



Gluck (India) Mfg. Co.

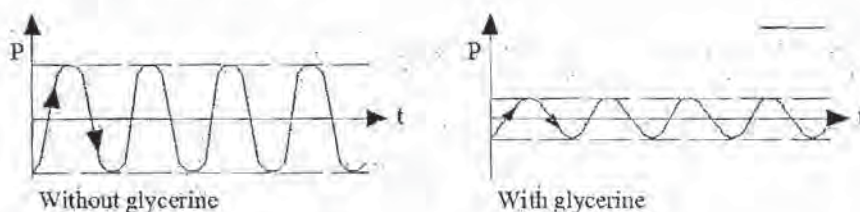
Pressure Gauge Selection

General Information

Operation

With applications incurring frequent pressure changes, pressure peaks and external vibration, general purpose or dry case pressure gauges are subjected to rapid wear. Under such conditions, the moving parts of the gauge suffer oscillations, the amplitude of which is often higher than the natural frequency of the acting forces. This may lead to a fracture of the measuring element. Simultaneously, transmission parts, bearings and gears are warmed up and abraded. An exact reading is usually impossible due to pointer oscillations. To provide effective protection against such conditions, pressure gauges are filled with glycerine. The dampening effect of the liquid, thus reduces the amplitude of the vibrations.

Principle of oscillation dampening



The lubrication provided by the glycerine reduces the abrasion of pinion and shafts and considerably extends the gauge life. Additionally, the filling prevents the formation of condensed water within the case and the entry of unwanted aggressive gases. The equalization of pressure within the case is provided by a bleeder.

- *Shock, Vibration & Pulsation*

Consider liquid filled gauges to enhance the reliability and integrity of the measuring system when operating for long periods under extreme operating conditions. In addition pulsation snubbers are used to minimize effects from pulsation and pressure spikes/surges. The snubber helps keep accurate data flowing by dampening pulsation and spikes/surges. Gauge life is also extended by reducing gauge wear. Further, mounting option become an important consideration for elimination of mechanical vibration between mechanical equipment and the pressure gauge. In some application it may be appropriate to connect the pressure gauges to the mechanical device using flexible hose and tubing so that equipment's mechanical vibration is dampened by structural components. *gluck* offers a wide range of dial sizes, mounting options and case styles to fit customer's gauge mounting needs.

- *Operating Temperature & Ambient conditions*

The normal ambient temperature range for most standard dry or silicone filled gauges is -40 to $+140^{\circ}\text{F}$. The normal temperature range for glycerine filled gauges is -4 to $+140^{\circ}\text{F}$. Steam and other hot media raise the safe working limits of the gauge, such temperature change effects the stiffness of elastic element (Bourdon Tube) and change in stiffness of element will effect gauge accuracy. In these cases, siphons, cooling towers or chemical seals may be used to trap condensed steam or other vapor to isolate the gauge from the heat source i.e. making liquid seal in the line to the gauge for preventing high temperature reaching the gauge internals.



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MODEL Decoding of Bourdon Type Gauges

General Information

For understanding the Model decoding please refer to an example of Model **8A-BD** where the alphabets is to be divided in to parameter “8”, “A-” & “BD” and for values of each parameter refer table 1, 2 & 3 respectively as under.

Table – 1 : Specifies the dial size and general MOC of the wetted parts i.e. Bourdon tube & Shank (Socket or Process Connection)

15	1-1/2" (40mm) Dial Size, Copper Alloy internals
5	2" (50mm) Dial size, Copper Alloy internals
9	2-1/2" (63mm) Dial size, Copper Alloy internals
1	4" (100mm) Dial size, Copper Alloy internals
2	6" (150mm) Dial size, Copper Alloy internals
4	10" (250mm) Dial size, Copper Alloy internals
3	2-1/2" (63mm) Dial size, Steel Alloy internals
7	4" (100mm) Dial size, Steel Alloy internals
8	6" (150mm) Dial size, Steel Alloy internals
6	10" (250mm) Dial size, Steel Alloy internals

Notes:

- 1) Copper Alloys : Brass, Ph. Bronze
- 2) Steel Alloys : SS-304, SS-316, SS-316L, SS-316Ti, Monel

Table – 2 : Specifies utility, construction in general, case MOC and case option (Dry or filled case)

-	General Purpose, Non Weather Proof
E-	General Purpose, Economic, Non Weather Proof
A-	Industrial Purpose, Weather Proof, Aluminium Black Coated Casing (Dry Case)
S-	Industrial Purpose, Weather Proof, SS Casing (Dry Case)
M-	Industrial Purpose, Weather Proof, Steel Black Coated Casing (Dry Case)
AG-	Industrial Purpose, Weather Proof, Aluminium Black Coated Casing (Filled Case)
SG-	Industrial Purpose, Weather Proof, SS Casing (Filled Case)
MG-	Industrial Purpose, Weather Proof, Steel Black Coated Casing (Filled Case)

Table – 3 : Specifies Mounting

BD	Bottom Entry Direct Mounting
BS	Bottom Entry Surface Mounting
CBD	Center Back Entry Direct Mounting
CBP	Center Back Entry Panel Mounting
CBB	Center Back Entry Bracket Mounting
SBD	Side Back Entry Direct Mounting
SBP	Side Back Entry Panel Mounting
SBB	Side Back Entry Bracket Mounting

From the taken example of Model no. **8A-BD** gauge categories as under:

6" (150mm) Dial size Steel Alloy internals X Industrial Purpose, Weather Proof, Aluminium Black Coated Casing (Dry Case) X Bottom Entry Direct Mounting type Bourdon operated Gauge

Gluck (India) Mfg. Co.



Industrial Weather Proof SS Case Bourdon Gauge with Stainless Steel Alloys	PART – 6	Spec. Series : BTW-S
	XS – XXX	: Dry Version
	XSG – XXX	: Filled Version

Universal Stainless Steel Bourdon Type Gauge: Many applications require pressure gauges, which must remain fully functional under extreme operating condition such as aggressive fluids under pressure or aggressive environments. In this case the materials used for the pressure gauges components must be selected with particular care.

Gluck high quality pressure gauges are built with stainless, chrome- nickel steels (i.e. S.S.316). They can be used under all operational conditions, practically without limitations. Their concept combines sturdy design and high measuring accuracy.

The pressure gauges are suitable for extreme measuring conditions. Variable designs and materials enable them to meet the requirements of virtually all-international pressure gauge standards. The gauges can be used for all liquids and gases used in processes except for those having a high viscosity, or which are liable to crystallized.

Nominal Size

63, 100, 150 mm

Accuracy

63 mm: Class 1.6 / 2.5 as per EN-837-1 or Class II as per IS-3624

100 and 150 mm: Class I as per EN-837-1 or Class IB as per IS-3624

Scale Ranges

0...0.6 to 0...800 Kg/Cm² for 100 and 150 mm

0...1 to 0...400 Kg/Cm² for 63 mm

or equivalent other units of pressure or vacuum

Working Pressure

Steady: 3/4 of full scale value

Fluctuating: 2/3 of full scale value

Short Duration: Full scale value

Over Pressure Safety

1.25 X Full scale value. (Up to scale range 100 Kg/Cm²)

1.15 X Full scale value. (For scale range > 100 & ≤ 400 Kg/Cm²)

1.10 X Full scale value. (For scale range > 400 Kg/Cm²)

Enclosure or Weather Protection

IP 65 as per IS 13947 (Part-1)-1993

Operating Temperature

Ambient: -20...+60° C

Medium: +200° C

Temperature Error (Reference temperature +29° C)

Deviation of indication per 10° C about +0.3 % of indicated value for higher temperatures, about -0.3 % of indicated value for lower temperatures.

The temperature used for the correction of the indication is the temperature of the measuring system, and not the temperature of the fluid under pressure.

Standard Features

Pressure Connection (Shank)

Material: Stainless Steel 316

Thread Size: 1/8", 1/4" BSP(M) / BSPT(M) / NPT(M), 14mm Flat for 63mm

1/4", 3/8", 1/2" BSP(M) / BSPT(M) / NPT(M), 22mm Flat for 100, 150 & 250mm

Pressure Element

Material: Stainless Steel 316

< 100 Kg/Cm²: C-type

≥ 100 Kg/Cm²: Helical type



Gluck (India) Mfg. Co.

Industrial Weather Proof SS Case Bourdon Gauge with Stainless Steel Alloys

PART – 6 Spec. Series : BTW-S
XS – XXX : Dry Version
XSG – XXX : Filled Version

Movement
 Stainless Steel 304

Dial
 White Aluminium or ABS Plastic with black lettering

Pointer
 Black Aluminium or Tin

Mounting
 -) Bottom Entry Direct Mounting (BD)
 -) Bottom Entry Surface Mounting (BS) for 100, 150 and 250mm
 -) Side Back Entry Direct Mounting (SBD)
 -) Side Back Entry Bracket Mounting (SBB)
 -) Center Back Entry Direct Mounting (CBD)
 -) Center Back Entry Bracket Mounting (CBB)

Case
 Stainless Steel 304 Semi Glossy Finish

Bezel Ring
 Stainless Steel 304 Bayonet lock type

Window
 Laminated safety glass (Shatter Proof Glass) for 100 & 150mm
 Clear plain glass for 63 mm

Blow Out Protection
 Neoprene Disc at back of the case for 100 and 150 mm
 Bleeder at top of the case for 63mm
 (For filled version bleeder shall be provided on the top of the case for all dial sizes.)

Zero Adjustment
 Provided on the pointer for 100 and 150 mm
 Not available for 63 mm

Optional Features
 -) Accuracy class 0.6 as per EN-837-1 or class IA as per IS 3624 for 150mm
 -) Pressure connection and element material of Stainless Steel 316 L, Monel (Availability to be confirmed with factory)
 -) Liquid filled version available. For 63 mm window shall be acrylic glass. (For details on glycerine filling refer Pressure Gauges Selection)
 -) Other process connection.
 -) Metal Bush bearing movement, Stainless Steel 316 movement (available for 100 and 150 mm).
 -) Scale graduation with °C for refrigerant R717 (NH₃) Ammonia Pressure Range -1-0-16 Kg/Cm² and -1-0-25 Kg/Cm².
 -) Specific custom required scale.
 -) Acrylic window, Toughened Glass window.

Nom. Size	Model No.		Mounting					
	Dry Version	Filled Version	Bottom Entry Direct	Bottom Entry Surface	Side Back Entry Direct	Side Back Entry Bracket	Center Back Entry Direct	Center Back Entry Bracket
63 mm	3S	3SG	BD	NA	NA	NA	CBD	CBB
100 mm	7S	7SG	BD	BS	SBD	SBB	NA	NA
150 mm	8S	8SG	BD	BS	SBD	SBB	NA	NA

NA: Not Available

Gluck (India) Mfg. Co.



Chemical Seals

Diaphragm Seals, Inline Seals, Capsule Seals

General Information

Modern chemical processing and process manufacturing procedures demand ever greater accuracy and reliability from their pressure and level measuring instruments. In order to minimize costs, both rejection level and production down time must be kept to the absolute minimum.

In some applications it is necessary to isolate the pressure measuring instrument from the process medium in order to maintain these accuracy and reliability objectives; the *Gluck* range of Chemical Seals are specifically designed for this purpose.

If a particular instrument and/or chemical seal are needed, user should be aware of the material characteristics, operating conditions for the instrumentation and the method of installation.

The following general information about features, applications and function of our chemical seal is relevant all our Models/Types. Furthermore, you will find user instructions and our advice about how to order in this leaflet. ***Detailed information, dimensional data and drawings can be found on the separate data sheets of the individual models.***

• Application

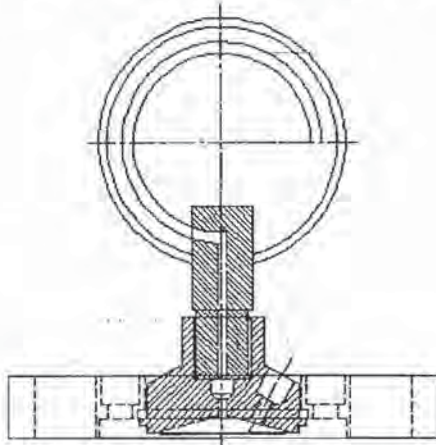
Chemical seals separate the measuring system from the process medium. This way they enlarge the possible applications for pressure gauges, pressure switches, pressure transducers and pressure transmitters a lot. Chemical seals are used and recommended as separators,

- When the process medium is corrosive and requires special corrosion resistance. Bourdon tubes are only available in certain standard materials. When none of these materials suits for the medium, a chemical seal made out of a suitable special material is a reasonable solution.
- When the process medium is thick or viscous fluid, pressure measuring element or bourdon tube shall be suitably protected.
- When process medium tends to crystallize, solidifies or polymerize causing the connection / inlet of the pressure instrument to be obstructed and can generate dead volumes in pressure measuring element.
- When process medium is Heterogeneous fluid with fibrous content, where deposits take place in dead zones.
- When process medium contains suspended solids it should be restricted to enter a measuring element such as bourdon tube.
- When process medium temperature or the ambient temperature at the measuring point is high this would affect the pressure instrument performance if in direct contact.
- For hygienic reasons often found in food or pharmaceutical where no dead space is allowed. Here bacteria zone conform which are sometimes difficult to clean.
- When measurement situations are difficult where either pressure instrument is difficult to read or install.
- For atmospheric or environmental contamination problem where adequate measurement must be made for safety reasons.
- When high over range protection is required.

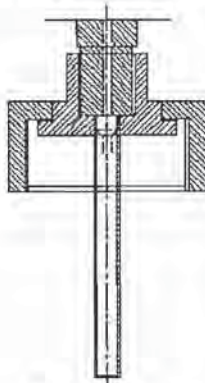
• Function

Chemical seals are mainly used on pressure gauges with Bourdon tubes, pressure switches, pressure transmitters or pressure transducers. They can be directly attached to measuring instrument, or through a capillary line or a cooling element can be mounted between measuring instrument and chemical seal.

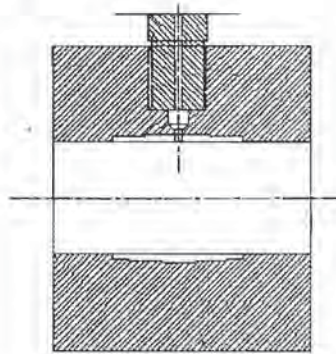
The essential part of a chemical seal is a \the separating element. This can be a membrane (Diaphragm Seal), a tube (Inline seal) or an immersion tube shaft (Capsule seal), compare the simplified drawings of these three basic types below.



Diaphragm Seal Mounted to a Bourdon tube Pressure Gauge



Capsule Seal



Inline Seal

The most current version is a diaphragm seal mounted to a Bourdon tube pressure gauge. Therefore we use this version as an example to describe construction and function:

The pressure element of the gauge and the space behind the membrane form a completely sealed system, evacuated and then filled with a suitable filling liquid. The process medium reaches the membrane which deflects under pressure and causes a volume change inside the system.

The membrane has to displace as much volume as the measuring element needs to indicate the pressure. The deflection of the membrane must stay below its limit of elasticity which is determined by material, form, thickness and diameter of the membrane.

The volume displaced by the membrane is called "displacement volume" or "operation volume". The volume that is necessary to cause the element to indicate the pressure is called "control volume" or "driving volume".



- **Particulars**

The influence of a chemical seal on the measuring result should be as small as possible. Therefore it is important to take all operating conditions in to consideration when choosing a chemical seal, to find the most suitable version for an optimized measurement.

Temperature

The system is filled at ambient temperature, approx +27°C. A different temperature of the medium or the ambience at the measuring point causes a volume change, which changes the pressure inside of the filled system and may cause a significant indication error.

This influence can be minimized by using the best suitable filling fluid. The volume respectively the space behind the membrane of the chemical seal should be as small as possible to reduce temperature caused errors. Also the diameter of the membrane is important for the temperature effect. The bigger the diameter the better the compensation of temperature caused volume change.

For temperature higher than +100°C a capillary line or a cooling element between measuring instrument and chemical seal is recommended, so that the measuring instrument can stay remote from the measuring point. Cooling elements as well as capillary lines reduce temperature arriving at the measuring instrument.

Response Time

Generally a chemical seal retards the reading of the instrument. This can be desired for a better dampening effect on the indicating instrument.

The response time depends on the volume of the filling medium, the viscosity, the pressure range of the measuring instrument, the inner diameter and the length of a capillary line.

Height Difference

When the measuring instrument and the chemical seal are not mounted on the same level, this difference in height influences the measurement through the hydrostatic pressure of the fluid column. Please specify a level difference when ordering, so we can take this into consideration for the calibration.

Filling Fluid

The filling fluid has to be suitable for working and ambient temperature, namely as well as for the possible minimum temperature as for the possible maximum temperature. Furthermore the filling liquid has to be compatible to the medium, especially when the instrument is used for oxygen or chlorine services or in food and dairy industries. It can never be fully precluded that through a damaged membrane filling fluid might drip into the process medium.

Material

The standard and common special materials for chemical seals resp. wetted parts are specified in our data sheets. If you don't find the suitable material for your requirement, please contact us. We shall be pleased to offer individually on your specification.

Capillary Line

Capillary lines are made of stainless steel with protection at both the ends. Optionally the capillary line can be supplied with flexible armour (stainless steel). The maximum possible length of the capillary line depends upon the pressure range and the chemical seal model.

**Attachment of outside bought Measuring Instruments**

Upon request we also attach measuring instrument from other manufacturers to our seals. Therefore we need a detailed description and user instruction of the instrument, so we can verify the suitability of the displacement volume of the selected seal.

User Instruction

Unfortunately chemical seals are often damaged by incorrect handling. The repair of instruments with chemical seals is very time consuming and expensive. Measuring instruments with chemical seal should therefore be handled very carefully.

Please note especially the following notes:

- Avoid touching the membrane ineptly. It is very thin. Any contact with sharp instruments causes damage. Chemical seal should never be cleaned with high pressure water or sharp instruments.
- Do not open any connection of the system.
- All those chemical seal supplied with filling screws which is sealed shall not be opened.
- When the capillary line is not welded but screwed to the chemical seal, this connection are also not allowed to be opened.
- Do not use capillary at all for carrying or moving the instrument. The welding connections are not allowed to be stressed. The capillary line may never be buckled or bended. Buckling or bending causes an increased response time or even a leak, this means to damage the complete system.
- Before you send an instrument back for repair service, please pay attention to clean all wetted parts carefully from the process medium, especially from any health effecting substances. You should state on the delivery notes for which medium the instrument was used.

- **How to Order**

Besides the specification of the required measuring instrument enquiry or order needs to contain the following information:

- Model/Type of chemical seal (If already chosen; otherwise we will be pleased to help you selecting the suitable model)
- Material of construction for wetted parts
- Process connection
- Required Transmitting fluid
- Operating and maximum pressure
- Temperature at the chemical seal; if changing: from ____ upto ____ °C or °F
- Ambient temperature
- Minimum and maximum temperature in case of flush or other cleaning procedures
- When capillary extension is required, please specify further details as under;
 - Length of extension
 - Any difference in height between chemical seal and measuring instrument
 - Mounting of the measuring instrument
 - Bottom entry surface mounting i.e. Rear flange at the instrument
 - Bottom entry yoke mounting i.e. Pipe clamp mounted on back of the case
 - Back entry panel mounting i.e. Front flange at the instrument
 - Back entry bracket mounting i.e. Bracket at the instrument and Case MOC shall be Aluminium black only.



Gluck (India) Mfg. Co.

Chemical Seals

Diaphragm Seals, Inline Seals, Capsule Seals

General Information

*In our data sheets you find information about our standard models and configurations. Besides that we developed in close cooperation with our customer numerous **INDIVIDUAL TECHNICAL SOLUTIONS** for pressure measurements.*

Please do not hesitate to contact us, it shall be our privilege to find the most suitable solution to your individual pressure measuring requirements.

Gluck chemical seals are basically designed and categorized as under:

- | | |
|---------------------------------------|-------------------|
| • Sandwich Diaphragm Seals | Prefixed as CS-S |
| • Welded Diaphragm One Piece Design | Prefixed as CS-W1 |
| • Welded Diaphragm Two Piece Design | Prefixed as CS-W2 |
| • Welded Diaphragm Three Piece Design | Prefixed as CS-W3 |

Please refer decoding information on each type of above seals for the general available option for its selection parameters. For every selection's detailed information refer Data / Specification sheets.



Gluck (India) Mfg. Co.

MODEL & Item Code Decoding of Chemical Seals (Sandwich Diaphragm Seals)	General Information
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Considering large permutation and combination of various parameters for chemical seals it is must to have MODEL reference for identifying type of chemical seal in **general** with respect to its construction & type of process connection. All the chemical seals under Sandwich Diaphragm Seals type are prefixed with CS-S i.e. Chemical Seal – Sandwich type. Second parameter specifies construction & type of seal i.e. CS-S-XX where XX₁ has to be replaced as per Table-1 hereunder.

Table-1 : Specifies construction & Seal Type (XX ₁)	
TH	Threaded Connection Seals (Male or Female)
RF	Regular Flanged Connection Seals
IF	I-Section Flanged Connection Seals
MT-TH	Most Tapper Threaded Connection Seals (For High Viscous Application)
TH-FL	Threaded Connection Seals with flushing arrangements (Male or Female)
OF	Open Type Flanged Connection Seals (Flush Diaphragm)
TGF	Tongue & Groove Flanged Connection (For High Pressure)

Further to MODEL reference it is must to identify the other parameters for the seal and the same are defined below which form the specific item code for the seal.

Item Code Generation: CS-S-XX₁-XX₂-XX₃-XX₄-XX₅-XX₆-XX₇-XX₈

Please refer Table-2 to 8 hereunder for values of each parameter to be replaced for XX₂ to 8 respectively.

Table-2 : Specifies MOC of Top Housing (XX ₂)	
MSB	Carbon Steel Black Coated
MSP	Carbon Steel Plated
S4	Stainless Steel 304
S6	Stainless Steel 316
FRG	Forged Flange (For the Forging grade data sheet is to be referred)

Table-3 : Specifies MOC of Bottom Housing (XX ₃)	
MSB	Carbon Steel Black Coated
MSP	Carbon Steel Plated
S4	Stainless Steel 304
S4L	Stainless Steel 304L
S6	Stainless Steel 316
S6L	Stainless Steel 316L
MN	Monel
HC	Hest alloy 'C'

Table-4 : Specifies Protection on Bottom Housing (XX ₄)	
NA	Not Applicable
PTC	PTFE Coated
PTL	PTFE Lined
PVC	PVC Coated
PVL	PVC Lined
RL	Rubber Lined



Gluck (India) Mfg. Co.

MODEL & Item Code Decoding of Chemical Seals (Sandwich Diaphragm Seals)	General Information
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Table-5 : Specifies MOC of Diaphragm (XX ₅)	
S6	Stainless Steel 316
S6L	Stainless Steel 316L
MN	Monel
HC	Hestalloy 'C'
IN	Inconel
N2	Nickle-200
N4	Nickle-400
TA	Tantalum

Table-6 : Specifies Protection on Diaphragm (XX ₆)	
NA	Not Applicable
PTC	PTFE Coated
PTL	PTFE Lined
ETL	Halar (High Grade Teflon – ECTFE) Lined

Table-7 : Specifies Gasket MOC / Grade (XX ₇)	
A-GR	Asbestos of various Grade
T	Teflon
P	PVC
NR	Neoprene Rubber

Table-8 : Specifies Seal Range Note (XX ₈)	
L	Low Pressure Range of 0.6 Kg/cm ²
R	Regular Pressure 0-1 up to 25 Kg/cm ²
M	Medium Pressure 0-30 up to 60 Kg/cm ²
H	High Pressure 0-70 up to 160 Kg/cm ²
VH	Very High Pressure 0-210 up to 400 Kg/cm ²

For understanding item code refer an example of item code:

CS-S-TH-MSB-S6-NA-S6-PTC-A60-R

This specifies Chemical Seal Parameters as under:

- o CS : Chemical Seal
- o S : Sandwich Diaphragm Type
- o TH : Threaded Connection (For Size and Type Data/Specification sheet to refer)
- o MSB : Top Housing CS Black Coated
- o S6 : Bottom Housing Stainless Steel 316
- o NA : Bottom Housing Protection not Applicable
- o S6 : Diaphragm (Membrane) of Stainless Steel 316
- o PTC : Diaphragm protected with Teflon Coating
- o A54 : Asbestos Gasket of Grade-60 of Champion Make Acid Proof Temp. 210°C & Pressure 150 Kg/cm².
- o R : Regular Pressure Range i.e. 0-1 up to 25 Kg/cm²

In addition to above for filling fluid, mounting information, Bourdon Gauge type to be attached to the seal refer specific data sheet.

