



Toase-ehe Park Sanati Gohar Ofogh  
Petrochemical Co.  
**CONCEPTUAL, BASIC and DETAIL DESIGN  
ENGINEERING OF STYRENE PARK OFFSITE**



Bina Consulting Eng. Co.

Document Title : Specification for Field Instrument

Document No. : EI027-000-ED-IN-SPC-001

Rev. R2

Page 1 of 17

# STYRENE PARK OFFSITE

**Document Title:**

**Specification for Field Instrument**

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پتروشیمی توسعه پارک  
صنعتی کوهر افق

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Rev. R2

Page 2 of 17



**REVISION RECORD SHEET**

Page	Revisions							Page	Revisions						
	R0	R1	R2	R3	R4	R5	R6		R0	R1	R2	R3	R4	R5	R6
1	X	X						41							
2	X	X						42							
3	X	X						43							
4	X	X						44							
5	X	X	X					45							
6	X	X	X					46							
7	X							47							
8	X	X						48							
9	X	X						49							
10	X	X	X					50							
11	X		X					51							
12	X							52							
13	X	X						53							
14	X							54							
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31								71							
32								72							
33								73							
34								74							
35								75							
36								76							
37								77							
38								78							
39								79							
40								80							

	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p>Bina Consulting Eng. Co.</p>
	Document Title : Specification for Field Instrument		
	Document No. : EI027-000-ED-IN-SPC-001	Rev. R2	Page 3 of 17

## TABLE OF CONTENTS

1. GENERAL INTRODUCTION.....	4
2. SPECIFICATION FOR FLOW MEASURING ELEMENTS .....	8
3. SPECIFICATION FOR LEVEL INSTRUMENT .....	11
4. SPECIFICATION FOR TEMPERATURE TRANSMITTER.....	13
5. SPECIFICATION FOR THERMOWELL.....	14
6. SPECIFICATION FOR TEMPERATURE GAUGE.....	14
7. HAZARDOUS AREA CLASSIFICATION .....	15
8. NAME PLATE.....	15
9. GUARANTEE .....	16
10. INSPECTION AND TESTS .....	16
11. PREPARATION FOR SHIPMENT.....	17
12. VENDOR DOCUMENTATION .....	17

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p>Bina Consulting Eng. Co.</p>
	Document Title : Specification for Field Instrument		
	Document No. : EI027-000-ED-IN-SPC-001	Rev. R2	Page 4 of 17

## 1. GENERAL INTRODUCTION

### 1.1. INTRODUCTION

Creation and development of chain units of Styrene Monomer is the mission of Gohar Ofogh Industrial Park. This Company joint investment of 4 companies including JPC, Asaluyeh Sadaf Chemical, Kimia Sanaye Dalahoo and Entekhab Group and is located in Asaluyeh.

Feed and utility lines and network construction, Styrene Monomer tank construction, Peroxide and its sidelong equipment warehouse are among this company's missions.

Some of the ongoing Projects of this company are:

ABS-Rubber project

ESBR project

EPS project

Poly Styrene

### 1.2. SCOPE

This specification covers the minimum requirements for design of Field Instrument. All components, as far as mechanical characteristics and performances are concerned. Any deviation from the present specification at any stage of the project shall be subject to CLIENT approval.

### 1.3. REFERENCE DOCUMENTS STANDARD & CODE

All equipment supplied under this specification shall conform to the following standards:

IPS-C-IN-100 "Construction and inspection standard for General Instrumentation field Inspection Calibration and Testing of Instrument"

IPS-C-IN-140 "Construction (Installation) Standard for Instrument"

- PRESSURE INSTRUMENT (bar a/g) :

IPS-E-IN-110 "Engineering Standard for Pressure Instrument"

IPS-M-IN-110 "Material and Equipment Standard for Pressure Instrument"

IPS-C-IN-110 "Construction (Installation) Standard for Pressure Instrument"

- TEMPERATURE INSTRUMENT (°C) :

IPS-E-IN-120 "Engineering Standard for Temperature Instrument"



