ensure that the items do not come loose in transit or be otherwise damaged.

Instruments having delicate movements and assembled into panels for inspection and test must be replaced in markers special shock absorbing packages for transit, all connections being marked for remounting in Iran. Such instruments to be packed in same case as associated panel, but protected by a bulkhead or equivalent packing arrangement.

12. GUARANTEE

Vendor shall guarantee the following when the instrument is operated in accordance with the written operating instructions.

12.1 Designed performance and quality under conditions per specifications.

12.2 Instrument is free from fault in design, workmanship and material to fulfill satisfactorily the operating conditions specified.

12.3 Spare parts guarantee for minimum 10 years and performance guarantee for one year after installation or 18 months after shipment whichever is closer.