Gluck (India) Mfg. Co. Ghatkopar (West), Mumbai - 400 086.		Chemical Seal Unit (Sandwich Diaphragm Type) having threaded process connection		Series REV	CS-S 0
Gluck chemical seals are used wherever it is necessary to avoid direct contact of the pressure gauge with the measured medium, like 1) The process fluid being measured would contain solid particles or viscous which would normally clog the pressure element. 2) Pressure element materials capable of withstanding corrosive effects of certain fluids are not available. 3) The process fluid might freeze due to changes in ambient temperature and damage the element. This is a common occurrence in the chemical, petrochemical, food and paper industries or wherever special process techniques takes place. Chemical seals transmit the pressure from a process fluid to a pressure instrument and act as an isolating element. Bourdon tube pressure gauges or pressure transducers or pressure switches are used for the indication/controlling of measured value. Chemical seals are designed for the pressure ranges 0/0.6 bar (0/10 PSI) to 0/800 bar (0/10000 PSI). In most cases pressure instrument is directly mounted on the chemical seal, but a separation of the chemical seal and pressure instrument is possible. In this case, a flexible connection line or capillary tube is installed between the chemical seal and pressure instrument. The volume in the pressure sensor and in the bourdon tube measuring system is completely filled with a liquid. The pressure acts on the process side of the sensor only. Pressure changes are transmitted to the measuring system of the pressure instrument by the filling liquid i.e. transmitting fluid. As the entire system is filled, the connection between the pressure sensor and pressure instrument can not be separated. Both parts are sealed to avoid tampering.					
MODEL / TYPE		CS-S-TH			
SPECIFICATION					Remark
Type		Direct mounting chemical seal			
Top Housing		S.S. 304			2)
Sensing Element	MOC	Diaphragm / Membrane of S.S. 316			2)
	Protec.	PTFE (Teflon) Coated			
Bottom Housing	MOC	S.S. 316			2)
	Protec.	None			
Packing Material		Fibre Asbestos Acid proof gaskets			
Transmitting Fluid		Silicone Oil (General Use)			
Process Conn.	Type	Threaded Connection			
	Size	1/2" NPT (M)			
Capillary		Not applicable			2)
Capillary Protec.		Not applicable			2)
Pressure Instr.		Seal shall be attached to Bourdon Gauge Model :- 8S-BD			1)
Optional Req.		Not applicable			
Accessories (Suitable to Gauge Conn.)					
Notes & Deviation: 1) For detail specification of Pressure Instrument, please refer attached specification sheet of specified Model. Seal shall be assembled with pressure instrument at our works and shall be supplied as a single unit. 2) For steel alloys offered grade of material is as minimum and better can be offered at our options.					
Our Ref.	YYP/TIL-WWS//Q/E/006/09 Dtd 16.04.2009			ISO 9001:2000 Certified No. 29177	
Yr. Ref.	OC-7833 PO 3841				
Project	M/s. Cairn Energy India Pty. Ltd. / Condensate Polishing System			For Gluck (India) Mfg. Co., (Sign)	
Client	M/s. Thermax Limited (WWS/WTP), Pune				
Consultant	L&T Limited., India Faridabad & Baroda				
Representative	Ganu				
Purpose	Final Submission				

Gluck (India) Mfg. Co. Ghatkopar (West), Mumbai - 400 086.		Industrial weather proof stainless steel case bourdon gauge with stainless steel internals		Series REV	BTW-S 0
Universal Stainless Steel Bourdon Type Gauge: Many applications require pressure gauges, which must remain fully functional under extreme operating condition such as aggressive fluids under pressure or aggressive environments. In this case the materials used for the pressure gauges components must be selected with particular care. Gluck high quality pressure gauges are built with stainless, chrome- nickel steels (i.e. S.S.316). They can be used under all operational conditions, practically without limitations. Their concept combines sturdy design and high measuring accuracy. The pressure gauges are suitable for extreme measuring conditions. Variable designs and materials enable them to meet the requirements of virtually all-international pressure gauge standards. The gauges can be used for all liquids and gases used in processes except for those having a high viscosity, or which are liable to crystallized.					
MODEL / TYPE	8S-BD				
SPECIFICATION					Remark
Nominal Dial Size	150 mm (6")				
Case & Bezel	S.S. 304 semi glossy finished case with bayonet lock type S.S. 304 bezel				1)
Enclosure	IP-65 as per IS-13947 (Part-1) - 1993				
Dial & Graduation	Aluminium or ABS Plastic, Black markings on white dial				
Sensing Element	Bourdon Tube of S.S. 316 (<100 Kg/Cm ² : C-type & ≥ 100 Kg/Cm ² : Helical Type)				1)
Shank / Socket	S.S. 316				1)
Movement	S.S. 304 (Ratio ≤16 Kg/Cm ² : 1:11 & > 16 Kg/Cm ² : 1:18)				1)
Pointer	Black, aluminium or tin or ss (Shall depend on range & selected by us)				
Window	Shatter Proof Glass				
Blow Out Prot.	Neoprene at back of the case				
Over Range Safety	130% of FSD (Confirming to IS-3624 Para 14.3)				
Zero Adjustment	Internal, provided on pointer				
Max. Oper. Temp.	Ambient: -20...+60 °C Medium: +200 °C (For higher temperature use siphon)				
Joints	Argon Arc welded and stress relieved				
Accuracy	± 1% of FSD (Class I as per EN-837-1 or Class IB as per IS-3624)				
Mounting	Bottom entry direct mounting				
Process Conn.	3/8" BSP (M)				
Accessories (Suitable to Gauge Conn.)					
Notes & Deviation: 1) For steel alloys offered grade of material is as minimum and better can be offered at our options.					
Our Ref.	YYP/TIL-WWS//Q/E/006/09		Dtd 16.04.2009		ISO 9001:2000 Certified No. 29177
Yr. Ref.	OC-7833 PO 3841				
Project	M/s. Cairn Energy India Pty. Ltd. / Condensate Polishing System				
Client	M/s. Thermax Limited (WWS/WTP), Pune				
Consultant	L&T Limited., India Faridabad & Baroda				
Representative	Ganu				
Purpose	Final Submission				For Gluck (India) Mfg. Co., (Sign)

Gluck (India) Mfg. Co. <i>Ghatkopar (West), Mumbai - 400 086.</i>		Chemical Seal Unit (Sandwich Diaphragm Type) having flanged process connection		Series REV	CS-S 0
Gluck chemical seals are used wherever it is necessary to avoid direct contact of the pressure gauge with the measured medium, like 1) The process fluid being measured would contain solid particles or viscous which would normally clog the pressure element. 2) Pressure element materials capable of withstanding corrosive effects of certain fluids are not available. 3) The process fluid might freeze due to changes in ambient temperature and damage the element. This is a common occurrence in the chemical, petrochemical, food and paper industries or wherever special process techniques takes place. Chemical seals transmit the pressure from a process fluid to a pressure instrument and act as an isolating element. Bourdon tube pressure gauges or pressure transducers or pressure switches are used for the indication/controlling of measured value. Chemical seals are designed for the pressure ranges 0/0.6 bar (0/10 PSI) to 0/800 bar (0/10000 PSI). In most cases pressure instrument is directly mounted on the chemical seal, but a separation of the chemical seal and pressure instrument is possible. In this case, a flexible connection line or capillary tube is installed between the chemical seal and pressure instrument. The volume in the pressure sensor and in the bourdon tube measuring system is completely filled with a liquid. The pressure acts on the process side of the sensor only. Pressure changes are transmitted to the measuring system of the pressure instrument by the filling liquid i.e. transmitting fluid. As the entire system is filled, the connection between the pressure sensor and pressure instrument can not be separated. Both parts are sealed to avoid tampering.					
MODEL / TYPE		CS-S-RF			
SPECIFICATION					Remark
Type		Direct mounting chemical seal			
Top Housing		S.S. 304			2)
Sensing Element	MOC	Diaphragm / Membrane of S.S. 316			2)
	Protec.	PTFE (Teflon) Coated			
Bottom Housing	MOC	S.S. 316			2)
	Protec.	None			
Packing Material		Acid proof gaskets			
Transmitting Fluid		Silicone Oil (General Use)			
Process Conn.	Type	Flanged Connection			
	Size	1" (25 NB)	ANSI B 16-5	#150 lbs	RF
Mounting Info.		Seal shall be mounted on to line flange using nut & bolt. (Not in our scope of supply)			
Capillary		Not applicable			Length: Not applicable
Capillary Protec.		Not applicable			2)
Pressure Instr.		Seal shall be attached to			Bourdon Gauge Model :- 8SG-BD
Optional Req.		Not applicable			1)
Accessories (Suitable to Gauge Conn.)					
Notes & Deviation: 1) For detail specification of Pressure Instrument, please refer attached specification sheet of specified Model. Seal shall be assembled with pressure instrument at our works and shall be supplied as a single unit. 2) For steel alloys offered grade of material is as minimum and better can be offered at our options.					
Our Ref.	YYP/TIL-WWS//Q/E/006/09 Dtd 16.04.2009			ISO 9001:2000 Certified No. 29177	
Yr. Ref.	OC-7833 PO 3841			 For Gluck (India) Mfg. Co., (Sign)	
Project	M/s. Cairn Energy India Pty. Ltd. / Condensate Polishing System				
Client	M/s. Thermax Limited (WWS/WTP), Pune				
Consultant	L&T Limited., India Faridabad & Baroda				
Representative	Ganu				
Purpose	Final Submission				

Gluck (India) Mfg. Co. Ghatkopar (West), Mumbai - 400 086.		Industrial weather proof stainless steel case bourdon gauge with stainless steel internals		Series	BTW-S
				REV	0
Universal Stainless Steel Bourdon Type Gauge: Many applications require pressure gauges, which must remain fully functional under extreme operating condition such as aggressive fluids under pressure or aggressive environments. In this case the materials used for the pressure gauges components must be selected with particular care. Gluck high quality pressure gauges are built with stainless, chrome- nickel steels (i.e. S.S.316)-They can be used under all operational conditions, practically without limitations. Their concept combines sturdy design and high measuring accuracy. The pressure gauges are suitable for extreme measuring conditions. Variable designs and materials enable them to meet the requirements of virtually all-international pressure gauge standards. The gauges can be used for all liquids and gases used in processes except for those having a high viscosity, or which are liable to crystallized.					
MODEL / TYPE	8SG-BD				
SPECIFICATION					Remark
Nominal Dial Size	150 mm (6")				
Case & Bezel	S.S. 304 semi-glossy finished case with bayonet lock type S.S. 304 bezel				1)
Enclosure	IP-65 as per IS-13947 (Part-I) - 1993				
Dial & Graduation	Aluminium or ABS Plastic, Black markings on white dial				
Sensing Element	Bourdon Tube of S.S. 316 (<100 Kg/Cm ² : C-type & ≥ 100 Kg/Cm ² : Helical Type)				1)
Shank / Socket	S.S. 316				1)
Movement	S.S. 304 (Ratio ≤ 16 Kg/Cm ² : 1:11 & > 16 Kg/Cm ² : 1:18)				1)
Pointer	Black, aluminium or tin or ss (Shall depend on range & selected by us)				
Window	Shatter Proof Glass				
Blow Out Prot.	Nitrile Bleeder at top of the case				
Over Range Safety	130% of FSD (Confirming to IS-3624 Para 14.3)				
Zero Adjustment	Internal, provided on pointer				
Max. Oper. Temp.	Ambient: -20...+60 °C Medium: +200 °C (For higher temperature use siphon)				
Joints	Argon Arc welded and stress relieved				
Accuracy	± 1% of FSD (Class I as per EN-837-1 or Class IB as per IS-3624)				
Mounting	Bottom entry direct mounting				
Process Conn.	3/8" BSP (M)				
Accessories	Glycerine Filled Case				
(Suitable to Gauge Conn.)	Built-in-snobber				
Notes & Deviation: 1) For steel alloys offered grade of material is as minimum and better can be offered at our options.					
Our Ref.	YYP/TIL-WWS//Q/E/006/09 Dtd 16.04.2009			ISO 9001:2000 Certified No. 29177	
Yr. Ref.	OC-7833 PO 3841				
Project	M/s. Caim Energy India Pty. Ltd. / Condensate Polishing System				
Client	M/s. Thermax Limited (WWS/WTP), Punc				
Consultant	L&T Limited., India Faridabad & Baroda				
Representative	Ganu			For Gluck (India) Mfg. Co., (Sign)	
Purpose	Final Submission				

EFFLUENT TREATMENT PLANT		INDEX		1. Cover page 2. Replies to the comment 3. Specification for Pressure switch 4. Catalogue of Pressure switch - SWITCHER : Page no. 5 to 8 : Page no. 3 to 4 : Page no. 2 : Page no. 1		Note:- Electrical connection shall be plug & socket type which is selected as made no 2. Contact type shall have De rating along with AC rating.	
PROJECT		PRAGATI-III COMBINED CYCLE POWER PROJECT		1500 MW (NOMINAL) (A Govt. of India Enterprise) CONSULTANCY WING		CUSTOMER: 	
CONSULTANT:		NTPC LIMITED, CONSULTANCY WING (DATE) _____ (SIGNATURE) _____ FOR INFORMATION AND RECORDS AS NOTED AFTER INCORPORATION OF COMMENTS/ MODIFICATIONS DRAUGHTING/ DOCUMENT MODIFICATIONS AS NOTED RESUBMIT THE USED DRAWING/ DOCUMENT DATE: 11/8/10 PRAGATI POWER CORPORATION LIMITED (PPCL) APPROVED FOR FABRICATION/ CONSTRUCTION APPROVED FOR RELEASE FOR FABRICATION/ CONSTRUCTION APPROVED FOR RELEASE FOR FABRICATION/ CONSTRUCTION		BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA		THERMAX LIMITED PUNE	
DATA SHEET FOR PRESSURE SWITCH		THERMAX DOC NO.: WHJAC00007 SH NO. 1 OF 4 REV. NO : 03		THERMAX 		DATA SHEET FOR PRESSURE SWITCH	



PROJECT: - PRAGATI-III COMBINED CYCLE POWER PROJECT 1500MW (NOMINAL). (ETP PLANT)
OWNER: PRAGATI POWER CORPORATION LIMITED (PPCL)
CLIENT: BHARAT HEAVY ELECTRICALS LTD
CONSULTANT: NTPC LIMITED, CONSULTANCY WING
CLIENT DOC NO: PE-YO-314-164-A201 REV NO.03
THERMAX OC NO: 630128

REPLIES TO THE COMMENT ON DATA SHEET

PRESSURE SWITCH NO. WHJAC00007

S.NO.	COMMENT	THERMAX REPLY	REMARKS
1	Electrical connection shall be in Plug in socket type	Noted & confirmed	

PRESSURE SWITCH							
TYPE				Direct Mounting			
SENSING ELEMENT				S8 - 316L BELLOWS			
WETTED PARTS				S8318			
ENCLOSURE				Weather proof (IP-66)			
HOUSING				DIE CAST AL epoxy painted.			
ELECTRICAL CONNECTION				PUSH-ON-SCREW TYPE			
ACCURACY				±5 % of FSR			
REPEATABILITY				±0.5% of FSR			
PROCESS CONNECTION				40 NB FLANGE 150# FLANGE from bottom			
TYPE OF CONTACT				2 NO + 2NC SPDT SNAP ACTION DRY CONTACT			
SWITCH RATING				15A @ 250V AC			
SWITCHING DIFFERENTIAL				FIXED			
OVER RANGE				MIN.130% OF FULL SCALE			
SET POINT				Adjustable throughout the range.			
TAG NO	PROCESS LIQUID	NORMAL PR KG/CM2	SET PR. KG/CM2	RESET PR. KG/CM2	RANGE KG/CM2	SWITCH ACTUATION	LOCATION
PSH-301	EFFLUENT	3	3.3	3.153	0.6 to 6	RISING	DISCHARGE OF P-3010 A/B
PSH-302	EFFLUENT	2.9	3.19	3.043	0.6 to 6	RISING	DISCHARGE OF P-3020A/B
PSH-303	EFFLUENT	7	7.7	7.553	1 to 10	RISING	DISCHARGE OF P-3050 A/B
PSH-304	EFFLUENT	2.2	2.42	2.27	0.6 to 6	RISING	DISCHARGE OF P-3060 A/B
PSH-305	EFFLUENT	8.2	8.82	8.673	1 to 10	RISING	DISCHARGE OF P-3070 A/B
PSH-306	EFFLUENT	3.6	3.96	3.543	0.6 to 6	RISING	DISCHARGE OF P-3080 A/B
PSH-307	EFFLUENT	7.6	8.36	8.213	1 to 10	RISING	DISCHARGE OF P-3090 A/B
PSH-308	WASTE WATER	1	1.1	1.0505	0.2 to 2	RISING	DISCHARGE OF P-3040 A/B/C
PSL-309	SSF BACK WASH WATER	6.5	5.85	5.997	1 to 10	FALLING	DISCHARGE OF P-3030 A/B
PSH-310	API SEPARATOR OVERFLOW WATER	1.8	1.98	1.833	0.4 to 4	RISING	DISCHARGE OF P-3100 A/B

DIAPHRAGM TYPE CHEMICAL SEAL UNIT		TAG NO.
Seal type	Direct on Instrument	PSH-301
Diaphragm type	Replaceable diaphragm	
Process connection	40 NB ANSI 150# RF 304SS flanged	TO
Diaphragm	316SS with teflon sheath	
Top housing	304SS	PSH-310
Bottom Housing	304SS with teflon insert	
Filling	Silicone oil	

TAG NO.	6	MODEL NO	ON /OFF DIFFERENTIAL VALUES m BAR
PSH-301			147
PSH-302			147
PSH-303			147
PSH-304			147
PSH-305			147
PSH-306			147
PSH-307			147
PSH-308			49.5
PSL-309			147
PSH-310			147

SS tag plate shall be supplied along with switches.

QTY :- 10 NOS MAKE :- SWITZER	PROJECT:PRAGATI-BI COMBINED CYCLE POWER PROJECT 1500 MW (NOMINAL) AT BAWANA,DELHI	6	16/7/2010	SKS	APU	AVS
		5	2/7/2010	SKS	APU	AVS
		4	19/2/2010	SKS	APU	AVS
		3	16/2/2010	SKS	APU	AVS
		2	12/2/2010	SKS	APU	AVS
		1	15/12/2009	SKS	APU	AVS
THERMAX LIMITED Water & Waste Solutions 3rd Chambers, Wakadewadi Pune 411 003 (INDIA)	O.C NO: 630126 OWNER: PRAGATI POWER CORPORATION LTD.,DELHI CLIENT : BHARAT HEAVY ELECTRICALS LTD CONSULTANT:- NTPC - CONSULTANCY WING	0	5/10/2009	SKS	APU	AVS
		Rev	Date	Prepd by	Chkd by	App by
		Specification No		Plant		SH NO
		WHUAC00007		ETP		3 OF 4

PRESSURE SWITCH							
TYPE	2" pipe / Direct mounting (pls refer notes)						
SENSING ELEMENT	SS - 316L BELLOWS						
WETTED PARTS	SS316						
ENCLOSURE	Weather proof (IP-66)						
HOUSING	DIE CAST AL. epoxy painted.						
ELECTRICAL CONNECTION							
ACCURACY	±5 % of FSR						
REPEATABILITY	±0.5% of FSR						
PROCESS CONNECTION	REFER NOTE						
TYPE OF CONTACT	2 NO + 2NC SPDT SNAP ACTION DRY CONTACT						
SWITCH RATING	15A @ 250V AC.						
SWITCHING DIFFERENTIAL	FIXED						
OVER RANGE PROTECTION	MIN.130% OF FULL SCALE						
SET POINT	Adjustable throughout the range.						

TAG NO	PROCESS LIQUID	NORMAL PR KG/CM2	SET PR. KG/CM2	RESET PR. KG/CM2	RANGE KG/CM2	SWITCH ACTUATION	LOCATION
PSH-311 A	EFFLUENT	3.7	4.07	3.923	0.6 to 6	RISING	DISCHARGE OF P-3200 A/B
PSH-311 B	EFFLUENT	3.4	3.74	3.593	0.6 to 6	RISING	DISCHARGE OF P-3210 A/B
PSH-311 C	EFFLUENT	2.3	2.53	2.383	0.6 to 6	RISING	DISCHARGE OF P-3220 A/B
PSH-311 D	EFFLUENT	2.6	2.86	2.713	0.6 to 6	RISING	DISCHARGE OF P-3230 A/B
PSH-312	EFFLUENT	8.8	9.68	9.29	1.6 to 16	RISING	DISCHARGE OF P-3140 A/B
PSH-313	TREATED WATER	2.5	2.75	2.55	0.6 to 6	RISING	DISCHARGE OF P-3120 A/B/C
PSH-314	EFFLUENT	6.2	9.02	8.7275	1.6 to 16	RISING	DISCHARGE OF P-3150 A/B
PSH-315	THICKNER OVER FLOW	7.6	8.36	8.213	1 to 10	RISING	DISCHARGE OF P-3190 A/B
PSH-316	SLUDGE	1	1.1	1.051	0.2 to 2	RISING	DISCHARGE OF P-3130 A/B
PSH-317	DRAIN SUMP WATER	5.4	5.94	5.793	1 to 10	RISING	DISCHARGE OF P-3310 A/B
PSH-318	DRAIN SUMP WATER	2.9	3.19	3.043	0.6 to 6	RISING	DISCHARGE OF P-3320 A/B
PSH-319	WATER	5	5.5	5.402	1 to 10	RISING	DISCHARGE OF P-3240 A/B

DIAPHRAGM TYPE CHEMICAL SEAL UNIT		TAG NO.
Seal type	Direct on Instrument	PSH-311 A,B/C/D
Diaphragm type	Replaceable diaphragm	PSH-312
Process connection	40 NB ANSI 150# RF 304SS flanged	PSH-314
Diaphragm	316SS with teflon sheath	PSH-315
Top housing	304SS	PSH-316
Bottom Housing	304SS with teflon insert	PSH-317
Filling	Silicone oil	PSH-318

FOR PSH 313 & PSH-319 1/4" TO 1/2" NPT Adapter Shall be supplied by Vendor (2" pipe mounting)

TAG NO.	6	MODEL NO.	ON /OFF DIFFERENTIAL VALUES m BAR
PSH-311 A			147
PSH-311 B			147
PSH-311 C			147
PSH-311 D			147
PSH-312			292.5
PSH-313			98
PSH-314			292.5
PSH-315			147
PSH-316			49.5
PSH-317			147
PSH-318			147
PSH-319			98

SS tag plate shall be supplied along with switches.

QTY :- 12 NOS	PROJECT:PRAGATI -III COMBINED CYCLE POWER PROJECT 1500 MW (NOMINAL) AT BAWANA,DELHI	6	18/7/2010	SKS	APU	AVS
MAKE :- SWITZER		5	2/7/2010	SKS	APU	AVS
		4	19/2/2010	SKS	APU	AVS
		3	16/2/2010	SKS	APU	AVS
		2	12/2/2010	SKS	APU	AVS
		1	18/12/2009	SKS	APU	AVS
		0	5/10/2009	SKS	APU	AVS
		Rev	Date	Prepd by	Chkd by	App by
THERMAX LIMITED	O.C NO: 630128					
Water & Waste Solutions	OWNER: PRAGATI POWER CORPORATION LTD.,DELHI					
Sai Chambers, Wakadnivedi	CLIENT : BHARAT HEAVY ELECTRICALS LTD	Specification No		Plant		
Pune 411 003 (INDIA)	CONSULTANT:- NTPC - CONSULTANCY WING	WHJAC00007		ETP		SH NO
						4 OF 4



PRESSURE SWITCHES

WEATHERPROOF
FLAMEPROOF

SERIES 200

- GOOD REPEATABILITY
- TAMPERPROOF SET POINT ADJUSTER WITH LOCKING DEVICE
- OVERTRAVEL STOP
- RUGGED DESIGN



Model 201 in GK Flameproof Enclosure



Model 204 in GM Weatherproof Enclosure

Series 200 Pressure Switches is a SWITZER mainstream product range for switching upto 75 bar and includes models for vacuum, compound and millibar ranges and high overload protection. Precision mechanisms are of stainless steel for arduous atmospheres and high humidity. Enclosures, sensing elements and switching modes can be combined to offer the

variety needed to suit the demands of rapidly expanding industrial processes. Precise and accurate operation is obtained by using time proven seamless hydraulically formed bellows or diaphragm. Setpoint is continuously adjustable over the instrument range. A scale is provided for approximate switch setting.