IPS-M-IN-120 "Material and Equipment Standard for Temperature Instrument"

IPS-C-IN-120 "Construction (Installation) Standard for Temperature Instrument"

- LEVEL INSTRUMENT:

IPS-E-IN-140 "Engineering standard for Level Instruments"

IPS-C-IN-140 "Construction and Installation Standard for Level Instrument"

	<p>Toase-eh Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p>Bina Consulting Eng. Co.</p>
	Document Title : Specification for Field Instrument		
	Document No. : EI027-000-ED-IN-SPC-001	Rev. R2	Page 5 of 17

IPS-M-IN-140 "Material and Quality Control Standard for Level Instrument"

- **FLOW INSTRUMENT:**

IPS-E-IN-130 "Engineering standard for Flow Instruments"

IPS-C-IN-130 "Construction (Installation) Standard for Flow Instrument"

IPS-M-IN-130 "Material and Quality Control Standard Flow Level Instrument"



Other international standard codes for all instruments:

ANSI/ASME "Pipe threads, general purpose"

API std 551 "Process measurement Instrumentation"

IEC 60529 "Degree of Protection on provided by enclosures (IP) Code"

ISO 9000 "Quality Management systems Fundamental and Vocabulary"

ISO 9001 "Quality Management Systems Requirements"

API RP 500 "Recommended Practice For classification of Location for Electrical

Installation at petroleum facilities classification as Class 1, Zone 0, Zone 1 and Zone 2.

API RP 554 "Process Instrumentation and Control.

ISO 5167 "Measurement of Fluid Flow by Means of Pressure Differential Devices

Inserted In Circular Cross Section Conduits Running Full"

Metric SI system units shall be applied to all dimensions and relevant documents.

#### 1.4. SPECIFICATION FOR PRESSURE TRANSMITTER

Unless stated otherwise, the sensing element shall be of the direct electronic sensing, sealed capsule type (strain gauge, capacitance sensing, etc.). Pressure transmitters shall be able to withstand maximum design pressure without the need for recalibration. Transmitters shall have an integral output meter showing a linear scale.

Transmitters shall be diaphragm type with an integral digital output meter, showing a linear scale in engineering units. Smart pressure transmitters shall be micro-processor based electronic device using conventional capacitance pick-up cell sensors preferably. Transmitter shall be selected from VENDORS standard ranges.

Transmitter output shall be HART Smart 4-20 mA.



LCD local indicator shall be provided for transmitters.

Process connections shall be 1/2" NPT.

Unless otherwise specified in detailed hook-up sketches, each pressure transmitter shall be equipped with 2-valve block manifold directly connected to the transmitter. This block manifold will allow isolation, zero testing and depressurizing.

Pressure range of transmitters shall be selected so that, normal operating pressure will be within 50% and 80% of calibrated range.

The following items are preliminary requirements for instruments, that detail of them will be clarified in the related data sheets.

	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p>Bina Consulting Eng. Co.</p>
	Document Title : Specification for Field Instrument		
	Document No. : EI027-000-ED-IN-SPC-001	Rev. R2	Page 6 of 17

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

The transmitter shall be equipped with an integral indicator. The transmitter digital electronics shall have a non-volatile EEPROM memory to be used for storing the configuration data and sensor linearization data.

Accuracy shall be better than  $\pm 0.1\%$  of full scale.

Instrument enclosure shall be waterproof to IP 65 minimum.

In general, all analogue instruments, in hazardous area installations shall be Intrinsically Safe, Ex 'ia' and type IIB T4, unless higher gas group / temperature class is required.

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

Electrical connections shall be supplied with the threaded connection, ISO M20. 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.

## 1.5. SPECIFICATION FOR PRESSURE GAUGE

### 1.6. PRESSURE ELEMENT



Pressure elements shall be bellows or bourdon as specified in individual data sheets. Absolute pressure elements shall be automatically compensated for changes in barometric pressure.

Guaranteed gauge accuracy shall be better than  $\pm 1\%$  of full scale because class 1 is regular gauges in the market. The following items are preliminary requirements for instruments, that detail of them will be clarified in the related data sheets.



### 1.7. OVER PRESSURE PROTECTION

Pressure elements shall be capable of withstanding intermittent over-ranging to 1.3 times of the maximum scale reading without shifting the calibration more than 0.1% of the scale range. Over range, protectors shall be provided for the above specified over range limit.

	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p>Bina Consulting Eng. Co.</p>
	Document Title : Specification for Field Instrument		
	Document No. : EI027-000-ED-IN-SPC-001	Rev. R2	Page 7 of 17

### 1.8. BOURDONS, SOCKETS AND TIPS

Bourdon tubes shall be welded to socket and tip and stress relieved as required. Unless otherwise specified 316 stainless steel shall be used for bourdons, sockets and tips material. For seawater services, Monel or diaphragm seal shall be used for bourdons, sockets and tips material.

The pressure range of the bourdon tube and the tube material shall be stamped on the socket.

### 1.9. CASES

Gauges shall be solid front type with cast aluminium alloy or stainless steel cases as specified in specific data sheets. The glass shall be held in face-plate between gaskets by a screwed metal retainer ring and shall be shatter proof. Instrument enclosure shall be waterproof to IP 65 minimum.

### 1.10. MOVEMENTS

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

### 1.11. DIALS

Dials shall have diameter of 150 mm and shall be white, non-rusting metal or no-plastic dial, with black figures over 270° and sunlight resistant. Pointers shall be adjustable without removing them from their shafts. The scale units shall be dual (psig/Barg).

### 1.12. MOUNTING AND CONNECTIONS

Direct and surface mounted connected gauges shall have 1/2" NPT bottom connections with wrench flats.

Flush mounted direct connected gauges shall have 1/2" NPT back connections with wrench flats.

### 1.13. MANIFOLDS

2 valves block manifold shall be 316 stainless steel.

### 1.14. BLOWOUT PROTECTION

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

Surface mounted gauges shall have rubber grommet blowout disc located in the lower side of case.



Direct and flush mounted gauges shall have rubber grommet blowout disc located in back of case.

Steam mounted gauges shall have rubber grommet blowout back or disc located in the back of case.

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

### 1.15. CALIBRATION

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

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-eh Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p>Bina Consulting Eng. Co.</p>
	Document Title : Specification for Field Instrument		
	Document No. : EI027-000-ED-IN-SPC-001	Rev. R2	Page 8 of 17

### 1.16. WEEP HOLES

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

### 1.17. STANDARD RANGES

The standard ranges (Normal operating pressure) for the pressure gauges shall be between 25% and 75% of full scale and shall be selected as follows:

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.

### 1.18. DIAPHRAGM-SEALED PRESSURE GAUGES 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. Gauge with diaphragm seals shall have capillary bleeder.

### 1.19. PROCESS CONNECTION

Process connection shall be 1/2" NPT screwed bottom connection.

Capillary tube if required shall be stainless steel, its length shall be as specified in the relevant data sheet.

Other requirements shall be considered as per IPS-M-IN-110 and IPS-E-IN-110.

Each pressure gauge shall be included damping device on pulsating pressure.

## 2. SPECIFICATION FOR FLOW MEASURING ELEMENTS

Generally, for flow measurements, square edge orifice plates with concentric entrance and flange taps and/or carrier ring will be used. Flange tap size should be 1/2" NPTF.

The following items are preliminary requirements for instruments, that detail of them will be clarified in the related data sheets.

Weep holes shall be provided in steam or gas flow installation where condensation can occur and in liquid flow installation when gas entrainment can occur.



Orifice plate identification shall comply with ISA RP 3.2, with the upstream side of the orifice plate tab handle permanently marked with:

Tag No

Orifice diameter

Line size



	<p>Toase-e Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p>Bina Consulting Eng. Co.</p>
	Document Title : Specification for Field Instrument		
	Document No. : EI027-000-ED-IN-SPC-001	Rev. R2	Page 9 of 17

Flange rating

Plate material, and

The Lettering “UPSTREAM”

NACE compatibility (if applicable)

The calculation of such orifice plates and their application range will be in accordance with ISO 5167 Code or AGA-ASME.