GENERAL SPECIFICATIONS

Enclosure

GM	Pressure die cast Aluminium, weatherproof to IP:66.	Max. Working Temperature	170°C for SS bellows; 110°C for PB bellows; 110°C for 316L SS diaphragm. (Note 15)
GA	316 SS, investment cast, weatherproof to IP:66	Ambient Temp.	(-) 10°C to (+)60°C (Note 14)
GK	Die cast Aluminium, weatherproof to IP:66 & flameproof to Gr.IIA, IIB or IIC (Note 1)	Connection Process	1/4" NPT(F) direct for 201, 203 & 281. 1/4" or 1/2" NPT(F) direct for 204. Other sizes through Adaptor. Flanged connection for 208 & 209. For details refer ordering matrix.
Ranges	Several std. ranges, from full vac. to 75 bar.	Electrical	3/4" ET(F) standard & 1/2" NPT(F) optional. Dual Entry on request
Sensor	Phosphor Bronze / 316L SS bellows or 316L SS diaphragm.	Mounting	Back panel / wall / field
Wetted Parts	Refer page 2.	Conformity	Generally to BS 6134 : 1991.
Repeatability	± 0.5% FSR for 201 & 203 ± 1.0% FSR for 204, 208, 209, 281 (Note 4)		
Scale Accuracy	± 5% FSR (Note 6)		
Switching Element	Instrument quality SPCO (SPDT) Microswitch. (Notes 10 & 11)		
Differential	Fixed or wideband adjustable. For exact values ask for Differential Tables.		

ORDERING MATRIX

ENCLOSURE

Aluminium pressure die cast weatherproof to IP:66 with Nitrile gasket. — **GM**

304 / 316 SS investment cast weatherproof to IP:66 with overall size as style GM – for aggressive atmospheres. Fit for offshore. — **GA**

Aluminium die cast flameproof cum weatherproof. CIMFR approved to Gr.IIA, IIB & IIC of IS:2148:2004 for flameproofness and IP:66 for weatherproofness. — **GK**

MODEL

This is the basic pressure switch actuated by a seamless bellows having close fixed non-adjustable switching differential. — **201**

Same as 201, but with auxiliary mechanism permitting switching differential adjustment between 8–15% min. to 60% max. without disturbing the set point. — **203**

A variant of series 200, employs twin levers each operating a SPCO microswitch actuated by a single sensor through a unique linkage thereby providing two independent adjustable setpoints, each with its own setting scale, spring & switch. Min. separation between setpoints must be more than sum of on-off differentials; or 10% of FSR whichever is higher. — **281**

Designed to operate in similar ranges as 201, except actuation is by a 316L SS diaphragm which withstands overpressures upto 100 bar. For overpressure upto 200 bar consult factory. — **204**

Similar to 204 but with ANSI 1½" #300 RF or 2" #150 or 300 RF flange. Direct actuation by a 316L SS diaphragm. More responsive than using a chemical seal filled system and suitable for Viscous media. — **208**

Similar to 208 but having 2" nut and Silicone gasket connection to BS 4825 Part 4 for the food industry, free of cavities of crevices for hygiene purposes. — **209**

MATERIALS OF WETTED PARTS

Models 201, 203 & 281

Phosphor Bronze Bellows with brass wetted parts. — **01**

316L SS Bellows with 316 SS wetted parts. — **02**

316L SS Bellows with 316 SS wetted parts to NACE MR-01-75. — **0N**

Monel bellows with Monel Wetted Parts — **0M**

Models 204, 208 & 209

316L SS Diaphragm with 304 SS wetted parts and Nitrile 'O' Ring. — **04**

316L SS Diaphragm with 316 SS wetted parts and Nitrile 'O' Ring. — **02**

316L SS Diaphragm with 316 SS wetted parts and Viton 'O' ring to NACE MR-01-75. — **0N**

Monel Diaphragm with Monel wetted Parts and Nitrile 'O' ring. — **0M**

316LSS Diaphragm with 316 SS wetted parts of welded construction. — **W2**

Model 204 only

316L SS Diaphragm + 304 SS wetted parts + Teflon® 'O' Ring and backup Sheathing for special services. — **T4**

316L SS Diaphragm + 316 SS wetted parts + Teflon® 'O' Ring and backup Sheathing for special services. — **T2**

Model 208 only

316L SS Diaphragm + 304 SS wetted parts with Teflon® Insert and Sheathing for Chlorine service. — **T4**

RANGE CODE : Refer Table-1

SWITCH CODE AND RATING : Refer Table-2

ELECTRICAL ENTRY : Refer Table-3

Table-1 : RANGE CODE & AVAILABILITY

RANGE CODE	RANGE	201	203	204 / 208 / 209	281
A1K	- 1 to 0 bar	✓	✓	204 Only	X
A2K	- 0.5 to +0.5 bar	✓	✓	204 Only	X
C0K	- 1 to +1.5 bar	✓	✓	X	X
D4C	5 to 50 mbar	✓	X	✓	X
D5C	7.5 to 75 mbar	✓	X	X	X
D8D	10 to 100 mbar	✓	X	X	X
A3B	5 to 200 mbar	✓	X	X	X
A3C	5 to 250 mbar	✓	X	X	X
A3K	0.05 to 0.16 bar	✓	✓	X	X
A4K	0.08 to 0.4 bar	✓	✓	✓	✓
A5K	0.2 to 1 bar	✓	✓	X	✓
C1K	0.1 to 1.1 bar	✓	✓	X	✓
C2K	0.2 to 2 bar	✓	✓	X	✓
A6K	0.4 to 4 bar	✓	✓	✓	✓
C3K	0.6 to 6 bar	✓	✓	X	✓
A7K	1 to 10 bar	✓	✓	X	✓
A8K	1.6 to 16 bar	✓	✓	X	✓
A9K	2 to 20 bar	✓	✓	X	✓
C4K	8 to 32 bar	✓	✓	X	✓
B1K	10 to 40 bar	✓	✓	X	✓
B2K	10 to 60 bar	✓	✓	X	✓
B3K	15 to 75 bar	✓	✓	X	X
B4K	0.3 to 1.6 bar	X	X	✓	X
B7K	0.7 to 7 bar	X	X	✓	X
P8B	1.5 to 15 bar	X	X	✓	X
D3B	2.5 to 25 mbar	X	X	✓	X
D4B	100 to 1000 mmWc	X	X	✓	X
X8K	-1000 to 0 mmWc	X	X	204 only	X
X9K	-200 to +200 mmWc	X	X	204 only	X

Note : For On-off Differential values ask for respective Differential table

Table-2 : SWITCH CODE, RATING & AVAILABILITY (Note 10)

SWITCH CODE (SPCO)	AC RATING	DC RATING IN AMPS						AVAILABILITY OF SPCO IN MODELS	AVAILABILITY OF DPCO IN MODELS
		RESISTIVE			INDUCTIVE				
		220V	110V	24V	220V	110V	24V		
2	5A 250 / 125V	0.25	0.5	5.0	0.10	0.25	3.0	201 & 281	201
D	15A 250 / 125V	0.2	0.4	2.0	0.02	0.03	1.0	201, 281 204, 208 & 209	201, 204, 208 & 209
3	15A 250 / 125V	N.R.	N.R.	N.R.	N.R.	N.R.	N.R.	201, 281 204, 208 & 209	201, 204, 208 & 209
W	15A 250 / 125V	0.3	0.5	8.0	0.05	0.1	4.0	203	203
4	1A 125V	N.A.	0.5	0.5	N.A.	0.25	0.25	201, 281 204, 208 & 209	201, 204, 208 & 209
5	5A 250 / 125V	0.2	0.4	4.0	0.2	0.4	3.0	201, 281 204, 208 & 209	201, 204, 208 & 209
6	0.1A 125V	N.A.	N.R.	0.1	N.R.	N.R.	N.A.	201, 281 204, 208 & 209	201, 204, 208 & 209
7	N.R.	N.R.	N.R.	1.0	N.R.	N.R.	0.5	201, 281 204, 208 & 209	201, 204, 208 & 209
8	5A 250 / 125V	N.A.	N.A.	5.0	N.A.	N.A.	3.0	201, 281 204, 208 & 209	201, 204, 208 & 209
S	5A 250 / 125V	0.25	0.5	3.0	0.1	0.2	2.0	201, 281 204, 208 & 209	201, 204, 208 & 209
J	5A 250V	N.R.	N.R.	5.0	N.R.	N.R.	3.0	201, 281 204, 208 & 209	201, 204, 208 & 209
K	1A 125V	N.R.	N.R.	1.0	N.R.	N.R.	0.5	201, 281 204, 208 & 209	201, 204, 208 & 209
A	N.A.	3.0	10.0	15.0	1.5	6.0	10.0	201 & 203	201
E	15A 250 / 125V	0.3	0.75	15.0	0.2	0.4	10.0	201, 204, 208 & 209	—
F	15A 250 / 125V	0.3	0.75	15.0	0.2	0.4	10.0	201, 204, 208 & 209	—

Codes 2, 3, D & W – For General purpose usages.

Code 4 – With Gold alloy contact.

Code 5 – For General purpose with good DC rating.

Code 6 – With Noble metal contact (Low Rating).

Code 7 – Environmentally sealed switch with Gold plated contact.

Code 8 – Environmentally sealed switch with Silver alloy contact.

Code J – Hermetically sealed, inert gas filled with

For DPCO, change switch code to "22", "33", etc., while ordering

N.A. – Not Available N.R. – Not Recommended

Silver alloy contact.

Code K – Hermetically sealed, inert gas filled with

Gold plated contact.

Code A – High DC rated microswitch.

Codes E & F – Manual reset switch. Auto change

over on rising and falling pressure respectively.

Resetting is Manual.

Code 8 – IP-67 sealed microswitch with silver –

Nickel contact.

Table 3 : ELECTRICAL ENTRY

Size *	Single Entry	Dual Entry
3/4" ETF	A	M
1/2" NPTF	B	N
3/4" NPTF	C	O
M20 x 1.5 F**	D	P
M16 x 1.5 F	E	Q
Through Connector		
3 pin plug	2	—
7 pin plug	3	—
9 pin plug	4	—

* Cable gland available on request.
 ** Cable Entry is optional.
 Available on request.

Table 4 : MAXIMUM WORKING PRESSURE RATING (Note 12)

RANGE CODE	MAX. PR. RATING (in Bar)		
	201, 203 & 281	204	
	Element Code		
	01	02	02 / 04
A1K	4	4	100
A2K	4	4	100
COK	4	4	—
D4C	2	2	—
D5C	2	2	—
D8D	2	2	—
A3B	2	2	—
A3C	2	2	—
A3K	4	4	—
A4K	4	4	100
A5K	4	4	—
C1K	4	4	—
C2K	4	4	—
A6K	8	8	100
C3K	9	9	—
A7K	15	15	—
A8K	25	25	—
A9K	25	25	—
C4K	36	36	—
B1K	—	50	—
B2K	—	80	—
B3K	—	80	—
B4K	—	—	100
B7K	—	—	100
P8B	—	—	100
D3B	—	—	100
X7K	—	—	100
D4B	—	—	100
X8K	—	—	100
X9K	—	—	100

Note : For Model 208 M.W.P restricted to Flange rating; for Model 209, MWP is 20 Bar.

NOTES

- Gr.IIA & IIB of IS:2148 is equivalent to NEC CL.1, Gr.C & D. Gr.IIC of IS:2148 is equivalent to NEC CL.1, DIV.1, Gr.A & B.
- Style GM/GA is weatherproof only if all entries and joint faces are properly sealed. Style GK is weatherproof only if cover 'O' ring is retained in position and flameproof only if proper FLP cable gland is used. It is recommended to procure cable glands along with GK instruments to avoid neglect of it while installation.
- Intrinsic Safety (Exi) — Pressure Switches are classified as simple electrical apparatus as per BS 5345-6.3.3. Hence Pressure Switches with GM/GA enclosures may be used in intrinsically safe systems without certification if energy levels are limited to 1.2V, 0.1A or 25 mW.
- Accuracy & Repeatability are not different for all blind pressure switches. A shift of $\pm 2\%$ may be observed in setpoint when pressure falls from full static pressure. Settings will also shift with varying temperature.
- The instrument is calibrated in the mounting position depicted in the drawing. Mounting in any other direction will cause a minor range shift, especially in low and compound ranges. Ranges above 1 bar will not experience this shift.
- A pressure switch is a switching device and not a measuring instrument — even though it has a scale to assist setting. For this reason, Test Certificates will not contain individual ON-OFF switching values at different scale readings. Maximum differential obtained alone will be declared, besides other specifications.
- Select working range of the instrument such that the set value lies in the mid 35% of the range i.e., between 35% and 70% of range span.
- For switching differential values please ask for Differential table. Switching differentials furnished are nominal values under test conditions at mid-scale and will vary with range settings and operating conditions.
- On and off settings should not exceed the upper or lower range value.
- DPCO action is achieved by two SPCO switches synchronised to practical limits i.e., $\pm 2\%$ of FSR. Deadband for DPCO contacts are higher than that of SPCO as force required to actuate the contacts are more. Please refer respective range table for exact values.
- Contact life of microswitches are 5×10^5 switching cycles for nominal load. To quench DC sparks, use diode in parallel with inductance, ensuring polarity. A 'R-C' network is also recommended with 'R' value in Ohms equal to coil resistance and 'C' value in micro Farads equal to holding current in Amps.
- In model 201 Pneumatic air switch can be incorporated instead of standard microswitch. In 'L' code switch air output turns 'ON' on falling pressure and in 'M' code switch air output turns 'ON' on rising pressure. These switches can be connected to an air source of rating 7 bar maximum. Please consult factory for availability.
- Higher Maximum Working Pressure is available on request for some ranges; but ON-OFF differentials will be higher.
- Ambient temperature range: All models are suitable for operating within a range of ambient temperature from $(-)$ 10°C to $(+)$ 80°C provided the process does not freeze within this range. Below 0°C, precautions should be taken in humid atmospheres to prevent frost formation inside the instrument from jamming the mechanism. Occasional excursions beyond this range are possible but accuracy might be impaired. The microswitch is the limiting factor which should never exceed the limits $(-)$ 50°C to $(+)$ 80°C.
- Fluid Temperature: A pressure switch when connected to the process is not subjected to through flow and therefore is not fully exposed to the fluid temperature. Use of adequate length of impulse piping will greatly reduce excessive heating of the sensing element. For e.g., connection of 7.5 cm of 12 mm dia impulse piping will reduce water temperature of 100°C to 65°C at an ambient temperature of 50°C. Ask factory for temperature nomogram for different temperatures.
- Ensure that impulse pipework applies no stress on sensing element housing and use spanners to hold pressure port / housing when connections are made.
- For pressure above 75 bar, Switzer S20/920 series and GB-930 (Bourdon Tube operated version) are available. Complementary instrumentation for differential pressure is available in Series 300.
- Custom built instruments are available for special service requirements under Special Engineering Category.
- For models 204 & 208, select proper 'O' Ring material compatible with process medium.
- Accuracy figures are exclusive of test equipment tolerance on the claimed values.
- All performance data are guaranteed to $\pm 5\%$.

OPTIONS / ACCESSORIES

- Damping coil for minimising process pulsations — increases instrument's life many times.
- Breather / Drain for flameproof enclosures; blow out disc for weatherproof enclosure.
- Snubbers, pigtail syphons, over-range protectors.
- Brass / 316 SS double compression cable glands to suit cable OD of 1/2", 15 mm & 17 mm.
- Degreasing for Oxygen service & special parts for Ammonia service.
- Provision of line fault monitoring.

DIAPHRAGM CHEMICAL SEALS

Diaphragm chemical seals can be provided as optional extra either direct mounted or remote with capillary and threaded / flanged connection, duly evacuated and filled with suitable filling liquid. This device permits the use of pressure switches with bellows element with viscous / aggressive fluids and permits higher process temperatures. Switching lag will be present, when pressure changes rapidly.

While ordering it is important to specify ambient and process temperatures, setpoint, maximum process pressure, relative elevation between connection and switch head, nature of process medium

and whether reactive to common filling liquids should the diaphragm seal leak into the process.

Switching differentials for Instruments with chemical seal — Apply a Multiplication factor of 1.3 for SPCO and 1.5 for DPCO to values given in Range Table for GM / GA housings and apply a multiplication factor of 1.2 for SPCO and 1.5 for DPCO to values of Differential Table for GK housings.

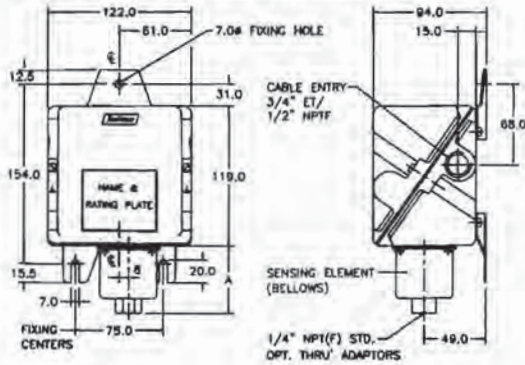
Chemical seals are not available in certain models and ranges and also for instruments with PB Bellows.



MOUNTING DIMENSIONS

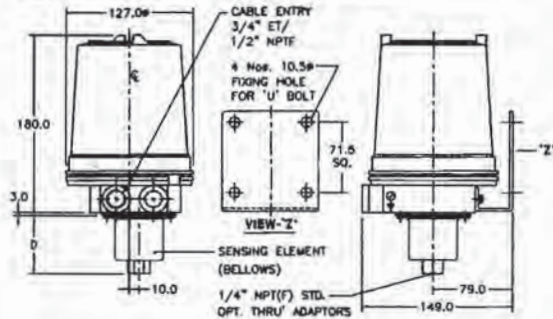
BELLOWS VERSION

MODELS 201, 203 & 281 IN GM ENCLOSURE



► DIM 'A' VARIES FROM 42 TO 92^{±2} DEPENDING ON RANGE

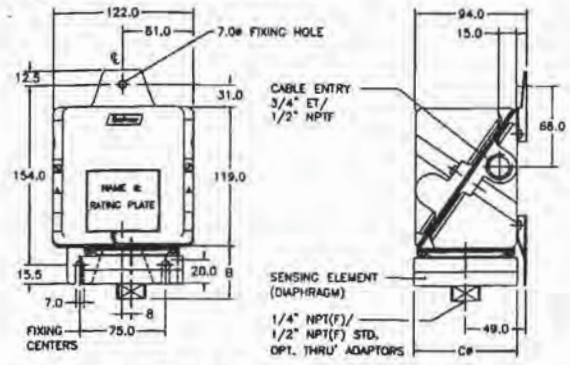
MODELS 201, 203 & 281 IN GK ENCLOSURE



► DIM 'D' VARIES FROM 42 TO 92^{±2} DEPENDING ON RANGE

DIAPHRAGM VERSION

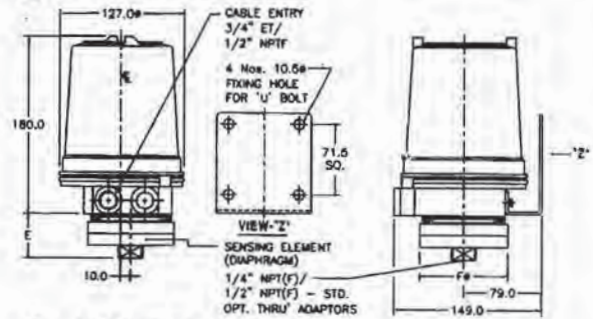
MODEL 204 IN GM ENCLOSURE



► DIM 'B' VARIES FROM 45 TO 74^{±2} DEPENDING ON RANGE

► DIM 'C#' VARIES FROM 66 TO 88 DEPENDING ON RANGE

MODEL 204 IN GK ENCLOSURE

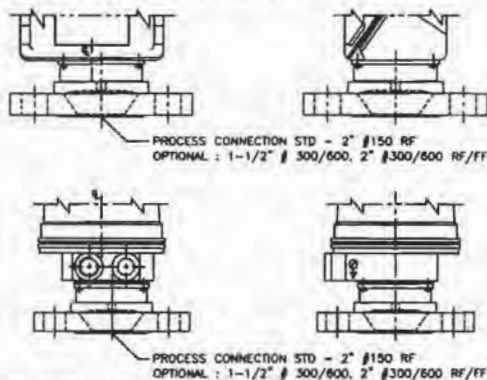


► DIM 'E' VARIES FROM 45 TO 74^{±2} DEPENDING ON RANGE

► DIM 'F#' VARIES FROM 66 TO 88 DEPENDING ON RANGE

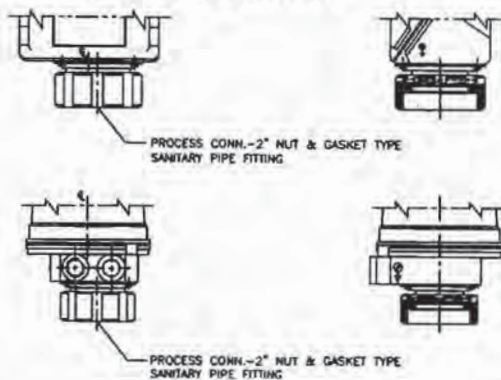
DIAPHRAGM VERSION (FLANGED CONNECTION)

MODEL 208 IN GM/GK ENCLOSURE



NOTE: FIX CERTIFIED WEATHERPROOF CABLE GLAND FOR GM/GK ENCLOSURE.
FIX CERTIFIED WEATHERPROOF CUM FLAMEPROOF CABLE GLAND FOR GK ENCLOSURE.
UNSPECIFIED GENERAL TOLERANCE: ± 1.0

MODEL 209 IN GM/GK ENCLOSURES



All dimensions are in mm

Prior notification of changes in specification is impracticable due to continuous development.

FOR **SWITZER'S** OFFICES IN INDIA

CHECK AT:

<http://www.switzerinstrument.com/offices.htm>

Cat-IV

S. Chandra
23/12/10

NTPC Limited
(A Govt. of India Enterprise)
CONSULTANCY WING

EFFLUENT TREATMENT PLANT

TRANS NO. **C81-185**DATE **22/2/2010**

(SIGNATURE)
(DATE)

- ☒ APPROVED/RELEASED FOR FABRICATION/CONSTRUCTION
☐ APPROVED/RELEASED FOR FABRICATION/CONSTRUCTION
SUBJECT TO INCORPORATION OF COMMENTS/
MODIFICATIONS AS NOTED RESUBMIT REVISED
DRAWING DOCUMENT
☐ NOT APPROVED/RELEASED FOR FABRICATION/CONSTRUCTION
AT THE INCORPORATION OF COMMENTS/MODIFICATIONS
AS NOTED
☒ FOR INFORMATION AND RECORDS.
☐ FOR REVISION AND RESUBMIT FOR INFO & REC.

BHARAT HEAVY ELECTRICALS LTD.
PROJECT ENGINEERING MANAGEMENT
(MECHANICAL AUXILIARY)

This approval status shall be interpreted as laid down in the contract and it shall not release the contractor from his contractual obligations.

APPROVAL: **CAT-IV** AWARDED = **J**

CAT I = Approved
CAT II = Approved With Comments as Noted
CAT III = Not Approved
CAT IV = Release for Drawing

BHEL - PEM-MAX APPROVED BY: **AKS**

NAME: **AKS** SIGNATURE: **AKS** DATE: **13/03/10**

APPROVAL CONVEYED HERE IN FURTHER RELIEVES THE CONTRACTOR OF CONTRACTUAL OBLIGATION AND RESPONSIBILITIES FOR CORRECTING THE DRAWINGS MATERIAL OR CONSTRUCTION DESIGN DETAILS ASSESSMENT FOR MATERIAL PARTS TOOLS AND CONFORMITY OF THE SUPPLIES WITH IT EXHIBITS APPROVED SCHEMES AND STATUTORY LAWS IN THIS REGARD THE CONTRACTOR SHALL BE RESPONSIBLE UNDER THE CONTRACT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DOCUMENTS IS PLANNED WITHIN THE CONTRACT.