The flow factors will be expressed in the following units:

- a) Gas:  $\text{Sm}^3/\text{h}$ , referred to a 1.013 bar pressure and a 15°C temperature and  $\text{Nm}^3/\text{h}$ , referred to a 1.013 bar pressure and 0°C temperature;
- b) Liquids:  $\text{m}^3/\text{h}$ , as referred to a 15°C temperature.

The preferred differential pressure meter-range will be 250 mbar, the alternative meter-range is: 125, 500, 600, 1000 mbar according to process requirements.

The ratio of orifice diameter to line diameter (d/D) for orifice plates shall be between 0.20 and 0.70 with 0.6 be the preferred d/D ratio.

The following items are preliminary requirements for instruments, that detail of them will be clarified in the related data sheets.

## 2.1. MEASURING INSTRUMENT

The instruments for the measurement of the differential pressure shall be usually of the diaphragm type. They shall withstand with no damage the design static pressure applied to a single chamber.

Transmitters connected to ESD of ICSS shall be based on two wire system 24VDC, 4-20mA signal and shall be SMART type with Hart protocol.

Transmitters connected to Dcs of ICSS shall be based on two wire system 24VDC, 4-20mA signal and shall be SMART type with Hart protocol.

For local DP measurement, Barton cell type direct instrument may be used.



Direct flow switches shall have a static sensing element, without any moving mechanical components such as blades or targets and they will be based on the probe/process fluid heat exchange.

Other devices as follows may be utilized, for special requirements:

Measurement devices with quick calibrated diaphragms which can be replaced maintaining the pressure in the line. These devices shall be utilized when measuring ranges larger than the acceptable range are expected for a single diaphragm (30% 90% of the full scale rate)

## 2.2. DIFFERENTIAL PRESSURE FLOW TRANSMITTER

The performance of the instrument shall be as follows:

	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN</b></p> <p><b>ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p>Bina Consulting Eng. Co.</p>	
	Document Title : Specification for Field Instrument			
	Document No. : EI027-000-ED-IN-SPC-001		Rev. R2	Page 10 of 17

- accuracy  $\pm 0.5$  % of span,
- repeatability  $\pm 0.25$  % of span,
- temperature effect  $\pm 0.1$  % of span/ $10^{\circ}$  C variation

### 2.3. ELECTROMAGNETIC FLOW METER

Electromagnetic flow meter shall be used on low resistivity liquid. The electrical connection and cable shall be done to the related data sheet . The performance of the instrument shall be as follows



- accuracy  $\pm 0.5$  % of flow rate,
- Repeatability  $\pm 0.25$  % of flow rate.

### 2.4. VARIABLE AREA METERS

The armoured variable area flow meter shall consist of an all metal metering tube with a magnetic type extension attached to the float. Glass tube type shall be not used. Float limit stops to be provided for over-range protection. The performance of the instrument shall be as follows



- calibration accuracy  $\pm 2$  % of span,
- repeatability  $\pm 0.25$  % of span,
- temperature effect  $\pm 0.5$  % of span/ $30^{\circ}$ C variation.

### 2.5. TURBINE METERS

Turbine meters shall be used only on fluids fully in the liquid phase without solid particles. The performance of the instrument shall be as follows:

- signal repeatability  $\pm 0.02$  % or better,
- meter linearity  $\pm 0.25$  % or better.



 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p>Bina Consulting Eng. Co.</p>
	Document Title : Specification for Field Instrument		
	Document No. : EI027-000-ED-IN-SPC-001		Rev. R2

## 2.6. MASS FLOWMETERS CORIOLIS FLOWMETER

Before initial installation, be sure that the transmitter and the sensor (flow tube) serial numbers match; the transmitter and sensor are calibrated at the factory as a matched set. For multiple sensor installations, do not exchange sensors and transmitters. To use an unmatched replacement transmitter (same model) with an existing sensor, the previous transmitter calibration and configuration settings must be matched on the replacement transmitter.

Use pipe clamps upstream and downstream close to the sensor and provide a stable, rigid mounting to ensure proper performance of the sensor.

Locate the sensor unit at least 0.6 m (2 feet) from any large transformer or motor. The mass flowmeter employs magnetic fields in its operation, therefore, do not mount the sensor near a large, interfering electromagnetic field. Also, do not drape sensor-to-transmitter interconnecting cable over equipment which project a magnetic field, such as electric motors.

In most cases, vibrations in a process plant are not a problem, however, care should be exercised in selecting the sensor's installation location.

Locate the sensor such that it remains full, or, if the process line needs to be purged, locate the sensor so it can be completely emptied of fluid. Keeping the sensor full will help prevent slug flow problems. To prevent gas accumulation within the sensor in a liquid application, avoid locating the sensor in a high point in the process piping.

The sensor measures accurately regardless of flow direction. For proper output display, set the transmitter flow direction as described in the appropriate transmitter instruction manual.

Coriolis meters shall be used to measure liquids, slurries, compressed gases, and liquefied gases.

Coriolis meters shall be capable of measuring mass flow rate, volumetric flow rate, fluid density and temperature from the same sensor.





## 3. SPECIFICATION FOR LEVEL INSTRUMENT

### 3.1. LEVEL INDICATORS

Level glasses shall be of the armoured type with steel body and borosilicate temperate crystals. Glass tube indicators (Tubular type) shall not be utilized.

The glass level indicators shall be provided complete with safety device against the break of the glass. Safety ball, insulating valves and drain valve will generally be provided.

Usually, reflex type level glasses will be used, whereas transparent type level glass shall be adopted for two liquids interfacing. Unless particularly required, transparent type level glasses will not be provided with lighting.

	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p>Bina Consulting Eng. Co.</p>
	Document Title : Specification for Field Instrument		
	Document No. : EI027-000-ED-IN-SPC-001	Rev. R2	Page 12 of 17

Glass column(s) of Level indicator shall cover the full operating range of the vessel, overlapping the HH trip level and vessel bottom, with minimum 1" (25mm).

If two or more columns are required to complete coverage of a vessel, the visible portion of the indicators shall overlap at least 1" (25mm).

### 3.2. DISPLACEMENT TYPE INSTRUMENT

The displacement type instruments will generally be fitted with external cages, cooling fins for temperature exceeding 200°C and torque bar extension for temperature lower than – 20°C.

The head of the instruments shall be of the revolving type.

The displacer shall withstand, without collapsing, the design pressure of the vessel on which it is installed.

Displacement type instrument will be generally used for standard applications, as well as for measuring ranges up to 60" (1524mm). The standard C-C distances such as 356mm (14") and 813mm (32") shall be used as far as possible.

Drain valves and venting plugs shall be provided for the external chamber/cage.

Transmitters connected to ESD of ICSS shall be based on two wire system 24VDC, 4-20mA signal and shall be SMART type with Hart protocol.

The performance of the instruments shall be as follows:

- Accuracy  $\pm 0.25\%$  of span,
- Repeatability  $\pm 0.25\%$  of span,
- Temperature effect  $\pm 0.1\%$  of span/10°C variation

### 3.3. D.P TYPE LEVEL INSTRUMENT

Differential pressure instruments could be selected for range exceeding 60" (1524mm).



They shall be of the same type of those used for the rate measures, except for their zero elevation and suppression device, which will be in accordance with the installation type.

For differential pressure level measurements requiring filled leg(s), these shall be of the flanged sealed capillary type.

Transmitters connected to ESD of ICSS shall be based on two wire system 24VDC, 4-20mA signal and shall be SMART type with HART protocol.

The performance of the instrument shall be as follows:

- Accuracy  $\pm 0.25\%$  of span,
- Repeatability  $\pm 0.25\%$  of span,
- Temperature effect  $\pm 0.1\%$  of span/10°C variation.