1	5/2/2010	REVISED AS PER NTPC COMMENTS	SKS	APU	AVS
0	18/12/2009	FOR APPROVAL	SKS	APU	AVS
Rev. No	Date	Description	Prepared By	Reviewed By	Released By
PROJECT		PRAGATI-III COMBINED CYCLE POWER PROJECT 1500MW(NOMINAL).			
CUSTOMER:		 PRAGATI POWER CORPORATION LIMITED (PPCL)			
CONSULTANT:		 NTPC LIMITED, CONSUTANCY WING			
		BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA			
		THERMAX LIMITED PUNE			
DATA SHEET FOR TEMPERATURE ELEMENT					
THERMAX DOC.NO.: WHJMD00003		BHEL DOC. NO. : PE-VO-314-164-A205		OC.NO. 630128 REV. NO : 01	



PROJECT: - PRAGATI-III COMBINED CYCLE POWER PROJECT 1500MW (NOMINAL), (ETP PLANT)
OWNER: PRAGATI POWER CORPORATION LIMITED (PPCL)
CLIENT: BHARAT HEAVY ELECTRICALS LTD
CONSULTANT: NTPC LIMITED, CONSULTANCY WING
CLIENT DOC NO: PE-VO-314-164-A205
THERMAX OC NO: 630128

REPLIES TO THE COMMENT ON DATA SHEET

TEMPERATURE ELEMENT DOC NO. WHJMD000003

S.NO.	COMMENT	THERMAX REPLY	REMARKS
I	Tag no. TE-801 is not matching with P&ID as well as with data sheet for temp transmitter	Noted & data sheet is revised accordingly	.
II	The given arrangement is not envisaged for head mounted temp transmitter pls, clarify	Noted, head assembly is suitable for head mounted temp transmitter, drawing is revised accordingly	

TEMPERATURE ELEMENTS-RTD	
CONSTRUCTIONAL DETAILS	
1. PROBE	SS 316
2. HEAD TYPE	DIE CAST ALUMINIUM, SUITABLE FOR HEAD MOUNTED TEMP TRANSMITTER
3. ENCLOSURE PROTECTION	WEATHER PROOF IP 65
4. AREA CLASSIFICATION	SAFE AREA
5. REFERENCE STANDARDS	DIN-4370 FOR RTD AND ASME PTC-19.3 FOR THERMO-WELL
6. COMPENSATING CABLE	NA
7. TYPE	RTD (PT 100) 100 OHM RESISTANCE AT ZERO DEG.C.
8. CABLE ENTRY	1/2" NPT (F), 2 NOS
TAG NO.	TE-901
MOUNTED ON	THERMOWELL
9. PROCESS CONNECTION	FLANGED 150#, 50 NB ANSI B 16.5 RF
INSTRUMENT CONNECTION	1/2 " NPT(M)
10. ELEMENT TYPE,	DUPLEX, 4WIRE
MATERIAL	Metal sheathed,Ceramic packed
11. OP.CONDITIONS	
TEMP.RANGE	0 - 50 DEG.C. MAX
PRESS. OPERATING	REFER TABLE
12. CONTR.DETAIL	
INNER SHEATH	Metal sheathed,Ceramic packed
OUTER SHEATH	Metal sheathed,Ceramic packed
TOTAL INSERTION LENGTH	475 mm
13. RESPONSE TIME	NA
14. MEDIUM	TREATED EFFLUENT
15. THERMOWELL	SS 316
16. THERMOWELL PROCESS CONNECTION	CS FLANGED 150#, 50 NB ANSI B 16.5 RF
17. CABLE BETWEEN TEMP. ELEMENT AND TRANSMITTER	NA

TAG NO	LOCATION	RANGE (DEG. CEL.)	OPERATING PARAMETERS	
			TEMP	PRESSURE KG/CM2
TE - 901	DISCHARGE OF COMMON HEADER OF P -3150	0 - 50	AMB	8.2

QTY :- 1 NO.	PROJECT:PRAGATI -III COMBINED CYCLE POWER PROJECT 1500 MW (NOMINAL) AT BAWANA,DELHI	2	5/2/2010	SKS	APU	AVS
MAKE :- TEPMSSENS		1	18/12/2009	SKS	APU	AVS
THERMAX LIMITED Water & Waste Solutions Sai Chambers, Wakadewadi Pune 411 003 (INDIA)	O.C NO: 630128	0	25/11/2009	SKS	APU	AVS
	OWNER: PRAGATI POWER CORPORATION LTD.,DELHI	Rev	Date	Prepd by	Chkd by	App by
	CLIENT : BHARAT HEAVY ELECTRICALS LTD	Specification No		Plant	SH NO	
	CONSULTANT:- NTPC - CONSULTANCY WING	WHJED00002		ETP	2 OF 2	

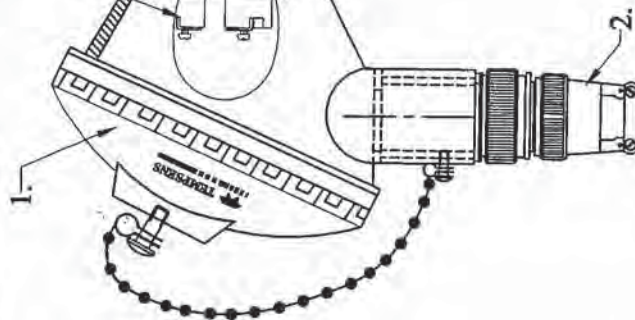
ID.NO. FG 5837

NOTE: ALL DIMENSIONS ARE IN mm
TOLERANCE ± 0.2 mm UP TO 10mm
TOLERANCE ± 0.5 mm UP TO 100mm
TOLERANCE ± 1 mm UP TO 1000mm ABOUT

DIR. _____
FILE NAME: _____

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TEMPSENS



NOTE:- HEAD ASSEMBLY IS SUITABLE FOR HEAD MOUNTED
TEMP. TRANSMITTER (EMERSON MAKE) SHALL BE FITTED
AT SITE, SCOPE IN THERMAX

QTY.:- 01 NOS.

PART NO.: WQGAD01009

TEMP. RANGE.: 0 TO 150°C

TAG NO.: TE-901

YOUR P.O. NO.: 12380 DTD.: 12.11.09

ITEM SR. NO.:- 18760

PROJECT: PRAGATI POWER CORPORATION LTD.

REV	DRN.BY:	CHD.BY:	DATE:	APP.BY:	REMARKS
01.	B.L.S.	S.D.D.	03.02.10	S.D.D.	

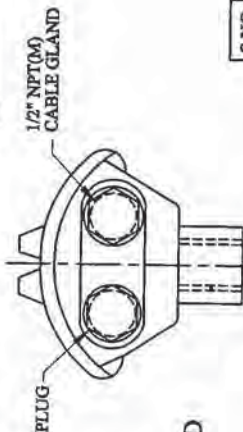
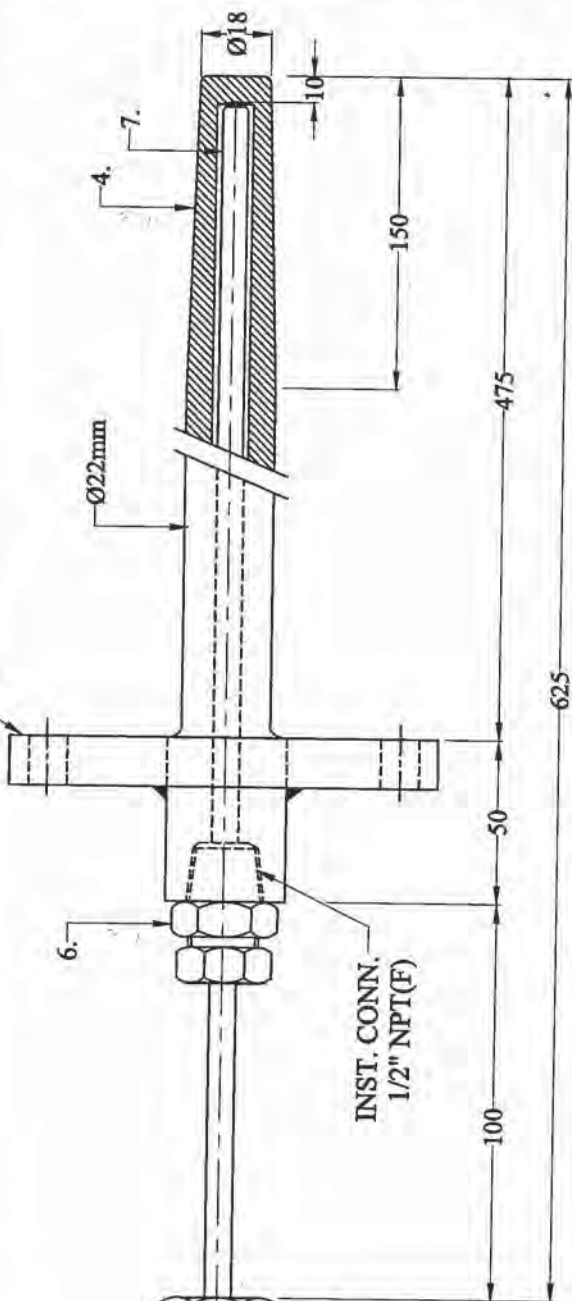
DRN.BY:	B.L.SHARMA	PO.NO.:
CHD.BY: <td>S.D.D.</td> <td>PROJ.NO.: 2598</td>	S.D.D.	PROJ.NO.: 2598
APP.BY: <td>S.D.D.</td> <td>DEPT: DESIGN</td>	S.D.D.	DEPT: DESIGN
DATE:	25.12.08	SCALE: NTS

PROJECTION	TEMPSENS INSTRUMENTS (I) PVT.LTD.UDAIPUR 313 003
	TITLE:- RTD PT-100 X 2, DUPLEX, 4 WIRE, CALI : DIN-43760, CLASS- "A"
	CUSTOMER:- M/s THERMAX LIMITED, (WATER & WASTE)

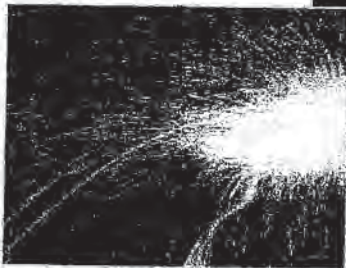
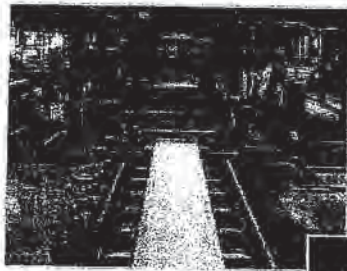
S.NO.	DISCRIPTION	M O C
1.	CONNECTION HEAD IP - 65	DIE CAST ALUMINIUM
2.	PLUG & SOCKET WITH 4 PIN CONNECTOR	ALUMINIUM
3.	TEMP. TRANSMITTER (MAKE EMERSSON)	(NOT IN OUR SCOPE)
4.	THERMOWELL (DRILLED BAR STOCK) TAPERED, OD X ID: Ø22 TO Ø18 X Ø8.5mm	SS 316
5.	2" ANSI B16.5 150#FF FLANGE, OD: 152.4, PCD: 120.7, 4-H-Ø19.1, THK: 19.6mm	C.S.
6.	ADI. COMP. FITTING: 1/2" NPT(M)	S.S.
7.	INSET :PT-100 X 2, DUPLEX, 4 WIRE, M.L:- Ø6mm	SS 316

DRG.NO.	REV.
445837/2596	1.

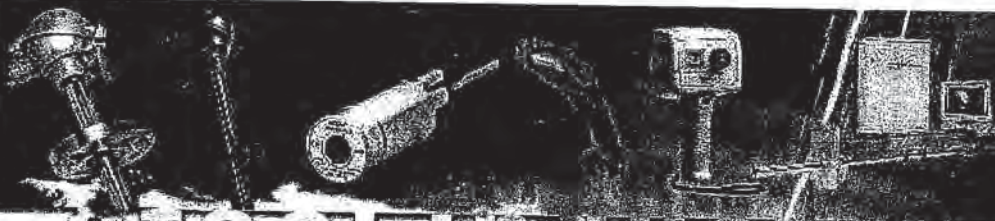
SHEET 1 OF 1	REV.
1	1



CABLE GLAND VIEW



Temperature Sensors



Steel Industry

Chs.



TEMPSENS
INSTRUMENTS

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Thermocouples

RTDs

Compensating Cables

Non Contact Pyrometers

Line Scanner

Furnace Camera

Thermal Imager

Thermography Survey

Temperature Calibration
Equipment

Calibration Services

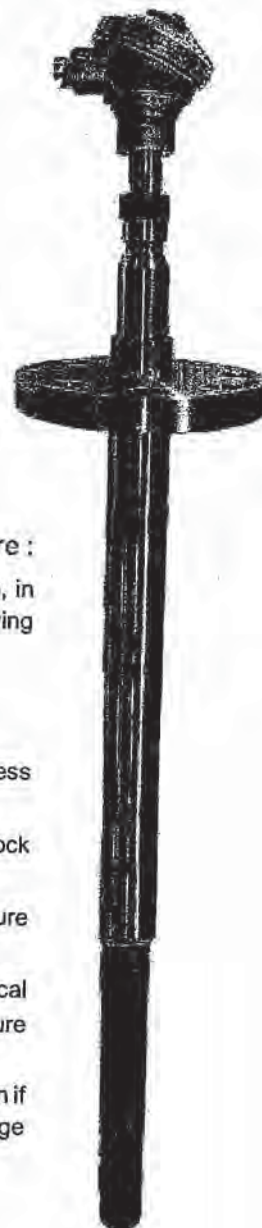
STOVE DOME THERMOCOUPLE

A Blast furnace consist of four major sections

- > Blast furnace
- > Charging unit
- > Gas cleaning equipment
- > Hot blast stove

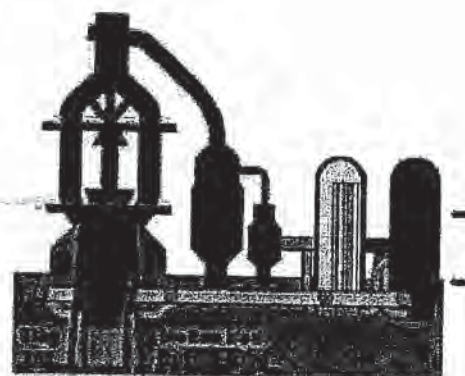
Stove dome / hot blast stove is one of the most critical section in the steel industry. The hot blast has 3 stage operation, either on gas, on blast or bottled up (ready and waiting to be put on blast).

Temperature is one of the major parameter for controlling of this critical process. The temperature inside the blast furnace is about 1100°C and high pressure. The high temperature and high pressure makes the assembly very critical.



The critical components of Stove dome thermocouple are :

- **Element** : 'S' Type / 'R' type , recommended 0.50 or 0.45mm, in some cases 'N' type thermocouple can be used for cost saving where the temperature is max 1100°C.
- **Inner protection tube** : 99.7% Recrystallised Alumina
- **Outer tube (Options):**
 - **Recrystallised Alumina 99.7%** - High wall thickness recommended
 - **Recrystallised Silicon Carbide** – Better thermal shock resistant
 - **Inconel 600** – Better mechanical strength, temperature limited to 1150°C
 - **Inconel 600 with ceramic coating** – good mechanical strength and good abrasion resistance, temperature limited to 1100°C
- **Glass Sealing** : Glass sealing provides a pressure boundry, even if the bottom of the thermocouple breaks there shall be no leakage from the thermocouple head
- **Holding tube** : SS310
- **Flange** : Welded (recommended) or threaded
- **Head** : Die cast aluminium, Ingress protection IP67



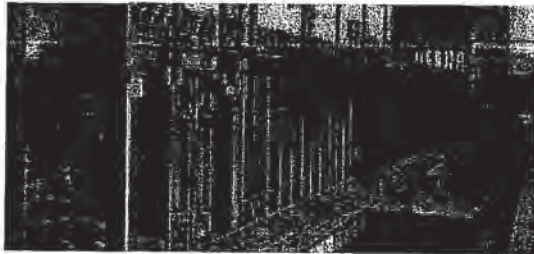
Blast Furnace

COKE OVEN THERMOCOUPLE

Coke is the most important raw material fed into the blast furnace in terms of its effect on blast furnace operation and hot metal quality. The coke making process involves carbonization of coal to high temperatures (1100°C) in an oxygen deficient atmosphere in order to concentrate the carbon. The commercial coke making process can be broken down into two categories: a) By-product Coke making and b) Non-Recovery/Heat Recovery Coke making.

The critical components of Coke oven thermocouple are :

- **Element** : 'S' Type / 'R' type , recommended 0.50 or 0.45mm.
- **Double Protection tube** : 99.7% Recrystallised Alumina with high wall thickness outer and inner tube.
- **Holding tube** : SS310, SS316
- **Head** : Die cast aluminium, Ingress protection IP67



HEARTH REFRACTORY THERMOCOUPLE

Refractory thermocouple (BF thermocouple)

Refractory thermocouples are very important for the startup phase and running phase of the refractory in the steel plants. These are normally very long length thermocouples (upto 40 meters) in mineral insulated construction.

- Thermocouple type : K, Mineral insulated Metal sheathed
- Outer sheath : SS316/SS310/ Inconel 600
- Sheath Dia : 3mm / 4.5mm / 6mm / 8mm
- Length : As per requirement
- Termination : Aluminium Head or Teflon flying leads

Thermocouples of various lengths can be grouped together in a single flange, for a particular area of the furnace.



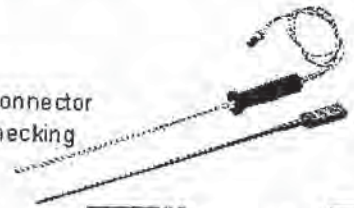
TEMPESENS

DRI KILN THERMOCOUPLES

Quick Response Thermocouple

Fast response thermocouple normally K type with miniature or Standard connector for DRI kiln application and normally used with a hand held indicator for checking immediate temperature.

- Thermocouple type K, Mineral insulated
 - Outer sheath : SS316/ SS310 / Inconel 600
 - Sheath Dia : 3mm / 4.5mm / 6mm / 8mm
 - Length : 600, 750, 1000mm (As per req)
 - Termination : miniature or standard connectors
- in dia meter 3mm / 4.5mm or 6mm with SS316 / Inconel sheathing.



GENERAL THERMOCOUPLE & RTD

High accurate Thermocouples for variety of application

BASE METAL THERMOCOUPLES



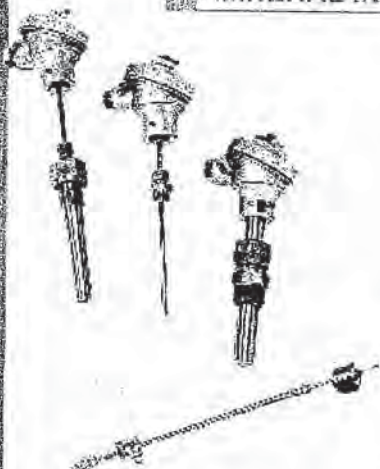
- | | |
|-------------------|---|
| Type | : J, K, T, E, N |
| Element size (MI) | : 1, 1.5, 3, 4.5, 6, 8 (mm) |
| (Non-MI) | : 1.2, 1.6, 2, 2.5, 3.2 (mm) |
| Protection sheath | : Seamless SS 316, SS 310, HRS 446, INCONEL, Nickel, Monel, Hastalloy, Titanium, Ceramic, Silicon carbide etc |
| Configuration | : Simplex / Duplex / Multipoints |

SPECIAL

- ↻ Coated Thermocouples
- ↻ Thermocouples with IBR Approved Thermowells
- ↻ Drilled Bar stock



MINERAL INSULATED RTDs



- | | |
|-------------------|--|
| Type | : Pt 100, 200, 500, 1000
Copper 50, 53 etc. |
| Element | : Wire wound ceramic encapsulated
Wire wound Glass encapsulated
Thin film ceramic encapsulated |
| Connection | : 2, 3, 4 wire |
| Accuracy | : Class A, B, 1/2, 1/3, 1/5 DIN |
| Protection sheath | : SS 304, SS 316, SS 310, INCONEL, Hastalloy, Monel etc. |



SPECIAL

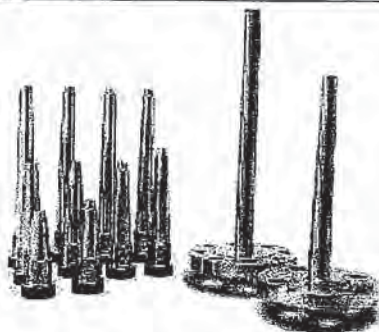
- ↻ Slide shoe RTDs
- ↻ Vibration proof RTDs for DG sets
- ↻ Bearing & Winding temperature RTDs
- ↻ Handheld & Probe in various designs
- ↻ RTDs with IBR approved Thermowells.



THERMOWELLS AND PROTECTION TUBES

A wide choice of refractory and Stainless Steel protective sheathing is available to suit for various applications.

METAL



Material	: SS304, SS 316, SS 316L, SS 321 : HRS 446, INCONEL 600/800 : Hastalloy, Monel, Alloy 20 : Titanium etc
Type	: Drilled barstock, Fabricated
Construction	: Tapered, Straight
Process connection	: Screwed, Flanged

CERAMICS



Material	: Recrystallised Alumina 99.7%
Type	: KER 710 (C-799)
Length	: 350, 530, 600, 650, 740, 900, 1030, 1200 1430 mm
OD x ID	: 6x4, 8x5, 10x6, 12x8, 15x10, 20x15 24x18mm etc.
Insulating Tubes	: 2/4/6 Holes.
OD	: 2.8, 3.5, 5.5, 8.5, etc.

SPECIAL



Metal Thermowells with Tungsten carbide
/ Ceramic / PTFE / PVDF / PFA coatings
Solid sintered tungsten carbide
Silicon carbide
Platinum thimble
Tantalum, Titanium, Nickel cladding
Graphite Thermowells

CABLE

Compensating cables for thermocouples J,K,T,E,N,R,S,B Types.

Wire Gauge	: 14 to 36 gauge (AWG/SWG)
Conductor	: Solid / Multistrand
Insulation	: Single and double fibre glass, teflon, ceramic fibre, silica fibre, SS braided, PVC etc.
Protection	: Armored / Unarmored



 **TEMPSENS**

NON CONTACT PYROMETER

PORTABLE

				
Instrument	IN14/ IN15	IGA 15 plus	IS 8 plus	IS 8 GS plus
Temperature ranges (Between.....and.....)	-32....600°C -32....900°C	250....1800°C	600....2500°C	1000....2000°C
Spectral range	8....14 µm	1.45....1.8 µm	0.6....1.1µm	0.55 µm
Field of view (minimum spot size in mm)	10:1 15:1 30:1 50:1(min 2.2)	200:1(min 1.25)	Min 300 : 1(min 0.8)	Min 300 : 1(min 0.8)
Response time t_{90}	300 ms 150 ms	20 ms	1 ms	500 ms
Output	-/RS232 or RS232 and analog output	RS232 and Analog output	RS232	RS232

ONLINE

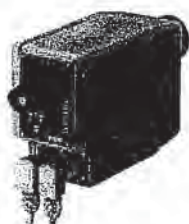
				
Instrument	IN 510, IN 510-N IN 520, IN 520-N	IS/IGA 200	IS/IGA 5	IS 50-LO PLUS IGA 50-LO PLUS
Temperature ranges (Between.....and.....)	-40....700°C	650...2500°C 300...1800°C	650...3000°C 250...3000°C	550....3300°C 300....2500°C
Spectral range	8....14 µm	0.8...1.1µm 1.45....1.8 µm	0.8...1.1 µm 1.45...1.8 µm	0.8....1.1µm 1.45....1.8µm
Field of view (minimum spot size ? in mm)	2:1 or 10:1	3 fixed optics Min 200: 1 (min 5) Min 100: 1 (min 6)	Optics N Min 160 : 1 (min 0.5) Optics F Min 200 : 1 (min 1)	Optical head I Min 100:1 (min1.2) Optical head II min 200:1 (min 0.45)
Response time t_{90}	180 ms adjustable up to 30 s	20 ms adjustable up to 10 s	72 ms adjustable up to 10 s	< 1 ms Adjustable up to 10 s
Output	0/4...20 mA, 0...5 V, thermoc. J / k, RS232/ RS485 (switchable)	4...20 mA	0/4... 20 mA, RS232 or RS485, PID-controller (option)	0/4...20 mA, RS232/ RS485 (switchable)

NON CONTACT PYROMETER

TWO COLOUR (RATIO)

				
Instrument	ISQ 5-LO	ISR/IGAR 12 -LO	ISR 50-LO	ISQ 5
Temperature ranges (Between.....and....)	700...2500°C	600...3300°C 300...2200°C	700...3000°C	600...3000°C
Spectral range	Channel 1: 0.9 µm Channel 2: 1.05µm	0.8...1.1 µm 1.28...1.7 µm	Channel 1:0.9 µm Channel 2:1.05µm	Channel 1:0.9 µm Channel 2:1.05µm
Field of view (minimum spot size ? in mm)	Optical head I Min 100 : 1 (min1.2) optical head II (focusable) Min 200:1(min 0.45)	Optical head I Min 100 : 1 (min1.2) optical head II (focusable) Min 200:1(min 0.45)	Optical head I Min 100 : 1 (min1.2) optical head II (focusable) Min 200:1(min 0.45)	Min 200 : 1 (min1.5)
Response time t_{90}	?10ms adjustable up to 10 s	2 ms ¹⁾	< 10 ms adjustable up to 10 s	< 10ms adjustable up to 10 s
Output	0/4....20mA, RS232 or RS485 PID-controller (option)	0/4....20mA, RS232 or RS485 (switchable)	0/4....20 mA, RS232 or RS485 (switchable)	0/4....20 mA, RS232 or RS485

SPECIAL ONLINE PYROMETER



IS/IGA 12 with scanner

Fully digital, highly accurate, fast pyrometer with built in scanner, digital display, view finder and optional targeting light, very small spot sizes, variable or fixed optics, analog output, digital interface maximum value storage. For small objects, oscillating wire, moving objects

Temperature ranges (Between.....and....)	550...2500°C 300...1800°C
Spectral range	0.7...1.1µm 1.45...1.8 µm
Field of view (minimum spot size in mm)	6 fixed optics Min 900:1 (min 0.1) 3 focusable optics min 800:1 (min 0.4)
Response time t_{90}	1 ms adjustable up to 10 s
Output	0/4...20mA, RS232 & RS485 (switchable)

PORTABLE TWO COLOUR PYROMETER

Typical Applications

Hot and molten metals, foundries, forging, annealing, induction heating etc.