 <p>پتروشیمی توسعه پارک صنعتی گوهر افق</p>	<p>Toase-eh Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p>Bina Consulting Eng. Co.</p>
	Document Title : Specification for Field Instrument		
	Document No. : EI027-000-ED-IN-SPC-001	Rev. R2	Page 13 of 17

### 3.4. CAPACITANCE TYPE LEVEL TRANSMITTER

These types of transmitters shall be used mainly on water base fluids or to measure interface level between water and oil. They shall be used only when differential pressure transmitter are not usable.

### 3.5. OTHER LEVEL MEASUREMENTS ELEMENTS

Ultrasonic, bubbling type, radar, conductivity type level elements and magnetic float type shall be utilized in special conditions.

## 4. SPECIFICATION FOR TEMPERATURE TRANSMITTER

The temperature transmitters shall be supplied completely with temperature element and thermowell.

Thermowell shall be 316 S.S. & 1 1/2" min. 600#RF.

The temperature transmitters and temperature elements shall be factory assembled and to be shipped ready for pipe installation.

Enclosure will be made of aluminium alloy, with polyurethane protection suitable for environmental conditions.

These transmitters are microprocessor-based type, and compatible with a variety of temperature sensors, including 2, 3, and 4-wire RTDs, thermocouples and other resistance and millivolt inputs.

The sensor type is software selectable from the hand-held communicator (HHC). It provides 4-20 mA HART output signal.

The input shall be galvanically isolated from the output and ground.

Input shall be RTD (PT 100) or type J or K thermocouple, as specified in related data sheets.

Power Supply shall be 24 VDC.



LCD local indicator shall be provided for transmitters.

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.

Reverse polarity protection shall be provided.

The transmitter accuracy shall be better than  $\pm 0.1\%$  of calibrated span.

Temperature transmitters located in hazardous area shall be Intrinsically Safe, Ex 'ia' and type IIB T4, unless higher gas group / temperature class is required.

	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 Bina Consulting Eng. Co.
	Document Title : Specification for Field Instrument		
	Document No. : EI027-000-ED-IN-SPC-001	Rev. R2	Page 14 of 17

Electrical entrance to the transmitter shall be made by means of M20 gland.

Instrument case and cover shall be weatherproof and dustproof (IP65) and shall be made of high resistance materials such as low-copper die-cast aluminium. Painting shall be epoxy-polyester. Cover of O-rings shall be Buna-N.

Other requirements shall be considered as per attached IPS No.: IPS-M-IN-120, IPS-E-IN-120.

The electrical connection and cable shall be done following the vendor recommendations.

The following items are preliminary requirements for instruments, that detail of them will be clarified in the related data sheets.

## 5. SPECIFICATION FOR THERMOWELL

Thermowells shall be made from solid bar stock material and the bore shall be concentric to 10% of wall thickness in 316 stainless steel (where the properties of the fluid is such that it requires other material, the thermo well material shall be suitable for the duty).

The well shall be polish finished below mounting threads or flange to 0.25 microns.

Thermowell shall be flange connection 1 1/2", Min 600# RF and the internal thread (element) shall be 1/2" NPT female. The resonance Vibration calculation for thermowell will be done by vendor.

## 6. SPECIFICATION FOR TEMPERATURE GAUGE



Temperature gauges shall be adjustable angle bimetalic thermometers.

Dial of temperature gauges shall have diameter of 150mm and shall be white, non-rusting metal, with black figures. Pointer shall be adjustable without removing them from their shaft. Figures should be mentioned with °C & °F.

Temperature gauges shall be capable of withstanding intermittent over-ranging to 1.3 times the maximum range.

Guaranteed gauge accuracy shall be 1% of full scale range.

The gauges shall be suitable for separable socket type (well) installation. The element shall be of sufficient length to firmly touch the well tip for the well length.

 <p>پتروشیمی توسعه پارک صنعتی کوهر افق</p>	<p>Toase-eh Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p>Bina Consulting Eng. Co.</p>	
	Document Title : Specification for Field Instrument		Rev. R2	Page 15 of 17
	Document No. : EI027-000-ED-IN-SPC-001			

The connection from thermometer to thermowell shall be 1/2" NPT.