Features

- Two colour technique
- Through-lens sighting
- Sharp focusing on targets
- 0.25% accuracy
- 10 different spectral responses
- Minimum measurable target diameter 0.65mm (0.025") (M90V with close focus lens set)
- Temperature display in eyepiece and rear window
- Outputs for remote recording, printing
- Built-in data logging



Model	Temperature Range °C	Spectral Response µm	Field of View	Accuracy
M90V	800 °C to 3000 °C	0.65 (same as optical pyrometers)	300:1	0.25% of reading
M90R-1	700 °C to 2000 °C	2-colour near 0.9 (µm)	60:1	0.70% of reading
M90R-2	900 °C to 3000 °C		180:1	

 TEMPESENS

young kook



STRAIGHT VIEW (RNV-103, 203, 303)

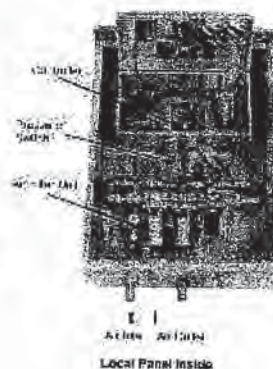
As a standard model of Ro-Ne Vision, it is used for monitoring the front image of the furnace interior and you can select various angles and lengths of the vision tube and this model is suitable for steel reheating furnace, kilns or Power generations etc.

VISION TUBE & WALL SLEEVE

Image Sensor	1 /4" interline transfer CCD
H. Resolution	More than 480 TV Lines
Video Output	Composite Video ,IVp_p ,75 NTSC/PAL
Power Source	DC 12V ± 10%
Current Consumption	Max.200mA
Angle of View	Horizontal :89°,Vertical:68°,Digonol:105°
Length	VT-1180:1180mm/VT 980:980mm
Wall Sleeve Length	350/500/600 (mm)
Wall Sleeve Diameter	Outer diameter :58mm Inner diameter :42mm

RETRACT CONTROLLER

Size(mm)	440(W) x225(H)x 160(D)
Power Source for Main	AC 220V
Power Source for Camera	DC 12V
Solenoid Power for Retract	DC24V
Locking Device	Air Chuck



■ THERMAL VIEW (RNV-503)

With the NIR camera and computer system. This product features an average atmosphere temperature display within any 20-point areas, and date recording/control function in addition to viewing the furnace interior. Each area is adjustable.

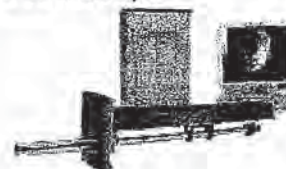
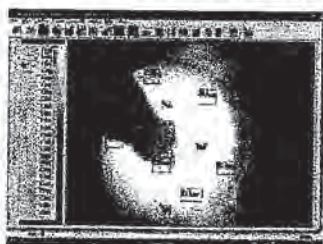
Thermal view is designed to process images by blocking visible images while only receiving infrared image, so it receives clear pictures, and using the software, it is possible to measure the regional temperature by coloring and different shades of infrared image source.

VISION TUBE

Image Sensor	1/2" interline transfer CCD
H. Resolution	More than 600 TV Lines
Power Source	DC 12V
Current Consumption	Max.200mA
Angle of View	Horizontal:89°- Vertical:68°.Digonal: 107°
Length	VT-1100:1100mm

TEMPERATURE MEASUREMENT SYSTEM

CPU	Pentium IV 2.4 GHz
Hard Disk	100GB
RAM	512MB
Monitor	17"
OS	Windows 2000 or XP
Power Source	AC 100 or 220 V
Temperature Range	600 ~ 2000 °C
Measurement Frequency	Min. 1 Sec.
No. of Measurement Place	Max. of 32 places
Measurement Errors	±1% (Standard : black body)
Temperature Display	Celsius or Fahrenheit
Optional	4-20 mA output



PORTABLE THERMAL IMAGERS & THERMOGRAPHY SERVICES

Affordable portable thermal imagers for predictive and preventive maintenance Thermal Imaging is technique for creating an image of scene based on the invisible thermal radiation emitted from an object. Using this technology, thermal images of faults in mechanical and electrical application can be easily located, before occurrence.

■ THERMAL IMAGERS - For Predictive Preventive Maintenance

Specification	Model IRI 4010	Model IRI 4030
Field of View	20° x 15°	20° x 15°
Focus	Manual	Manual
Thermal Sensitivity	150mK @ 25° C	150mK @ 25° C
Detector	160 x 120 pixels	160 x 120 pixels
Image Storage	Up to 1000 Images	Up to 1000 Images
Display	3½" colour LCD	3½" colour LCD
	4 colour palettes	4 colour palettes
Temp. Range	-10°C to + 250°C	200°C to + 900°C
Emissivity	0.2 to 1.0 adjustable	0.2 to 1.0 adjustable
Accuracy	±2% of reading or ± 2°C	±2% of reading or ± 2°C
Interfaces	USB type B	USB type B



IRISYS®

LINE SCANNERS & ONLINE THERMAL IMAGERS

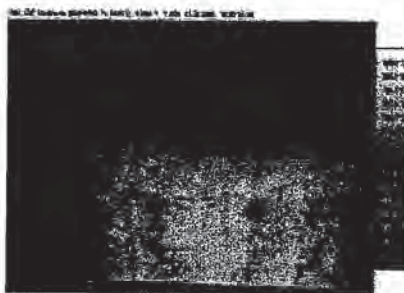
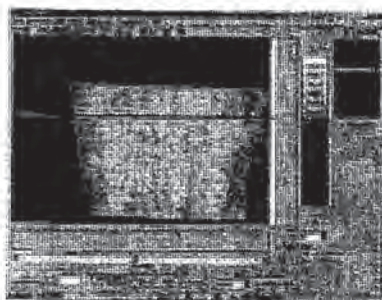
PYROLINE AND PREVIEW CAMERAS

High speed infrared line cameras provide instant non-contact measurement of temperature distribution. Pyroline scanners are useful for temperature profiling of moving objects & processes. For general application scanners at 8...14 µm and for metallic surface scanner at 1.4...1.8 µm.



impac
Germany

Application Picture



TEMPSENS

CALIBRATION BATH, MASTER SENSOR, NABL SERVICE

■ HIGHLY STABLE TEMPERATURE CALIBRATION BATH -30...1500°C

■ BATH

Model	Range	Stability	Medium
Polyscience 9702	-40 ... +200°C	± 0.01°C	Liquid Bath
CALsys -30/50	-30 ... +50°C	± 0.1°C	Liquid Bath
CALsys 300	50 ... +250°C	± 0.1°C	Liquid Bath

■ FURNACE

CALsys 650	50 ... +650°C	± 0.3°C	Dry Block
CALsys 1100	300 ... +1100°C	± 0.5°C	Dry Block
CALsys 1200	250 ... +1200°C	± 0.5°C	Dry Block
CALsys 1500	400 ... +1500°C	± 1°C	Dry Block
CALsys 1700	500 ... +1700°C	± 1°C	Dry Block

■ BLACK BODY SOURCES

CALsys 500 BB	Amb ... +500°C	± 0.5°C	Black Body
CALsys 1200 BB	400 ... +1200°C	± 1°C	Black Body
CALsys 1500 BB	400 ... +1500°C	± 1°C	Black Body
CALsys 1700 BB	500 ... +1700°C	± 1°C	Black Body

■ HIGHLY ACCURATE MASTER SENSORS

► RTD - Pt 100

Accuracy : 1/10, 1/5, 1/3, 1/2 DIN, Class A
Sheath Material : SS316 / Inconel

► Thermocouple

Accuracy : K/N/R/S
Special, Class 1,
with Cold junction compensation
Sheath Material : Inconel / Ceramic (KER 710-C 799)
Cold Junction Probe : J/ K/ E/ N/ R/ S/ B

for Thermocouple Type
Dual Probe Possible in
one Housing



NABL ACCREDITED CALIBRATION CAPABILITIES

IN HOUSE

S.#	Parameter Measured	Range	B.M.C.
1	Contact type temp sensors Thermocouples, RTDs, Digital Temp. Indicator, Thermometers	-38 ... 250 °C	±0.1°C
		250 ... 500 °C	±0.14°C
		500 ... 1000 °C	±1.3°C
		1000 ... 1200 °C	±2.1°C
		1200 ... 1500 °C	±4.2°C
2	Non-contact Infrared pyrometers	50 ... 250°C	±0.4°C
		250 ... 400°C	±0.9°C
		400 ... 500°C	±2.6°C
		500 ... 800°C	±3.5°C
		800 ... 1000°C	±4.1°C
		1000 ... 1200°C	±4.1°C
		1200 ... 1500°C	±5.8°C
3	Contact type temp sensors (For Calibration at fixed point cells) * TPW * Ga * Sn * Zn * AL	0.01°C	±0.015°C
		29.7646°C	±0.029°C
		231.928°C	±0.039°C
		419.527°C	±0.033°C
		660.323°C	±0.036°C

ON SITE

S.#	Parameter Measured	Range	B.M.C.
1	Contact type temp sensors Thermocouples, RTDs, Digital Temp. Indicator, Thermometers	-25 ... 140°C	0.07°C
		140 ... 500°C	0.14°C
		500 ... 1000°C	1.42°C
		1000 ... 1200°C	2.2°C
2	Non-contact Infrared pyrometers	50 ... 250°C	0.4°C
		250 ... 400°C	0.9°C
		400 ... 500°C	3.3°C
		500 ... 800°C	3.5°C
		800 ... 1000°C	4.1°C
		1000 ... 1200°C	4.1°C



TECHNICAL REFERENCES

THERMOCOUPLES REFERENCE DATA (ITS 90) mV v/s Temperature

TYPE		"T" Cu-CuNi	"J" Fe-CuNi	"K" NiCr-NiAl	"N" NiCrSi-NiSi	"S" PtRh10%-Pt	"R" PtRh13%-Pt	"B" PtRh30%-PtRh6%	"E" NiCr-CuNi
Calibration		IS 2056/ASTME 230	IS 2057/ASTME 230	IS 2054/ASTME 230	ASTME 230	IS 2055/ASTME 230	IS 2055	IS 6720	ASTME 230
Tolerances	Standard	± 1°C or ± 0.75%	± 2.2°C or ± 0.75%	± 2.2°C or ± 0.75%	± 2.2°C or ± 0.75%	± 1.5°C or ± 0.25%	± 1.5°C or ± 0.25%	± 0.5%	± 1.7°C or ± 0.5%
	Special	± 0.5°C or ± 0.4%	± 1.1°C or ± 0.4%	± 1.1°C or ± 0.4%	± 1.1°C or ± 0.4%	± 0.6°C or ± 0.1%	± 0.6°C or ± 0.1%	Over 800°C	± 1°C or ± 0.4%
TEMPERATURE °C	-100	-3,379	-4,633	-3,554	-2,407	-	-	-	-5,237
	0	0	0	0	0	0	0	0	0
	100	4,279	5,269	4,096	2,774	0,646	0,647	0,033	6,319
	200	9,288	10,799	8,138	5,913	1,441	1,469	0,178	13,421
	300	14,862	16,327	12,209	9,341	2,323	2,401	0,431	21,036
	400	20,872	21,848	16,397	12,974	3,259	3,408	0,787	28,946
	500	-	27,393	20,644	16,748	4,233	4,471	1,242	37,005
	600	-	33,102	24,905	20,613	5,239	5,583	1,792	45,093
	700	-	39,132	29,129	24,527	6,275	6,743	2,431	53,112
	800	-	45,494	33,275	28,455	7,345	7,950	3,154	61,017
	900	-	-	37,326	32,371	8,449	9,205	3,957	68,787
	1000	-	-	41,276	36,256	9,587	10,506	4,834	76,373
	1100	-	-	45,119	40,087	10,757	11,850	5,780	-
	1200	-	-	48,838	43,846	11,951	13,228	6,786	-
	1250	-	-	50,644	45,694	12,554	13,926	7,311	-
	1300	-	-	52,410	47,513	13,159	14,629	7,848	-
	1400	-	-	-	-	14,373	16,040	8,956	-
1500	-	-	-	-	15,582	17,451	10,099	-	
1600	-	-	-	-	-	-	11,263	-	
1700	-	-	-	-	-	-	12,433	-	

SHEATH MATERIALS

SHEATH	MELTING POINT °C	USABLE TEMP. °C	CHARACTERISTICS
SS-304	1430	800	High resistance to heat and corrosion
SS-316	1430	900	Excellent resistance to Heat, Acids & Alkalies
SS-321	1400	900	Excellent resistance to corrosion
SS-310	1410	1100	Good oxidation resistance at low temperature and sulphur atmosphere
HRS-446	1400	1150	Excellent oxidation resistance at elevated temperature and sulphur atmosphere
Inconel 600/800	1400	1100	Excellent oxidation resistance (do not use in sulphur atmospheres)
High Alumina 610	-	1500	General purpose
Sintered Alumina 710/C-799	1800	1500	Excellent thermal, mechanical, electrical and corrosion resistant.
Recrystallised Silicon Carbide	1850	1500	Outstanding resistance to thermal shock, good mechanical strength.

COLOUR CODE OF COMPENSATING CABLES & THERMOCOUPLES

Type	BRITISH BS 1843	AMERICAN ANSI/MIL-1	GERMAN DIN 12714	ISO 9146	JAPANESE JIS C 1516-1987
K					
T					
J					
E					
R					
S					
B					
N					

Other sheath materials like Titanium, Molybdenum, Graphite, Aluminum etc. are available against specific requirement

TOLERANCE VALUES OF RTD PT-100 (IEC 751)

TEMP (°C)	BASIC VALUES	TOLERANCE			
		CLASS A		CLASS B	
		(± °C)	(± Ω)	(± °C)	(± Ω)
-200	18.52	0.55	0.24	1.3	0.56
-100	60.26	0.35	0.14	0.8	0.32
0	100	0.15	0.06	0.3	0.12
100	138.51	0.35	0.13	0.8	0.30
200	175.86	0.55	0.20	1.3	0.48
300	212.05	0.75	0.27	1.8	0.64
400	247.09	0.95	0.33	2.3	0.79
500	280.98	1.15	0.38	2.8	0.93
600	313.71	1.35	0.43	3.3	1.06
700	345.28	-	-	3.8	1.17
800	375.70	-	-	4.3	1.28

EMISSION CHART

EMI in %		EMI in %	
"Black body"	100	Oil Paints	85..95
Human skin	98	Asphalt	85
Black matter	95	Textiles	75..95
Carbon black	95	Graphite	75..92
Wood	80..92	Cement	90
Masonry	85..95	Water	95
Chamotte	85..95	Glass	80
Rubber	85..95	Quartz	80
Porcelain	85..95	Steel (Oxidized)	60..80
Ceramics	85..95	Steel (Blank)	10..30
Paper	85..95	Aluminium (Blank)	2..15

TEMSENS

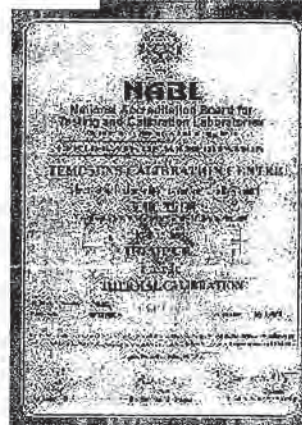
Always one step ahead....Committed to success

TEMPSENS Instruments (I) Pvt. Ltd. is a part of Pyrotech group which was established by four technocrats in 1976 at Udaipur, with our first product as Thermocouples and RTDs. To enhance our customer's success we provide high quality products and services for "Temperature solution", tailored to their needs, and delivered to meet their schedule.

We have tied up with world leaders in Temperature measuring technology for critical components, Non contact Temperature measurement and Thermal imaging solutions. We add value to these products and deliver complete engineered solutions, backed by efficient service and application support.

Today we have strong sales and service network operating from important locations of India. Continuing our constant endeavor of delivering solutions for temperature technology to our large base of over two thousand satisfied customers.

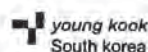
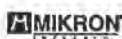
- 35 years of experience
- Large Customer base
- Execute Major-Projects of Steel industries in India and Abroad
- Production Expertise- Specialised Team & Facility for Steel T/C's, Pyrometer
- Thermocouple, Pyrometers, Kiln Shell Scanner Camera.
- NABL Accredited Calibration Laboratory upto 1500 °C
- Fixed Point Temperature Calibration - TPW, Ga, Sn, Zn & AL



TOTAL SOLUTION TO TEMPERATURE SENSOR TECHNOLOGY



OUR ASSOCIATES



Our Offices

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Raipur	: 09329026944	Mumbai	: 09322676597
Hyderabad	: 09390919399	Chennai	: 09382990001

EFFLUENT TREATMENT PLANT

Cat-IV

18/12/09



NTPC Limited
(A Govt. of India Enterprise)
CONSULTANCY WING

TRANS NO. 181-162

DATE 19.01.2010

(SIGNATURE)
(DATE)

- ☒ I APPROVED FOR FABRICATION/CONSTRUCTION
- ☐ II APPROVED FOR FABRICATION/CONSTRUCTION SUBJECT TO INCORPORATION OF COMMENTS/MODIFICATIONS AS NOTED RESUBMIT REVISED DRAWING/DOCUMENT
- ☐ III NOT APPROVED FOR FABRICATION/CONSTRUCTION AFTER INCORPORATION OF COMMENTS/MODIFICATIONS AS NOTED
- ☐ IV FOR INFORMATION AND RECORDS
- ☐ V REVISE AND RESUBMIT FOR INFO & REC

I APPROVAL CONVEYED HEREIN NEITHER RELIEVES THE CONTRACTOR OF HIS CONTRACTUAL OBLIGATION AND RESPONSIBILITIES FOR CORRECTNESS OF DIMENSIONS, MATERIAL OF CONSTRUCTION, DESIGN DETAILS, WORKMANSHIP, PARTICULARS AND CONFORMITY OF THE SUPPLY WITH SPECIFICATIONS, APPROVED SCHEMES AND STATUTORY REQUIREMENTS.

0	18/12/2009	FOR APPROVAL	SKS	APU	AVS
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Rev. No	Date	Description	Prepared By	Reviewed By	Released By
PROJECT		PRAGATI-III COMBINED CYCLE POWER PROJECT 1500MW(NOMINAL).			
CUSTOMER:		PRAGATI POWER CORPORTION LIMITED (PPCL)			
CONSULTANT:		NTPC LIMITED, CONSUTANCY WING			
		BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA			
		THERMAX LIMITED PUNE			

DATA SHEET FOR TEMPERATURE TRANSMITTER.

THERMAX DOC.NO.: WHJMD00002	BHEL DOC. NO. : PE-VO-314-164-A204	OC.NO. 630128 REV. NO : 00
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INDEX FOR TEMPERATURE TRANSMITTER							
TAG NO	OPERATING CONDITIONS			INSTRUMENT RANGE	LOCATION		
	MEDIUM	NORMAL PR. KG/CM2	TEMP				
TT - 901	TREATED EFFLUENT	8.2	30 ° C	0 - 50 ° C	DISCHARGE OF P-3150 A TO H		
QTY :- 1 SET	PROJECT PRAGATI -III COMBINED CYCLE POWER PROJECT 1500 MW (NOMINAL) AT BAWANA,DELHI						
MAKE :- EMERSON			1	18/12/2009	SKS	APU	AVS
THERMAX LIMITED	O.C NO: 630128		0	7/10/2009	SKS	APU	AVS
Water & Waste Solutions	OWNER: PRAGATI POWER CORPORATION LTD.,DELHI		Rev	Date	Prepd by	Chkd by	App by
Sai Chambers, Wakadewadi	CLIENT : BHARAT HEAVY ELECTRICALS LTD.		Specification No		Plant	SH NO	
Pune 411 003 (INDIA)	CONSULTANT - NTPC - CONSULTANCY WING		WHJMD00002		ETP	2 OF 3	

Temperature Transmitter Specification Sheet						
Sr	Identification			Specification		
	General					
1	Make			EMERSON		
2	Model Number			644HANAXAJ8MSC4Q4		
3	Type			Microprocessor based SMART type		
				2 wire with Local Indication -single Input Head mounted Temperature transmitter		
	Transmitter					
4	Accuracy			±0.1% Of Span		
5	Temperature Range			Refer index sheet		
6	Integral Square Rooting			NA		
7	Maximum Span Limit			- 20 TO 85 °c		
8	Output			4-20 mA with Digital Signal Based on HART Protocol		
9	Power Supply			24 V DC		
10	Maximum Turn Down Ratio			NA		
11	Static Pressure Rating			NA		
12	Stability			± 0.15 % Of URL		
13	Update time			150 milliseconds		
14	Local Indication			Digital LCD Indication in Engineering Unit		
15	Electrical connections / Conduit Entry Size			1/2 " -14 NPT (F) X 2Nos		
16	Mounting			field mounted		
17	Enclosure / Housing			NEMA 4X, IP66, SS316		
	Accessories					
18	Mounting Brackets			2 " Pipe Mounting		
NOTE: MATERIAL OF ACCESSORIES IN SS 316						

Rosemount 644 Temperature Transmitter

- Communicates easily using either 4-20 mA/HART® or FOUNDATION™ fieldbus protocol
- Meets NAMUR NE 21 recommendation ensuring reliable transmitter performance for head mount products
- The Transmitter-Sensor Matching feature improves temperature measurement accuracy by up to 75% when compared to unmatched assemblies
- The integral LCD Display conveniently displays the primary sensor input, and diagnostics of the transmitter
- An installation-ready solution that provides a variety of mounting options, transmitter configurations, and sensors/thermowells



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ROSEMOUNT

www.rosemount.com

EMERSON
Process Management

High Accuracy and Reliability for Control Applications

The Rosemount 644 temperature transmitter is ideal for critical applications (in many types of process environments). It provides reliability with advanced accuracy for all installations.

The Rosemount 644 can be ordered with either 4–20 mA/HART or a completely digital FOUNDATION fieldbus protocol. Each unit can be configured for a variety of sensor inputs: RTD, thermocouple, millivolt, or ohm.

DIGITAL FIELD DEVICES THAT POWER PLANTWEB



The advanced 644 powers *PlantWeb*® by communicating important temperature diagnostics and *PlantWeb* alerts to ensure process health and enable economical single-sensor architecture.

TRANSMITTER-SENSOR MATCHING

Entering the temperature-resistance profile specific to the RTD sensor into the 644 transmitter results in transmitter-sensor matching. This eliminates the sensor interchangeability error, which can improve accuracy by up to 75%.

INTEGRAL LCD DISPLAY

Local indication of temperature measurement and diagnostics provides immediate and accurate verification of process conditions.

RELIABLE TRANSMITTER PERFORMANCE

Meeting the NAMUR NE 21 recommendations, the 644 ensures top transmitter performance in harsh EMC environments. In addition, the 644 HART transmitter meets NAMUR NE 43 and NE 89 recommendations.

MOUNTING FLEXIBILITY

DIN A style head mount transmitters fits a variety of housings for remote transmitter mounting and can be integral or remote mounted to a sensor. The compact rail mount style is great for DIN rail mounting in the tight spaces of a crowded control room.

Rosemount Temperature Solutions

Rosemount 644 Temperature Transmitter

Head mount styles available with HART or FOUNDATION fieldbus protocol. Rail mount style available for HART protocol.

Rosemount 848T Eight Input Temperature Transmitter

Eight input transmitter available with FOUNDATION fieldbus protocol.

Rosemount 3420 Fieldbus Interface Module

Provides an interface between FOUNDATION fieldbus instruments and systems without fieldbus capability using standard interface protocols.

Rosemount 248 Temperature Transmitter

Head mount style (DIN B) and Rail mount style with HART protocol and complete temperature assembly.

Rosemount 144 Temperature Transmitter

Head mount style (DIN B) PC-programmable transmitter.

Rosemount sensors, thermowells, and extensions

Rosemount has a broad offering of RTD and thermocouples that are designed to meet plant requirements.

Specifications

HART AND FOUNDATION FIELDBUS

Functional Specifications

Inputs

User-selectable; sensor terminals rated to 42.4 V dc. See "Accuracy" on page 7 for sensor options.

Output

Single 2-wire device with either 4–20 mA/HART, linear with temperature or input; or a completely digital output with FOUNDATION fieldbus communication (ITK 4.5 compliant).

Isolation

Input/output isolation tested to 500 V ac rms (707 V dc) at 50/60 Hz.

Local Display

The optional five-digit integral LCD Display includes a floating or fixed decimal point. It can also display engineering units (°F, °C, °R, K, Ω, and millivolts), milliampere, and percent of span. The display can be configured to alternate between selected display options. Display settings are preconfigured at the factory according to the standard transmitter configuration. They can be reconfigured in the field using either HART or FOUNDATION fieldbus communications.

Humidity Limits

0–99% relative humidity

Update Time

≤ 0.5 seconds

Accuracy (default configuration) PT 100

HART (0–100 °C), ±0.16 °C

FOUNDATION Fieldbus: ±0.15 °C

Physical Specifications

Electrical Connections

Model Power and Sensor Terminals

644H Compression screws permanently fixed to terminal block
644R Compression screw permanently fixed to front panel
WAGO® Spring clamp terminals are optional (option code G5)

HART Communicator Connections

Communication Terminals

644H Clips permanently fixed to terminal block
644R Clips permanently fixed to front panel

Materials of Construction

Electronics Housing and Terminal Block

644H Noryl® glass reinforced
644R Lexan® polycarbonate

Enclosure (Option code J5 or J6)

Housing Low-copper aluminum
Paint Polyurethane
Cover O-ring Buna-N

Mounting

The 644R attaches directly to a wall or a DIN rail. The 644H installs in a connection head or universal head mounted directly on a sensor assembly, apart from a sensor assembly using a universal head, or to a DIN rail using an optional mounting clip.

Weight

Code	Options	Weight
644H	HART, Head Mount Transmitter	96 g (3.39 oz)
644H	FOUNDATION fieldbus, Head Mount Transmitter	92 g (3.25 oz)
644R	HART, Rail Mount Transmitter	174 g (6.14 oz)
M5	LCD Display	38 g (1.34 oz)
J5, J6	Universal Head, Standard Cover	577 g (20.35 oz)
J5, J6	Universal Head, Meter Cover	667 g (23.53 oz)

Enclosure Ratings (644H)

All option codes (S1, S2, S3, S4, J5 and J6) are NEMA 4X, IP66, and IP68. Option code J6 is CSA Enclosure Type 4X.

Rosemount 644

Product Data Sheet
00813-0100-4728, Rev LA
Catalog 2006 - 2007

Performance Specifications

EMC (ElectroMagnetic Compatibility) NAMUR NE 21 Standard

The 644H HART meets the requirements for NAMUR NE 21 Rating. (Hardware Rev 26 and later for HART devices.)

Susceptibility	Parameter	Influence
ESD	6 kV contact discharge 6 kV air discharge	HART None
Radiated	80 – 1000 MHz at 10 V/m AM	< 0.5%
Burst	1 kV for I/O	None
Surge	0.5 kV line-line 1 kV line-ground (I/O tool)	None
Conducted	150 kHz to 80 MHz at 10 V	< 0.5%

CE Mark

The 644 meets all requirements listed under IEC 61326: Amendment 1, 1998.

Power Supply Effect

Less than $\pm 0.005\%$ of span per volt

Stability

RTDs and thermocouples have a stability of $\pm 0.15\%$ of output reading or 0.15°C (whichever is greater) for 24 months

Self Calibration

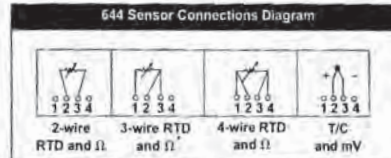
The analog-to-digital measurement circuitry automatically self-calibrates for each temperature update by comparing the dynamic measurement to extremely stable and accurate internal reference elements.

Vibration Effect

The 644 is tested to the following specifications with no effect on performance:

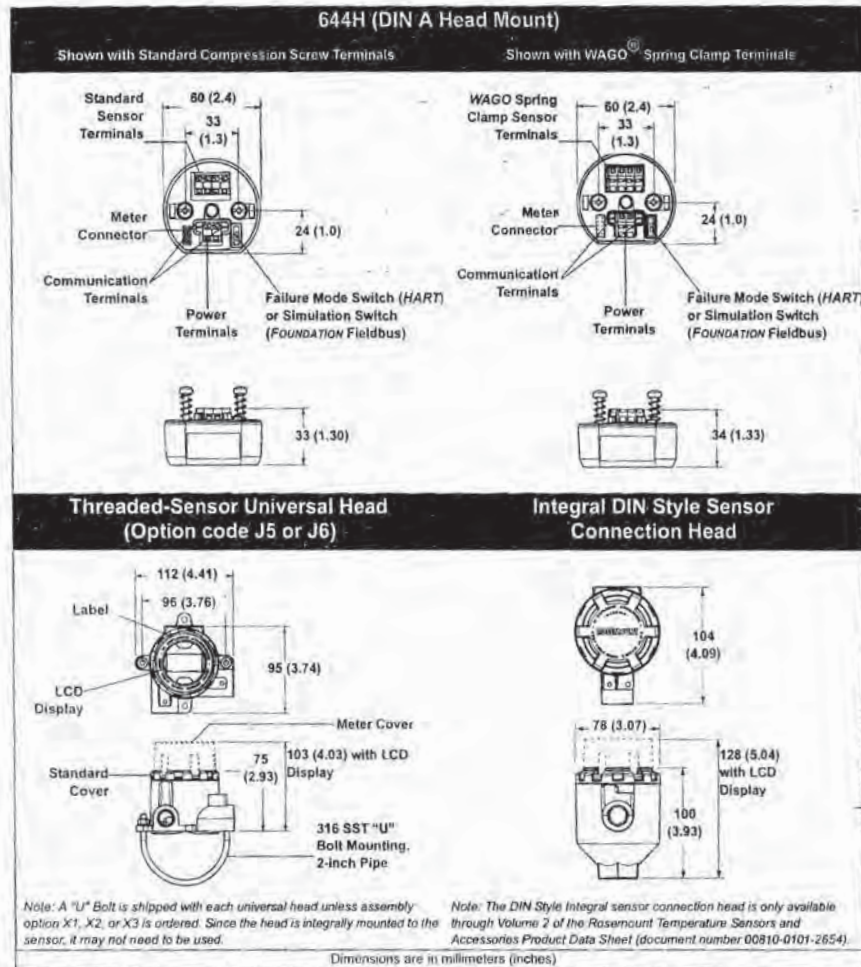
Frequency	Vibration
10 to 80 Hz	0.21 mm displacement
80 to 500 Hz	3 g peak acceleration

Sensor Connections



* Rosemount Inc. provides 4-wire sensors for all single element RTDs. You can use these RTDs in 3-wire configurations by leaving the unneeded leads disconnected and insulated with electrical tape.

Dimensional Drawings



FOUNDATION FIELDBUS SPECIFICATIONS

Function Blocks

Resource Block

- The resource block contains physical transmitter information including available memory, manufacture identification, device type, software tag, and unique identification.

Transducer Block

- The transducer block contains the actual temperature measurement data, including sensor 1 and terminal temperature. It includes information about sensor type and configuration, engineering units, linearization, reranging, damping, temperature correction, and diagnostics.

LCD Block

- The LCD block is used to configure the local display, if a LCD Display is being used.

Analog Input (AI)

- Processes the measurement and makes it available on the fieldbus segment.
- Allows filtering, alarming, and engineering unit changes.

PID Block

- The transmitter provides control functionality with one PID function block in the transmitter. The PID block can be used to perform single loop, cascade, or feedforward control in the field.

Block	Execution Time (milliseconds)
Resource	—
Transducer	—
LCD Block	—
Analog Input 1	45
Analog Input 2	45
PID 1	60

Turn-on Time

Performance within specifications in less than 20 seconds after power is applied, when damping value is set to 0 seconds.

Status

If self-diagnostics detect a sensor burnout or a transmitter failure, the status of the measurement will be updated accordingly. Status may also send the PID output to a safe value.

Power Supply

Powered over FOUNDATION Fieldbus with standard fieldbus power supplies. The transmitter operates between 9.0 and 32.0 VDC, 11 mA maximum. The power terminals are rated to 42.4 VDC (max.)

Alarms

The AI function block allows the user to configure the alarms to HI-HI, HI, LO, or LO-LO with a variety of priority levels and hysteresis settings.

Backup Link Active Scheduler (LAS)

The transmitter is classified as a device link master, which means it can function as a Link Active Scheduler (LAS) if the current link master device fails or is removed from the segment.

The host or other configuration tool is used to download the schedule for the application to the link master device. In the absence of a primary link master, the transmitter will claim the LAS and provide permanent control for the H1 segment.

FOUNDATION Fieldbus Parameters

Schedule Entries	25 ⁽¹⁾
Links	16 ⁽¹⁾
Virtual Communications Relationships (VCR)	12 ⁽¹⁾

(1) Minimum quantity

FOUNDATION
Fieldbus

Rosemount 644

Product Data Sheet
00813-0100-4728, Rev LA
August 2004

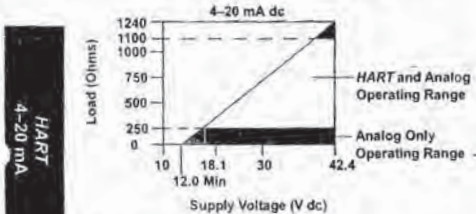
4–20 mA / HART SPECIFICATIONS

Power Supply

External power supply required. Transmitters operate on 12.0 to 42.4 V dc transmitter terminal voltage (with 250 ohm load, 18.1 V dc power supply voltage is required). Transmitter power terminals rated to 42.4 V dc.

Load Limitations

$$\text{Maximum Load} = 40.8 \times (\text{Supply Voltage} - 12.0)^{(1)}$$



(1) Without transient protection (optional).

NOTE

HART Communication requires a loop resistance between 250 and 1100 ohms. Do not communicate with the transmitter when power is below 12 V dc at the transmitter terminals.

Temperature Limits

	Operating Limit	Storage Limit
With LCD Display	-4 to 185 °F -20 to 85 °C	-50 to 185 °F -45 to 85 °C
Without LCD Display	-40 to 185 °F -40 to 85 °C	-58 to 248 °F -50 to 120 °C

Hardware and Software Failure Mode

The 644 features software driven alarm diagnostics and an independent circuit which is designed to provide backup alarm output if the microprocessor software fails. The alarm direction (HI/LO) is user-selectable using the failure mode switch. If failure occurs, the position of the switch determines the direction in which the output is driven (HI or LO). The switch feeds into the digital-to-analog (D/A) converter, which drives the proper alarm output even if the microprocessor fails. The values at which the transmitter software drives its output in failure mode depends on whether it is configured to standard, custom, or NAMUR-compliant (NAMUR recommendation NE 43, June 1997) operation. Table 1 shows the configuration alarm ranges.

TABLE 1. Available Alarm Range⁽¹⁾

	Standard	NAMUR- NE 43 Compliant
Linear Output:	$3.9 \leq I \leq 20.5$	$3.8 \leq I \leq 20.5$
Fail High:	$21.75 \leq I \leq 23$	$21.5 \leq I \leq 23$
Fail Low:	$3.5 \leq I \leq 3.75$	$3.5 \leq I \leq 3.6$

(1) Measured in milliamperes.

(2) I = Process Variable (current output).

Custom Alarm and Saturation Level

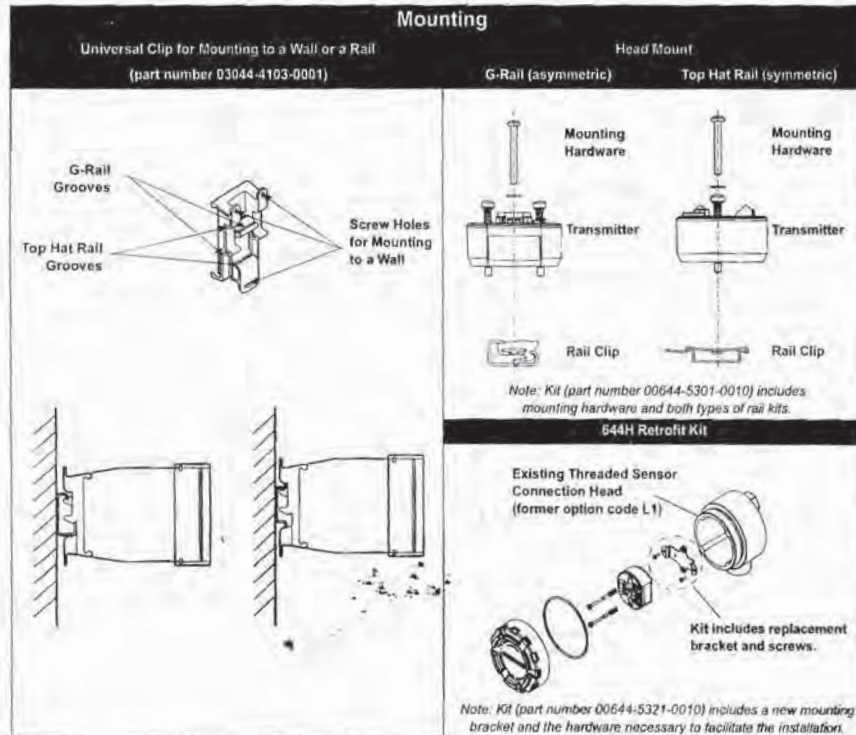
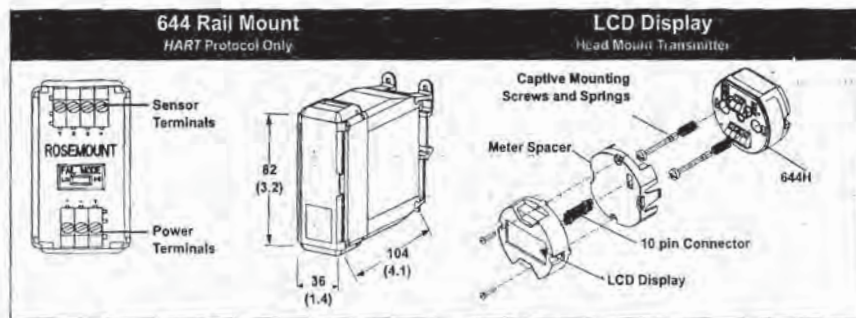
Custom factory configuration of alarm and saturation level is available with option code C1 for valid values. These values can also be configured in the field using a HART Communicator.

Turn-on Time

Performance within specifications in less than 5.0 seconds after power is applied, when damping value is set to 0 seconds.

Transient Protection

The Rosemount 470 prevents damage from transients induced by lightning, welding, or heavy electrical equipment. For more information, refer to the 470 Product Data Sheet (document number 00813-0100-4191).



3044-4001A01B, 644-5302B01A, D02A

3044-0000C01B, D01B, 644-104 1802B G/C

Ordering Information

● = Available
- = Not Available

Model	Product Description				
644	Smart Temperature Transmitter				
Code	Transmitter Type				
H	Head Mount (suitable for mounting in the field with enclosure options below)				
R	Rail Mount				
Code	Output	Head		Rail	
A	4-20 mA with digital signal based on HART protocol	●	●	●	●
F	Foundation fieldbus digital signal (includes 2 AI function blocks and Backup Link Active Scheduler)	●	●	●	●
Code	Product Certifications	A	F	A	F
Hazardous Locations Certificates (consult factory for availability)					
NA	No approval	●	●	●	●
E5	FM Explosion-Proof	●	●	●	●
I5 ⁽¹⁾	FM Intrinsic Safety (includes standard I.S. and FISCO for Fieldbus units)	●	●	●	●
K5 ⁽¹⁾	FM Intrinsic Safety and Explosion-Proof combination (includes standard I.S. and FISCO for Fieldbus units)	●	●	●	●
I6 ⁽¹⁾	CSA Intrinsic Safety (includes standard I.S. and FISCO for Fieldbus units)	●	●	●	●
K6 ⁽¹⁾	CSA Intrinsic Safety and Explosion-Proof combination (includes standard I.S. and FISCO for Fieldbus units)	●	●	●	●
E1	ATEX Flame-Proof	●	●	●	●
N1	ATEX Type n	●	●	●	●
NC	ATEX Type n Component	●	●	●	●
ND	ATEX Dust Ignition-Proof	●	●	●	●
I1 ⁽¹⁾	ATEX Intrinsic Safety (includes standard I.S. and FISCO for Fieldbus units)	●	●	●	●
E7	SAA Flame-Proof	●	●	●	●
I7 ⁽²⁾⁽¹⁾	SAA Intrinsic Safety (includes standard I.S. and FISCO for Fieldbus units)	●	●	●	●
N7 ⁽²⁾	SAA Type n	●	●	●	●
I2 ⁽²⁾	CEPEL Intrinsic Safety	●	●	●	●
E4 ⁽²⁾	JIS Explosion-Proof	●	●	●	●
I4 ⁽²⁾	JIS Intrinsic Safety	●	●	●	●
Code	Options	A	F	A	F
Plant Web Software Functionality					
A01	Regulatory Control Suite - 1 PID Block	●	●	●	●
Assembly					
XA	Sensor specified separately and assembled to transmitter	●	●	●	●
Local Display (644H only)					
M5	LCD Display	●	●	●	●
Enclosure					
J5 ⁽³⁾	Universal Head (junction box), aluminum alloy with 50.8 mm (2-in.) 316 SST pipe bracket (M20 entries)	●	●	●	●
J6 ⁽³⁾	Universal Head (junction box), aluminum alloy with 50.8 mm (2-in.) 316 SST pipe bracket (1/2-14 NPT entries)	●	●	●	●
J7 ⁽³⁾	Universal Head (junction box), cast SST with 50.8 mm (2-in.) 316 SST pipe bracket (M20 entries)	●	●	●	●
J8 ⁽³⁾	Universal Head (junction box), cast SST with 50.8 mm (2-in.) 316 SST pipe bracket (1/2-14 NPT entries)	●	●	●	●
S1	Connection Head, Polished Stainless Steel (1/2-14 NPT entries)	●	●	●	●
S2	Connection Head, Polished Stainless Steel (1/2-14 NPSM entries)	●	●	●	●
S3	Connection Head, Polished Stainless Steel (M20 x 1.5 conduit and entries)	●	●	●	●
S4	Connection Head, Polished Stainless Steel (M20 x 1.5 conduit entries, M24 x 1.5 head entry)	●	●	●	●
Configuration Options					
C1	Factory configuration date, descriptor, and message fields ("Configuration Data Sheet" on page 21 required)	●	●	●	●
C2	Transmitter-sensor matching, trim to specific Rosemount RTD calibration schedule (CVD constants)	●	●	●	●
A1	Analog output levels compliant with NAMUR recommendations NE 43: June 1997: high alarm configuration	●	●	●	●
CN	Analog output levels compliant with NAMUR recommendations NE 43: June 1997: low alarm configuration	●	●	●	●
C8	Low Alarm (standard Rosemount alarm and saturation values)	●	●	●	●
F6	60 Hz line voltage filter	●	●	●	●

		● = Available		— = Not Available	
		Head		Rail	
		A	F	A	F
Calibration Option					
C4	5-point calibration. Use option code Q4 to generate a calibration certificate	●	●	●	—
Q4	Calibration certificate. 3-Point calibration with certificate	●	●	●	—
Accessory Options					
G1	External ground lug assembly ⁽⁴⁾ (see "External Ground Screw Assembly" on page 18)	●	●	—	—
G2	Cable gland ⁽⁵⁾	●	●	—	—
G3	Cover chain. Only available with enclosure option codes J5 or J6. Not available with LCD Display option code M5.	●	●	—	—
G5	WAGO spring clamp terminals	●	●	—	—
Conduit Electrical Connector					
GE ⁽⁶⁾	M12, 4-pin, Male Connector (eurofast [®])	●	●	—	—
GM ⁽⁶⁾	A size Mini, 4-pin, Male Connector (minifast [®])	●	●	—	—
Typical Rail Mount Model Number: 644 R A IS					
Typical Head Mount Model Number: 644 H F IS A01					

(1) When IS approval is ordered on a Foundation fieldbus, both standard IS and FISCO IS approvals apply. The device label is marked appropriately.

(2) Consult factory for availability.

(3) Suitable for remote mount configuration.

(4) Only available with Enclosure option code J5 or J6. For ATEX approved units the Ground Lug Assembly is included. It is not necessary to include code G1 for units with ATEX approvals.

(5) Only available with Enclosure option code J5.

(6) Available with Intrinsically Safe approvals only. For FM Intrinsically Safe or non-incendive approval (option code IS), install in accordance with Rosemount drawing 03151-1009 to maintain NEMA 4X rating.

NOTE

For additional options (e.g. "K" codes), please contact your local Emerson Process Management representative.

SEWAGE TREATMENT PLANT <i>Copy</i> <i>Sahani</i> <i>Typh</i>		 NTPC Limited (A Govt. of India Enterprise) CONSULTANCY WING TRANS NO. <u>C85-293</u> DATE <u>13-7-10</u> SIGNATURE <u>[Signature]</u> (DATE) CL APPROVED/RELEASED FOR FABRICATION/CONSTRUCTION CL APPROVED/RELEASED FOR FABRICATION/CONSTRUCTION SUBJECT TO INCORPORATION OF COMMENTS/ MODIFICATIONS AS NOTED RESUBMIT REVISED DRAWING/DOCUMENT CL NOT APPROVED RESUBMIT REVISED DRAWING/DOCUMENT AFTER INCORPORATION OF COMMENTS/ MODIFICATIONS AS NOTED FOR INFORMATION AND RECORDS CNVL REVISE AND RESUBMIT FOR INF & REC IT IS HEREBY CONVEYED HEREIN NEITHER RELIEVES THE CONTRACTOR OF HIS CONTRACTUAL OBLIGATION AND RESPONSIBILITIES FOR CORRECTNESS OF DIMENSIONS, MATERIAL OF CONSTRUCTION DESIGN DETAILS ASSEMBLY, PERFORMANCE PARTICULARS AND CONFORMITY OF THE SUPPLIES WITH THE SPECIFICATIONS, APPROVED SCHEMES AND STATUTORY LAWS, NOR DOES IT LIMIT THE PURCHASER'S RIGHT UNDER THE CONTRACT. IF NO CHANGE IN APPROVED DRAWING/DOCUMENT IS PERMITTED WITHOUT OWNER'S CONCURRENCE IN WRITING.			
3	2/7/2010	FOR APPROVAL	SKS	APU	AVS
2	29/4/2010	REVISED AS PER NTPC COMMENT	SKS	APU	AVS
1	22/12/2009	REVISED AS PER NTPC COMMENT	SKS	APU	AVS
0	5/11/2009	FOR APPROVAL	SKS	APU	AVS
Rev. No	Date	Description	Prepared By	Reviewed By	Released By
PROJECT		PRAGATI-III COMBINED CYCLE POWER PROJECT 1500MW(NOMINAL).			
CUSTOMER:		 PRAGATI POWER CORPORATION LIMITED (PPCL)			
CONSULTANT:		 NTPC LIMITED, CONSUTANCY WING			
		 BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA			
		 THERMAX LIMITED PUNE			
DATA SHEET FOR ORIFICE PLATE					
THERMAX DOC.NO.:		BHEL DOC. NO. :PE-V0-314-673-A136		OC.NO. 630128	
WHJBB00011		SH NO.1 OF 2		REV. NO : 03	



PROJECT: - PRAGATI-III COMBINED CYCLE POWER PROJECT 1500MW (NOMINAL). (STP PLANT)
OWNER: PRAGATI POWER CORPORATION LIMITED (PPCL)
CLIENT: BHARAT HEAVY ELECTRICALS LTD
CONSULTANT: NTPC LIMITED, CONSULTANCY WING
CLIENT DOC NO: PE-VO-314-673-A136 rev no.03
THERMAX OC NO: 630128

ORIFICE PLATE DOC NO. WHJBB00011

S.NO.	PARAMETER	CLARIFICATION	REMARKS
I	Flange assembly drawing is revised for quantity	Flange assembly drawing is revised for quantity as per data sheet.	
II	Beta ratio range	Data sheet note no.01 is revised for beta ratio range & supporting document ISO 5167 is attached.	