Minimum 30% over temperature design shall be considered for sensor & movement.

## 7. HAZARDOUS AREA CLASSIFICATION

The station electrical equipment to be installed in hazardous area shall be suitable for operation in the stated hazardous area zone to IEC 60079-10 as stated in the project documentation.

All analogue instruments for hazardous area installation shall be intrinsically safe Ex 'ia'.

Intrinsically safe protection shall be achieved by means of galvanic separation barriers.

The digital instruments for classified area installation shall be explosion proof type Ex(d).



Gas group & temperature class shall be IIB T4, unless higher is required.

## 8. NAME PLATE

All field instruments shall be furnished with a stainless steel corrosion resistant nameplate permanently fastened with screws or stainless steel wire and stamped as follows:

- Manufacturer's name
- Model number
- Serial number
- Instrument tag number
- Supply voltage
- Range
- Output
- Hazardous Area Certification
- Pressure rating
- Year of manufacture
- Certifying authority
- Purchase order number

Metric SI system units shall be applied to all dimensions.

	<p>Toase-ehe Park Sanati Gohar Ofogh Petrochemical Co.</p> <p><b>CONCEPTUAL, BASIC and DETAIL DESIGN ENGINEERING OF STYRENE PARK OFFSITE</b></p>		 <p>Bina Consulting Eng. Co.</p>	
	Document Title : Specification for Field Instrument		Rev. R2	
	Document No. : EI027-000-ED-IN-SPC-001			
		Page 16 of 17		

## 9. GUARANTEE

The manufacturer shall be responsible for the conformity of all codes, standards and recommendations referred in this specification. Any special certification requirements or inspections by other authorities shall be arranged by the contractor.

The equipment to be provided by manufacturer shall be in compliance with this specification and all reference codes. Any exception or deviations shall be listed separately approval.

If any mal performance or defects occur the guarantee period, vendor shall make available repaired, altered or replacement parts free of any charges whatever direct on the purchaser's job site. Vendor shall make available free of charge to the purchaser qualified representative as he deems necessary to supervise the removal, repair and replacement of the defective parts in such manner in such manner that the guarantee be minted.

The guarantee period for repaired or replaced parts shall be 12 months after start up of repaired equipment but not more than 18 months after repaired parts and/or equipment are shipped. The guarantee period for the remaining equipment its operation is dependent upon the proper performance of the repaired part shall be extended by the number of days of fraction thereof that the equipment had been inoperative because of defects. Field labour charges for works during the guarantee period shall be subject to negotiation between the purchaser and Vendor.



## 10. INSPECTION AND TESTS

Purchaser reserves the right for inspection at any stage of manufacturing, testing or preparation for shipment. Purchaser's approval shall not relieve vendor of his commitments under the terms of purchases and this specification.

Type test certificates shall be provided by manufacturer and the manufacturer shall be fully responsible for carrying it out.

Routine tests shall be conducted in accordance with manufacturer's standard testing and inspection requirements as approved by the purchaser.



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	<p>Document No. : EI027-000-ED-IN-SPC-001</p>		<p>Rev. R2</p>

## 11. PREPARATION FOR SHIPMENT

Unless otherwise specified, preparation for shipment shall be in accordance with the manufacturer's standard. The manufacturer shall be solely responsible for the adequacy of the preparation for shipment employed with respect to materials and applications, and provide materials to their destination in ex-works condition when handled by commercial carrier systems.

## 12. VENDOR DOCUMENTATION

Vendor shall submit the following documents:

- General arrangement drawings showing the dimension, location of nozzles with size, rating, facing & connections.
- List of pre-commissioning, commissioning and start-up spares.
- List of operational spares for two years operation.
- Testing procedure, curves and certificates.
- Vendor quality assurance/quality manual requirements.
- Fabrication and shop test report.
- Installation, operation and maintenance manual.