ORIFICE PLATES (F/E)							
GENERAL	1	TAG NO		FE-511			
	2	SUPPLY		ORIFICE PLATE			
	3	MAKE TO		BS-1042 (LATEST REV.) / ISO-5167			
	4	PLATE MATERIAL		SS 316			
	5	PIPE MATERIAL		CS			
	6	TAP		FLANGED TAPPING			
	7	TAP SIZE		1/2" NPT (F)			
	8	LOCATION		DISCHARGE OF P-4070 A/B			
	9	LINE SIZE AND MATERIAL		50 CS			
OPERATING CONDITIONS	10	FLUID		TREATED SEWAGE			
	11	MAX. FLOW M ³ /HR		11			
	12	NOR. FLOW M ³ /HR		10			
	13	METER MAX M ³ /HR		13			
	14	PRESS OPERATING KG/CM ²		1.5			
	15	TEMP OPERATING DEG. CEN		AMB			
	16	S.G. AT 15 DEG CEN		1			
	17	PROCESS MAX. PRESS. KG/CM ²		2.5			
	18	PROCESS PIPE MATERIAL		IS:1239 PART-1, HEAVY DUTY, ERW			
PLATE DETAILS	19	TYPE		CONCENTRIC.			
	20	ORIFICE BORE		31.4			
	21	PIPE OD mm &	ID mm	80.3 / 51.3			
	22	FLANGE SIZE AND RATING		ANSI-B-18.5-150#			
	23	INDICATOR TYPE		DIFFERENTIAL PRESSURE TYPE.			
	24	DIFF RANGE mm of WC		2500			
	25	VENT HOLE		YES.			
	26	PLATE THICKNESS		3.18 mm.			
	27	QUANTITY		1			

NOTES :-

- (2) TAG NO., PIPE ID / OD, ORIFICE BORE, D. P. RANGE, FLOW RANGE, MATERIAL OF CONSTRUCTION, SERVICES ARE TO BE ENGRAVED ON THE UPSTREAM SIDE OF INTEGRAL BAR HANDLE FOR ALL ORIFICE PLATES.
- (3) COMPLETE ASSEMBLY I.e. ORIFICE PLATE WITH ANSI 300# WELD NECK FLANGES DULY TAPPED WILL BE IN THE SUPPLY OF INSTRUMENT VENDOR.
- (4) NO.OF TAP HOLES - 3

QTY :- 01		PROJECT:PRAGATI -III COMBINED CYCLE POWER PROJECT 1800 MW (NOMINAL) AT BAWANA,DELHI	5	2/7/2010	SKS	APU	AVS
MAKE :- MICRO PRECISION			4	29/4/2010	SKS	APU	AVS
THERMAX LIMITED		O.C NO: 830128	3	22/12/2009	SKS	APU	AVS
Water & Waste Solutions		OWNER: PRAGATI POWER CORPORATION LTD, DELHI	2	16/12/2009	SKS	APU	AVS
Sai Chambers, Wakadewadi		CLIENT : BHARAT HEAVY ELECTRICALS LTD	1	5/11/2009	SKS	APU	AVS
Pune 411 003 (INDIA)		CONSULTANT:- NTPC - CONSULTANCY WING	0	22/8/2009	SKS	APU	AVS
			Rev	DATE	PREPD. BY	CHKD. BY	App by
			Specification No		PLANT		SH NO
			WHJB000011		STP		2 OF 2

MICRO PRECISION PRODUCTS PVT. LTD. Faridabad

Bore Calculation as per ISO - 5167

CUSTOMER M/S THERMAX LIMITED
PROJECT/CONSULTANT PRAGATI - III CCPP 1500MW (NOMINAL)

P.O./Enq.No. E-MAIL ENQUIRY DT 26.09.2009
TAG/ITEM No. FE-511
MICRO Job No./ Quote No.

Service TREATED SEWAGE
Flow Element and Type O. PLATE, CONC. SQ. ED
Material of Flow Element 88316
Material of Pipe CARBON STEEL
Material of Flange A105
Pipe Size OD (mm) / ID (mm) 60.30 / 51.30

Type of Tapping FLANGE TAPS
No. of Tapping 3 PAIRS
Maximum Flow m³/Hr (Q) 11.00000000
Normal Flow m³/Hr (Q_n) 10.00000000
METER MAX (Design Flow) m³/Hr (Q_m) 13.00000000

Temperature Operating Celsius (t) 20.00000000
Upstream Pressure (Operating Condition) Kg/cm² (P)_{abs} 2.53320000

Density (Operating Condition) Kg/m³ RDH (p) t 1000.00000000
Viscosity (Operating Condition) (poise) Mu (u) 0.01000000

Diff Pressure at METER MAX mm of WC (hm) 2500.00000000
Diff Pressure at Normal Flow (hn) 1479.2899408

I.D. of Pipe at 20 deg. C mm (D) 51.30000000
Coeff. of Expan.-Flow Element mm/mm-C (a)_{pe} 0.00001731
Coeff. of Expan.-Pipe mm/mm-C (a)_p 0.00001201
Correction Factor For Pipe I.D. at t deg C (F_p) 1.00000000
Temp. Corr. Factor For Orifice Plate (F_{op}) 1.00000000

Reynold Number RD(n) 68915.2735936
Therefore Approx. Beta = d/D (Approx. Beta) (B) 0.61933871

Discharge Coefficient (C) 0.6123610

Beta Updated (B_i) 0.6141598

d (corrected) at 20 deg C d_c=d/F_{op} mm (d_c) 31.5064002

Vent Hole Diameter mm (G) 2.38000000
Vent Hole Location mm (D-G)/2 24.46000000
d (After Vent Hole Correction) mm (d_v) 31.4075181
Pressure Loss at (METER MAX) mm WC (w) 1501.9215050
Pressure Loss at (NORMAL FLOW) mm WC (w₁) 888.7109497
Pressure Loss at (MAXIMUM FLOW) mm WC (w₂) 1075.3402491

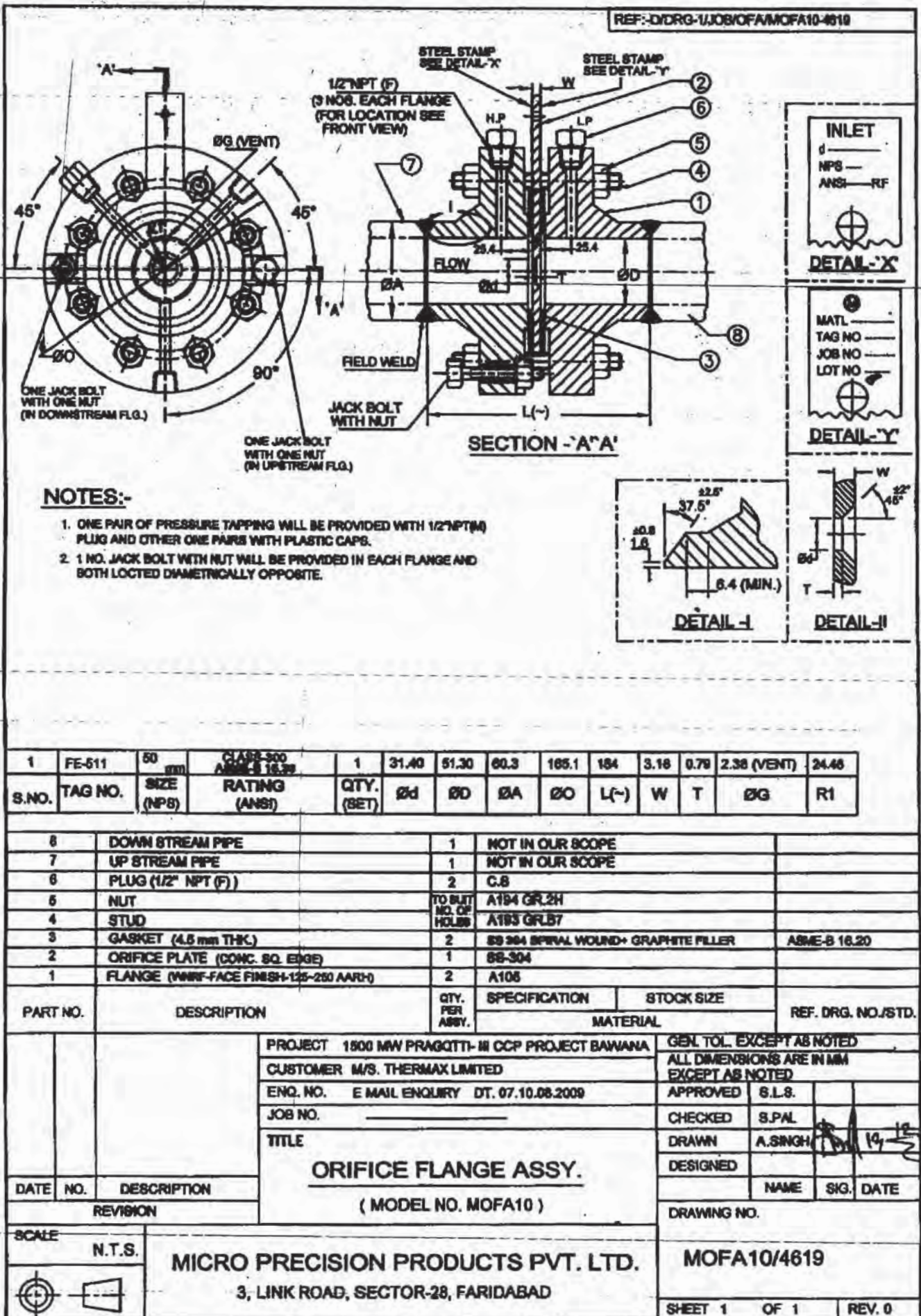
DATE 29/09/09
Revision no: A, DT 21.12.2009; TYPE & NO. OF TAPPINGS REVISED.
Reference no. THERMAX-D/FE-511

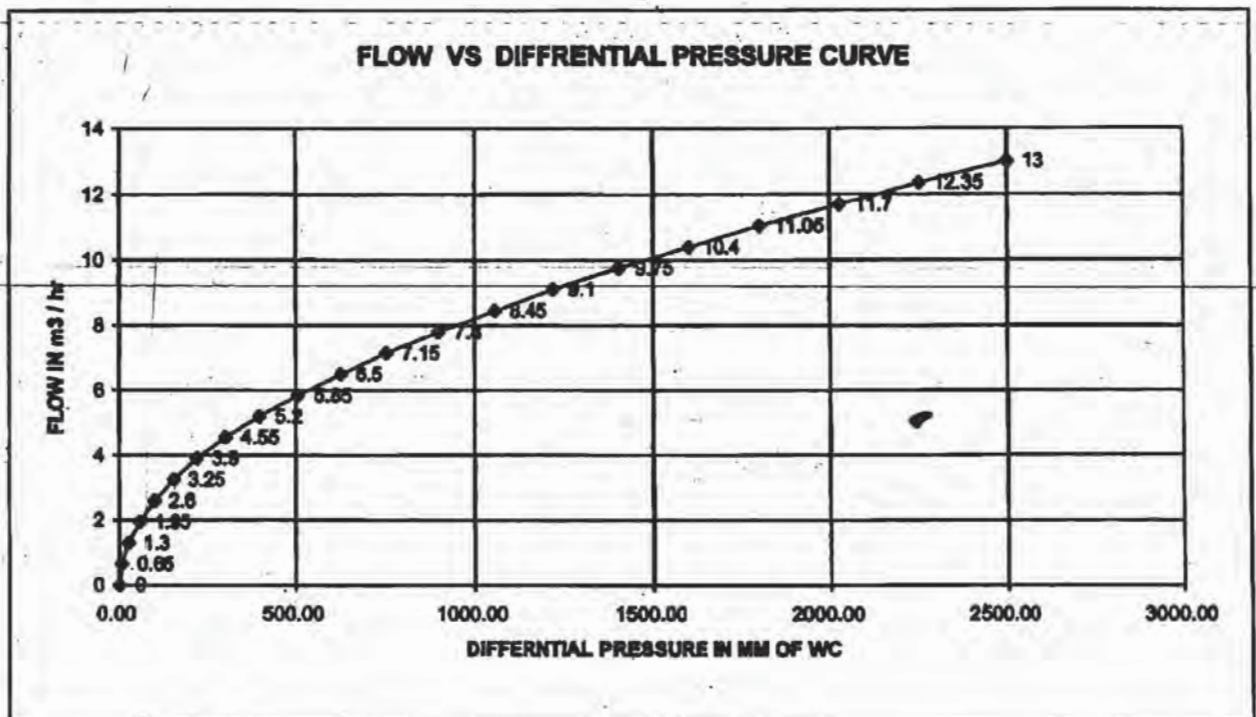
CROSS CHECK OF RESULTS USING CALCULATED VALUES BUT UNITS AS UNDER: -
Q_v : $3.14/4 * C * E * (d_i * d_i) * \text{SQRT}(2 * \text{DELTA}(P) * (p) t)$ where (p) t in kg/m³
Q_v in m³/sec : Delta(P) in Pa : d_i=(d/1000) in meters : E=1/SQR(1 - (B_i⁴)).
Q_v (m³/sec) = 0.00360783 Q_m (m³/Hr) = 12.98818183

Calculation done by : SSV/SK

Calculation checked by : /

7/13/01 REV.00 01/12/2005





1 CUSTOMER	:	M/S THERMAX LIMITED
2 P.O. NO.	:	E-MAIL ENQUIRY DT 28.09.2009
3 PROJECT	:	PRAGATI - III CCPP 1500 MW (NOMINAL)
4 JOB NO.	:	-
5 TAG NO.	:	FE-511
6 SERVICE	:	TREATED SEWAGE

7 O. PLATE I.D. 31.40 mm

8 FLOW EQUATION WITH CONSTANT DENSITY OF 1000.00 KG/M3

$W = K \times \text{SQRT}(DP)$ WHERE DP IS IN MM OF WC & FLOW IN M3/HR

$= 0.26 \times \text{SQRT}(DP)$

9 FLOW EQUATION WITH CHANGE IN DENSITY

$W = K \times \text{SQRT}(DP) \times \text{SQRT}(ROH)$ WHERE ROH IS IN KG/M3

$= 0.008222 \times \text{SQRT}(DP) \times \text{SQRT}(ROH)$



5.2.3.10 The diameter of the pipe shall be measured as specified in 6.4.2, the carrier ring being as part of the primary device. This also applies to the distance requirement given in 6.4 measured from the upstream edge of the recess formed by the carrier ring.

5.3 Coefficients and corresponding uncertainty of orifice plates

5.3.1 Limits of use

Standard orifice plates shall only be used in accordance with this part of ISO 5167 under the following conditions.

For orifice plates with corner or with D and $D/2$ pressure tapings:

- $d \geq 12,5$ mm;
- $50 \text{ mm} \leq D \leq 1\,000$ mm;
- $0,1 \leq \beta \leq 0,75$;
- $Re_D \geq 5\,000$ for $0,1 \leq \beta \leq 0,56$;
- $Re_D \geq 16\,000 \beta^2$ for $\beta > 0,56$.

For orifice plates with flange tapings:

- $d \geq 12,5$ mm;
- $50 \text{ mm} \leq D \leq 1\,000$ mm;
- $0,1 \leq \beta \leq 0,75$.

Both $Re_D \geq 5\,000$ and $Re_D \geq 170\beta^2 D$

where D is expressed in millimetres.

The pipe internal roughness shall satisfy the following specification if the uncertainty values in this ISO 5167 are to be met, i.e. the value of the arithmetical mean deviation of the roughness profile, R_a , is such that $10^4 R_a/D$ is less than the maximum value given in Table 1 and greater than the minimum value in Table 2. The maximum value equation (see 5.3.2.1) was determined from a database collected from the literature.

which Tables 1 and 2 are based is d and D are expressed in millimetres.

Table 1 — Maximum value of $10^4 R_a/D$

β	15	10	15	15	15	15	15	15	15	15
$\leq 0,20$	15	15	15	15	15	15	15	15	15	15
0,30	15	15	15	15	15	15	15	15	15	15
0,40	15	15	10	7,2	5,2	4,1	3,3	3,1	2,7	2,5

PRE-TREATMENT PLANT



NTPC Limited
(A Govt. of India Enterprise)
CONSULTANCY WING

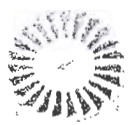
TRANS NO. **007-294**
DATE **16-7-10**
Access
(SIGNATURE)
DATE

☒ I. APPROVED/RELEASED FOR FABRICATION
☒ II. APPROVED/RELEASED FOR FABRICATION
SUBJECT TO INCORPORATION OF
MODIFICATIONS AS NOTED
DRAWING/DOCUMENT
☒ III. NOT APPROVED
AFTER INCORPORATION
AS NOTED
☒ IV. FOR INFORMATION AND RECORD
FOR REVISION AND RESUBMISSION

APPROVAL CONVEYED HEREIN NEITHER RELIEVES THE PURCHASER OF HIS
CONTRACTUAL OBLIGATION AND RESPONSIBILITY FOR THE FITNESS OF
DIMENSIONS, MATERIAL OF CONSTRUCTION, DESIGN, FINISH, ASSEMBLY,
PERFORMANCE PARTICULARS AND CONFORMITY OF THE SUPPLIES WITH THE
SPECIFICATIONS, APPROVED SCHEMES AND STATUTORY LAWS, NOR
DOES IT LIMIT THE PURCHASER'S RIGHT UNDER THE CONTRACT.

2	23/01/2010	FOR APPROVAL	SKS	APU	AVS
1	23/01/2010	FOR APPROVAL	SKS	APU	AVS
0	8/10/2009	FOR APPROVAL	SKS	APU	AVS
Rev. No	Date	Description	Prepared By	Reviewed By	Released By

PROJECT: **PRAGATI-III COMBINED CYCLE POWER PROJECT
1500MW(NOMINAL).**

CUSTOMER:

PRAGATI POWER CORPORATION LIMITED (PPCL)

CONSULTANT:

NTPC LIMITED, CONSULTANCY WING


BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA


THERMAX LIMITED
PUNE

DATA SHEET FOR ULTRASONIC LEVEL TRANSMITTER

THERMAX DOC.NO. WHICE00017	BHEL DOC. NO. PE-VO-314-158-A301	OC.NO. 630128 REV. NO. 02
-------------------------------	-------------------------------------	------------------------------

PROJECT: - PRAGATI-III COMBINED CYCLE POWER PROJECT 1500MW (NOMINAL). (PT PLANT)
 OWNER: PRAGATI POWER CORPORATION LIMITED (PPCL)
 CLIENT: BHARAT HEAVY ELECTRICALS LTD
 CONSULTANT: NTPC LIMITED, CONSULTANCY WING
 CLIENT DOC NO: PE-VO-314-158-A301
 THERMAX OC NO: 630128

REPLIES TO THE COMMENT ON DATA SHEET

ULTRASONIC TYPE LEVEL TRANSMITTER DOC NO. WHJCE.00017

S.NO.	COMMENT	THERMAX REPLY	REMARKS
I	Instrument specs should match with tender specs.	Offered instrument is as per tender specs, however pls note that offered accuracy is as per manufacturer standard.	
II	Accuracy not matching with tender specs	We have offered Ultrasonic type level transmitter of EMERSON make which is NTPC/BHEL approved vendor. Offered accuracy is as per manufacturer's standard	

INDEX FOR ULTRASONIC LEVEL TRANSMITTER							
SR NO.	TAG NO	TANK	TANK MOC	TEMP	TANK HEIGHT IN MM	FLUID	REMARK
1	LT-751	LIME SLAKING TANK - T 1070 A	RCC	AMB	2200	LIME	FOR SPECIFICATION REFER SFEET NO.03
2	LT-752	LIME SLAKING TANK - T 1070 B	RCC	AMB	2200	LIME	FOR SPECIFICATION REFER SFEET NO.03
3	LT-753	LIME DOSING TANK - T 1080 A	RCC	AMB	2100	LIME	FOR SPECIFICATION REFER SFEET NO.03
4	LT-754	LIME DOSING TANK - T 1080 B	RCC	AMB	2100	LIME	FOR SPECIFICATION REFER SFEET NO.03
5	LT-755	LIME DOSING TANK - T 1080 C	RCC	AMB	2100	LIME	FOR SPECIFICATION REFER SFEET NO.03
6	LT-756	FeCL3 DOSING TANK - T 1090 A	RCC	AMB	2400	FeCL3	FOR SPECIFICATION REFER SFEET NO.03
7	LT-757	FeCL3 DOSING TANK - T 1090 B	RCC	AMB	2400	FeCL3	FOR SPECIFICATION REFER SFEET NO.03
8	LT-758	FeCL3 DOSING TANK - T 1090 C	RCC	AMB	2400	FeCL3	FOR SPECIFICATION REFER SFEET NO.03
9	LT-759	PE DOSING TANK - T 1100 A	MSRI	AMB	2600	PE	FOR SPECIFICATION REFER SFEET NO.03
10	LT-760	PE DOSING TANK - T 1100 B	MSRI	AMB	2600	PE	FOR SPECIFICATION REFER SFEET NO.03

Note: 4" flange shall be supplied along with the tank. 4" counter flange of 2"

NPT (F) threaded connection for fitting the instrument shall be supplied (Thermax WWS scope)

QTY: 10	PROJECT PRASANTH COMBINED SITE POWER	2	2/3/2010	SKS	APU	AVS
MAKE: THERMAX	PROJECT 1500 MW UNIT 1 AT RAIPUR JHARKH	1	23/01/2010	SKS	APU	AVS
THERMAX LIMITED	G.C. NO. 630/28	0	17/08/2009	SKS	APU	AVS
Water & Waste Section	OWNER: PRASANTH POWER CORPORATION LTD. DELHI	For	Date	Prep'd by	Chkd by	App'd by
Sanitation & Wastewater	Client: THERMAX LIMITED	Date of Issue: 01/01/2010		PLANT	SHNO	
Boiler & P&ID	PROJECT: 1500 MW UNIT 1 AT RAIPUR JHARKH	Date of Issue: 01/01/2010		PT	J. S. S.	

Ultrasonic Level Transmitter Specification Sheet

Sr	Identification	Specification
	General	
1	Make	ELMECH
2	Model Number	EL212HART-01A-1
3	Type	Ultrasonic Type Level Transmitter SMART with local indication - 2 wire
	Transmitter	
4	Accuracy	$\pm 0.25\%$ Of Measured Distance for $> 1m$ $\pm 2.5\text{ mm}$ for $< 1m$
5	Level Range	Refer index (sheet no 02)
6	Maximum Span Limit	0 to 11 m
7	Output	4-20 mA with HART communication
8	Power Supply	12 - 30 V DC
9	Level Resolution	Better than 1 mm
10	Blanking Distance / Dead Zone	0.3 m
11	Process Pressure Rating	-0.25 to 3 bar
12	Process Temperature	-30 to 70 $^{\circ}$ C
13	Update Interval	1 second
14	Beam Angle	3 $^{\circ}$
15	Temperature Compensation	Automatic Integral. Optional remote sensor for dynamic
16	Local Indication	Digital LCD Indication in Engineering Unit
17	Process connections	2" NPT Thread
18	Electrical connections / Conduit Entry	PLUG & SOCKET TYPE X 2Nos
	Material Of Construction	
19	Sensing Element	PVDF
20	Cover Seal	Silicon Rubber
21	Sensor Body	EPDM
22	Enclosure / Housing	NEMA 4X, IP66, Polyurethane-covered Aluminum
	Accessories	
23	Tag Plate	Stainless Steel engraved Tag Plate
	Certificates	
24	Certificates	Ro Certificate - Standard

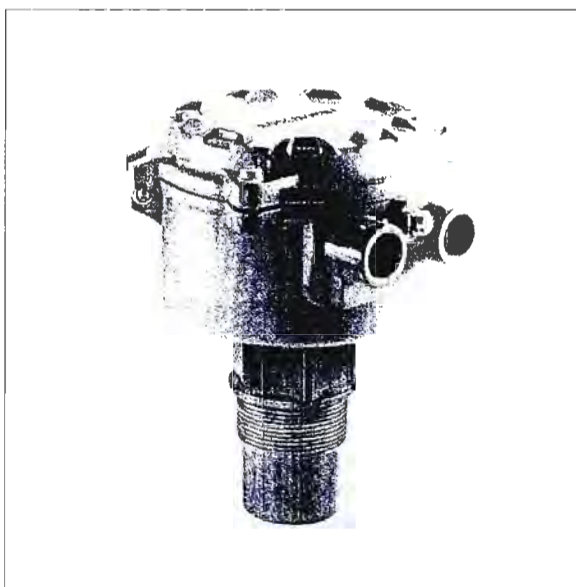
	PROJECT PRGAT. COMBINED CYCLE POWER PROJECT 1300 MW NORMAL ATB (LAMP DEHN)	2	2/3/2010	SKS	APU	AVS
		1	23/01/2010	SKS	APU	AVS
Thermal Limited	1000 MW	0	17/09/2009	SKS	APU	AVS
Auto & Waste Solutions	CHENNAI POWER CO. LTD. (P&T) (LAMP DEHN)	Rev	Date	Prep'd by	Checked by	Rev'd by
Sa. Chatterjee, Sr. Engineer	DEHN, 1000 MW, 1300 MW, 1300 MW, 1300 MW	Specification		CLASS	Set by	
Shree 411100000000	1000 MW, 1300 MW, 1300 MW, 1300 MW	SPECIFICATION		DT	1/1/10	

Rosemount 3100 Series Ultrasonic Level Transmitters

The Rosemount 3100 Series is a loop-powered ultrasonic transmitter designed for reliable continuous level measurement.

THE 3100 SERIES FEATURES:

- Non-contacting measurement with no moving parts.
- Integral LCD and push-buttons as standard for on-site programming,
- Continuous measurement of level or distance-to-surface. Volume or open channel flow calculations for models 3102 and 3105
- 2 integral signal relays for model 3102.
- Easy to install and configure.
- Rugged aluminum housing and PVDF wetted material.
- 2-wire dc loop-powered.



Contents

Measurement Principle	page 2
Special Features	page 2
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Installation Best Practices	page 6
Specifications	page 8
Temperature and Pressure Ratings	page 10
Load Limitations	page 10
Product Certifications	page 11
Dimensional Drawings	page 13
Ordering Information	page 14

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Reliability in a Universal Package

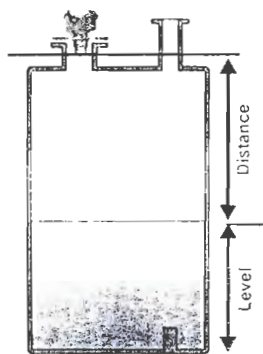
The Rosemount 3100 Series is a liquid level transmitter based on ultrasonic technology making it suitable for many liquid applications.

MEASUREMENT PRINCIPLE

Ultrasonic pulse signals are transmitted from the face of the transmitter, and are then reflected from the liquid surface. The transmitter 'listens' for these reflected signals (echoes) and measures the time-delay between transmitting and receiving.

The distance to the liquid surface is automatically calculated by using the computed time-delay.

$Distance = Speed\ of\ sound\ in\ air * (Time-delay / 2)$



An integral temperature sensor continuously measures the air temperature around the transmitter, and uses this to compute the *speed of sound in air*, thereby automatically compensating *Distance* for temperature effects.

Models 3102 and 3105 have the option of a Remote Temperature Sensor for dynamic temperature compensation.

The Distance measurement can be output through the 4-20mA or HART output.

Level Measurement

When programmed with the bottom reference of the application - usually the bottom of a tank - the transmitter will calculate the liquid depth (Level)

The calculated Level can be output through the 4-20mA or HART output

Volume Measurement

Models 3102 and 3105 can also calculate the volume of liquid in a tank. The transmitter has a library of profile shapes for selection

The calculated Volume can be output through the 4-20mA or HART output

Open Channel Flow Measurement

Models 3102 and 3105 can also calculate the rate of liquid flow in an open channel. The transmitter has a library of standard open channel flow structure profiles, but can also support a user-defined flow profile that is plotted or calculated.

The calculated Flow Rate can be output through the 4-20mA or HART output.

It is possible to enter a 10-point strapping table for non-standard tank shapes and flow structures.

SPECIAL FEATURES

Advanced software features

- Learn routine (false echo registration)
Manually teach the transmitter to ignore up to four false echoes, caused by the pulse signal reflecting off obstructions, until the actual level is seen.
- Empty tank mapping
When a tank is empty, automatically teach the transmitter up to four false echoes, without the need for user interaction
- Present depth
When the tank is not empty, the bottom reference can be automatically reset to be the sum of a user-entered (known) present depth and the distance to the surface.
- Set as empty
When the tank is known to be empty, the bottom reference can be automatically reset to be the measured distance.
- Distance offset
The distance to the surface can be adjusted by a user-entered positive or negative offset value
- Level offset
The level can be adjusted by a user-entered positive or negative offset value.
- Bottom blanking
If there is an obstruction on the bottom of a tank, the false echoes can be avoided by specifying an area to ignore.

Relays on model 3102

- Two integral relays for control functionality

Product Data Sheet

00813-0100-4840, Rev. AA

May 2007

Rosemount 3100 Series

Integral display and push buttons (all models)

The central area of the display allows up to five alphanumeric characters to be displayed. This is either the measurement or data to assist when programming.

To the left of the central area, on Model 3102 and 3105 only, there are **four arrow icons**, only one of which will be illuminated at any one time to indicate the duty chosen by the user:

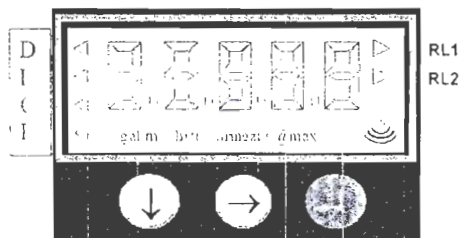
- D (Distance-to-surface)
- L (Level)
- C (Content / Volume)
- F (Flow)

To the right of the central area, on Model 3102 only, there are **two arrow icons** that indicate the status of the transmitter relay outputs RL1 and RL2.

When illuminated, they indicate that the relay contact is closed.

Under the central area is a list of units of measurement. The transmitter will illuminate only those characters applicable to the units of measurement chosen.

To the right of the measurement units is an **echo received icon** made up of 3 arc segments that continuously indicate the strength of the echo received (minimum, average, and good).



Integral push-buttons and display

Selecting a Rosemount 3100 Series transmitter

Overview of models

Choose model 3101 for simple level or distance measurements over a range of 1 - 26 ft (0.3 - 8 m), and a 4-20mA signal output.

Choose model 3102, with 2 integral relays, for level or distance measurements over a range of 1 - 36 ft (0.3 - 11 m). Also features volume and open channel flow calculations, and a 4-20mA / HART output.

Choose the Intrinsically Safe certified model 3105 for level or distance measurements over a range of 1 - 36 ft (0.3 - 11 m) in hazardous areas. Also features volume and open channel flow calculations, and a 4-20mA / HART output.

Housing

The housing is available in aluminum, and has two 1/2-inch NPT cable/conduit entries.

Option of M20 x 1.5 conduit/cable adaptors.

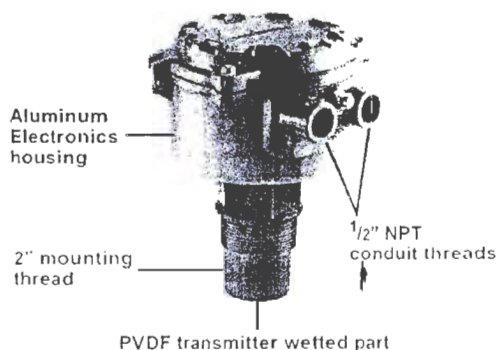
Wetted parts are made of corrosion resistant PVDF

Process Connection

Threaded Connection

Threads: 2-inch BSPT or 2-inch NPT

Optional flange accessories: See page 17.



Electrical connections

(For full specification, see page 8)

Power supply

The 3100 Series requires an external power supply:

3101: 12 - 30 Vdc

3102: 12 - 40 Vdc

3105: 12 - 40 Vdc, (12 - 30 Vdc in hazardous area)

Signal output

Model 3101 has an analog 4-20mA output, which is powered by the voltage supplied to the transmitter.

Models 3102 and 3105 have a 4-20mA output with HART® communication. This is powered by the voltage supply to the transmitter.

Relay outputs

Model 3102 has two relay outputs, which are powered by the voltage supply to the transmitter

Remote temperature sensor

All models have an integrated temperature sensor for automatically compensating for temperature effects.

Models 3102 and 3105 have support for connecting a Rosemount Remote Temperature Sensor, which is an optional accessory (see page 17). When used, it automatically overrides the integral sensor and provides dynamic temperature compensation.

Measurements and Calculations

3101: Level, or distance to the surface.

3102: Level (or distance), volume, open channel flow.

3105: Level (or distance), volume, open channel flow

Measurement range

3101: 1 - 26 ft (0.3 - 8 m)

3102: 1 - 36 ft (0.3 - 11 m)

3105: 1 - 36 ft (0.3 - 11 m)

Product certifications

(For a summary of certifications, see page 11.)

Non-hazardous area installation

3101 and 3102 are available for:

- FM and CSA Ordinary Location installation.

Hazardous area installation

3105 is available for:

- FM Intrinsically Safe/Non-incendive installation
- CSA Intrinsically Safe/Non-incendive installation
- ATEX and IECEx Intrinsically Safe installation

NOTE:

Product certifications are selected using the Ordering Information (see page 14 onwards).

System Integration

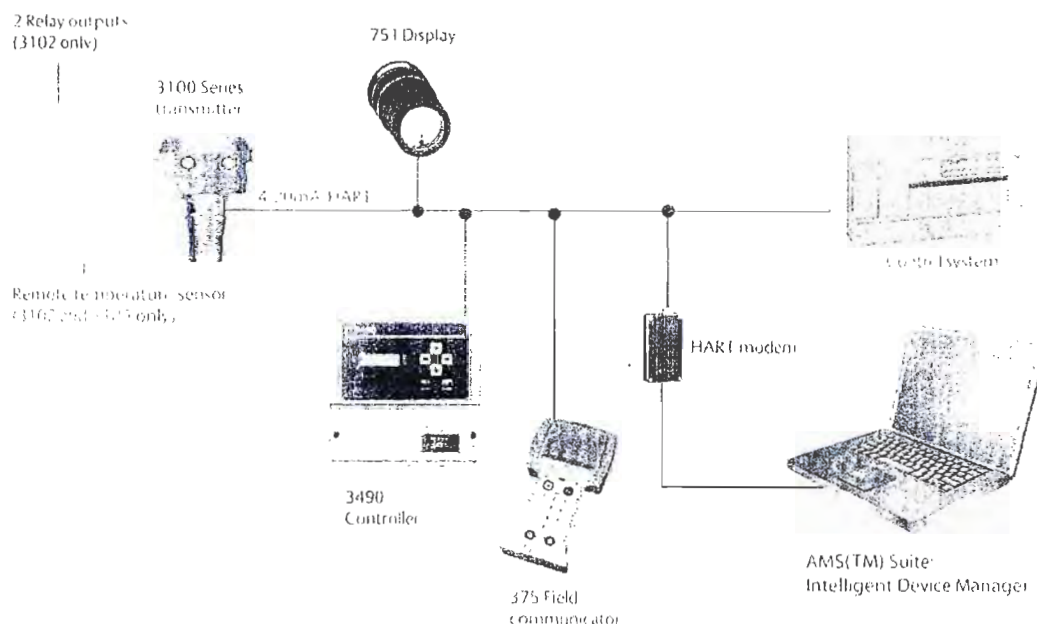
The Rosemount 3100 Series transmitter uses the same two wires for power supply and communication

Measurement data is transmitted as an analog 4-20mA signal as standard.

On models 3102 and 3105, a digital HART® signal superimposed on the 4-20mA signal.

The 3100 Series requires an external power supply

- 3101: 12 to 30 Vdc
- 3102: 12 to 40 Vdc
- 3105: 12 to 40 Vdc (30 Vdc in hazardous area).



The Rosemount 3100 Series transmitter powers PlantWeb® with easier configuration, lower installation costs, higher reliability and device diagnostics that enable predictive intelligence, reduce operating costs and improve plant availability

Installation Best Practices

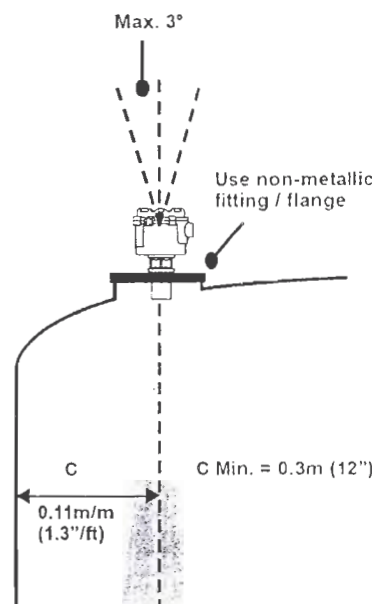
Correct location of the transmitter is essential for the reliable operation of any ultrasonic level measurement system.

NOTE:

The Rosemount 3100 Series is designed to be mounted in a *non-metallic fitting or flange*. Please check optional PVC flange accessories on page 17.

Mounting considerations

- The transmitter should be mounted above the liquid surface using the 2-inch thread provided. To facilitate mounting, optional flanges are available as an accessory - see page 17
- Mount the transmitter as near vertical as possible to ensure a *good echo* from the liquid surface for *maximum echo size* received.
- Obstructions within the beam angle generate strong "false-echoes"; wherever possible, the transmitter should be positioned such that false echoes are avoided.
- To avoid detecting unwanted objects in the tank or well, it is advisable to maintain a distance of at least 4.3 inches (0.11 metres) from the centre line of the transmitter for every metre range to the obstruction
- It is recommended not to mount the transmitter closer than 12 inches (0.3 metres) to the wall to avoid losing echo size.
- Avoid applications where heavy condensation could form on the transducer face.
- If the transmitter is mounted in a stand-off or nozzle, it is always preferable that the transmitter face protrudes at least 5mm into the tank. If this is not possible, see "Mounting in a nozzle" on page 7
- In environments where direct sunlight can cause high surface temperatures on exposed instruments, it is recommended to use a suitable sun-shade.



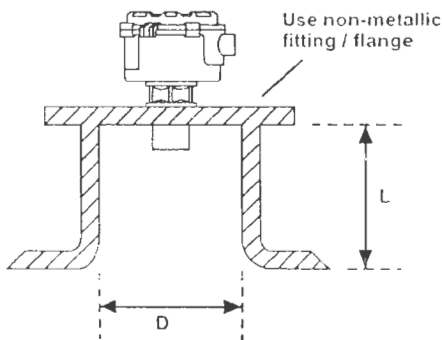
Liquid surface conditions

- Foaming liquids can reduce the size of the returned echo as foam is a poor ultrasonic reflector. It is always preferable to mount an ultrasonic transmitter over an area of clear liquid
- Beware of mounting the transmitter directly over any inlet stream.
- Liquid surface turbulence is not normally a problem unless it is excessive. In most cases, the effects of turbulence are minor, with excessive turbulence being catered for by fine-tuning the transmitter on site if necessary.
- A still-pipe can be used to avoid foam and turbulence.

In-tank effects

- Stirrers or agitators can cause a vortex. Always try to mount the transmitter off-centre of any vortex to maximise the return echo.
- As stirrer blades become uncovered, they will create echoes as they pass through the ultrasonic beam. The transmitter can be tuned on-site to ignore these false echoes.

Mounting in a nozzle



It is important that the *bottom reference* of the transmitter is related to the centre of the invert of the primary device (see below), and NOT the distance to the channel bottom directly below the transmitter.

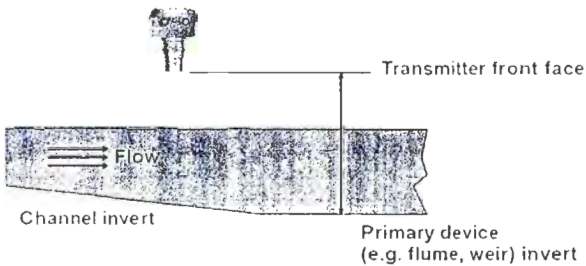


TABLE 1.

Nozzle Diameter Size (D)	Maximum Nozzle Length (L)
DN50 (2 inch)	18mm (3/4")
DN80 (3 inch)	100mm (4')
DN100 (4 inch)	100mm (4')
DN125 (5 inch)	200mm (8")
DN150 (6 inch)	350mm (14")

NOTES:

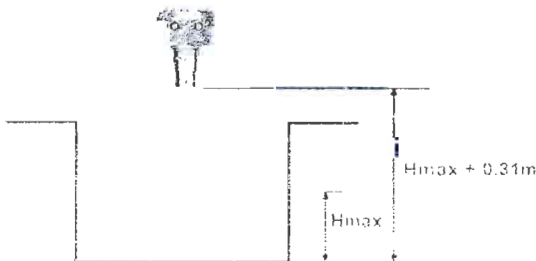
- The liquid surface at the point of measurement must have a stable, smooth surface and uniform approach velocity. It must not be affected by baffles, foam, hydraulic jumps or any other object likely to cause flow disruption
- The primary element should be free from any situation where it is likely to 'drown' (refer to relevant Standard for further information)

Open Channel Flow installations
(Models 3102/3105)

There are normally two distinct parts to an open channel flow measurement system; the primary element (flow structure) and the secondary element (head measurement instrumentation). For accurate open channel flow measurement, both parts of the system must be installed accurately.

The transmitter should be positioned at the correct distance upstream from the flow structure at a height that is at least equal to the maximum flow depth plus the blanking distance (dead zone) of the transmitter (see below)

A minimum distance of 0.31m is recommended.



Rosemount 3100 Series

Product Data Sheet

00813-0100-4840, Rev. AA

May 2007

Specifications

General	
Product	Rosemount 3100 Series level transmitters; Model 3101 for Level and Distance measurement Model 3102 for Level, Distance, Volume, and Open channel flow measurement with 2 integral signal relays. Model 3105 for Level, Distance, Volume, and Open channel flow measurement for hazardous locations.
Measurement principle	Ultrasonic, time-of-flight.
Measuring performance	
Measurement range	Model 3101: 1 - 26 ft (0.3 - 8 m) Model 3102: 1 - 36 ft (0.3 - 11 m) Model 3105: 1 - 36 ft (0.3 - 11 m)
Level resolution	Better than $\frac{1}{16}$ " (1 mm)
Level accuracy	Model 3101: ± 0.2 in. (5 mm) for < 3.3 ft (1 m). $\pm 0.5\%$ of measured distance for > 3.3 ft (1 m) Models 3102 and 3105: ± 0.1 in. (2.5 mm) < 3.3 ft (1 m), $\pm 0.25\%$ of measured distance for > 3.3 ft (1 m) under reference conditions ⁽¹⁾
Blanking distance (Dead Zone)	12" (0.3m)
Update interval	1 second
Display / Configuration	
Integral Display	4/5 digit display for live measurement, and for configuration purposes
Output Units	For Level or distance-to-surface: m, ft, in. or none For Contents: l, m ³ , gal, or ft ³ For Flow: l/s, l/m, m ³ /hr, gal/s, gal/m, ft ³ /m (cfm), ft ³ /hr, or none
Output Variables	Model 3101: Level, or distance-to-surface Model 3102: Level (or distance-to-surface), Content (Volume), and Flow. Model 3105: Level (or distance-to-surface), Content (Volume), and Flow.
Configuration tools	Standard integral push-buttons with LCD. Rosemount hand-held communicator Model 275 or 375. Rosemount 3490 Series universal control unit. Rosemount AMS(TM) Suite
Electrical	
Power supply	Loop-powered (2-wire) Model 3101: 12 - 30 Vdc Model 3102: 12 - 40 Vdc Model 3105: 12 - 40 Vdc (non-hazardous area), 12 - 30 Vdc (hazardous area).
Earthing	None required.
Current Output	Model 3101: Analog 4-20 mA Model 3102: Analog 4-20 mA, HART® Model 3105: Analog 4-20 mA, HART®.
Signal on alarm	Standard: Low = 3.75 mA, High = 21.75 mA Nimur NE43: Low = 3.8 mA, High = 22.5 mA
Saturation levels	Standard: Low = 3.9 mA, High = 20.8 mA. Nimur NE43: Low = 3.8 mA, High = 20.5 mA
Relay output (on 3102 model)	2 integral signal relays, SPST rated 1A @ 30VDC (inductive) and 2A @ 30VDC (resistive)
Electrical parameters	$U_i = 30$ V, $I_i = 120$ mA, $P_i = 0.82$ W, $L_i = 108 \mu$ H, $C_i = 0$ nF.
Cable entry	$\frac{1}{2}$ " - 14 NPT conduit entries for cable glands. Option: M20 x 1.5 conduit/cable adaptor
Output Cabling	Single twisted-pair and shielded, min. 0.22 mm ² (24 AWG), max. 1.5 mm ² (15 AWG).
Materials of construction	
Wet-side material	PVDF
Body and cover material	Polyurethane covered Aluminum.
Cover seal	Silicone rubber
Cover screws	316 Stainless Steel
Transducer body seal	EPDM.

Mechanical	
Mounting thread size	2" NPT, or 2" BSP. Optional flange accessories available.
Measuring	
Temperature compensation	Model 3101: Automatic Integral temperature compensation. Model 3102: Automatic Integral temperature compensation. Optional remote temperature sensor for dynamic temperature compensation. ⁽²⁾ Model 3105: Automatic Integral temperature compensation. Optional remote temperature sensor for dynamic temperature compensation. ⁽²⁾
Environment	
Ambient temperature	Model 3101: -4 °F to +158 °F (-20 °C to +70 °C) Models 3102 and 3105: -40 °F to +158 °F (-40 °C to +70 °C) ⁽³⁾
Process temperature	Model 3101: -4 °F to +158 °F (-20 °C to +70 °C) Models 3102 and 3105: -22 °F to +158 °F (-30 °C to +70 °C)
Process pressure	-4 to +44 psi (-0.25 to 3.0 bar)
Ingress protection	NEMA 4X, IP 66
Electromagnetic compatibility	EN61326 (Class B)
Certifications	CE-mark, FM, CSA, ATEX, or IECEx - dependent on order code

⁽¹⁾ Temperature: 20°C, Pressure: 101.3 kPa (atmospheric pressure), and Relative Humidity: 65%

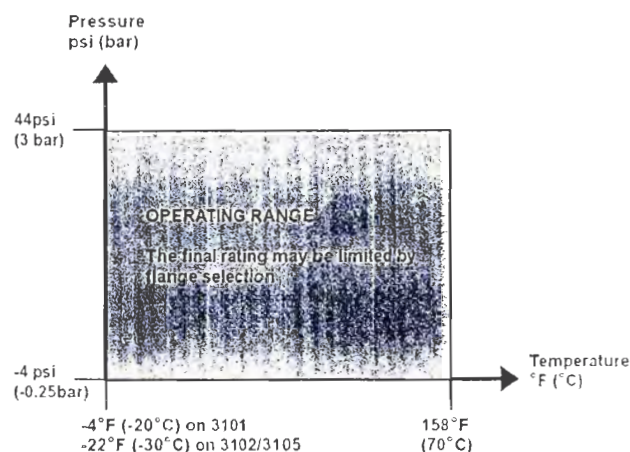
⁽²⁾ See page 17 for optional accessories

⁽³⁾ See page 11 onwards for approval temperature ranges

Rosemount 3100 Series

Temperature and Pressure Ratings

The process temperature/pressure rating depends on the design of the transmitter in combination with the flange materials.

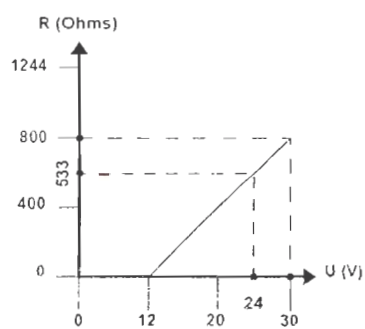


Process temperature and pressure diagram for Rosemount 3100 Series

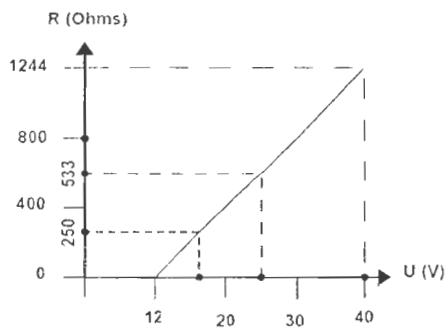
Load Limitations

A HART® Communicator requires a minimum load resistance of 250 Ohm within the loop in order to function properly. Communication with Rosemount 3490 Universal Controller does not require additional resistance. The maximum load resistance can be determined from these diagrams:

Non-Intrinsically Safe Installations

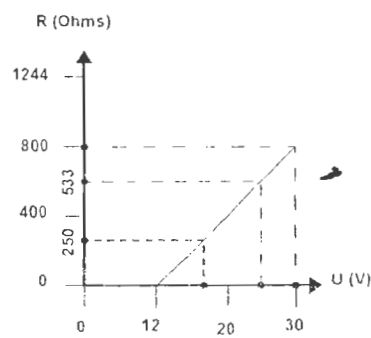


Model 3101



Models 3102 and 3105

Intrinsically Safe Installations



Model 3105

NOTE

R = Maximum Load Resistance

U = External Power Supply Voltage

Product Data Sheet

00813-0100-4840, Rev. AA

May 2007

Rosemount 3100 Series

Product Certifications

ORDINARY LOCATION CERTIFICATION FOR FM (MODELS 3101/3102)

- APPROVAL PENDING

G5 Project ID: 3024095

The transmitter has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by FM, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

ORDINARY LOCATION CERTIFICATION FOR CSA (MODELS 3101/3102)

G6 Project ID: 1878089

The transmitter has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by CSA, a nationally recognized testing laboratory as accredited by the Standards Council of Canada (SCC).

EUROPEAN DIRECTIVE INFORMATION

The EC declaration of conformity for all applicable European directives for this product can be found on the Rosemount website at www.rosemount.com. A hard copy may be obtained by contacting your local sales office.

ATEX Directive (94/9/EC)

Complies with the ATEX Directive.

Pressure Equipment Directive (PED) (97/23/EC)

3100 Series is outside the scope of PED Directive.

Electro Magnetic Compatibility (EMC) Directive

EN61326 (Class B)

CE-mark

Complies with applicable directives

3101, 3102 (EMC)

3105 (EMC, ATEX)

HAZARDOUS LOCATIONS CERTIFICATIONS (MODEL 3105)

Factory Mutual (FM) Approvals

Factory Mutual (FM) Intrinsically Safe Approval

I5 Project ID: 3024095

Intrinsically Safe for Class I, Div. 1, Groups A, B, C and D
Intrinsically Safe for Class I, Zone 0, AEx ia IIC
Temperature Code: T4 at +60°C, max ambient
Temperature Code: T6 at +55°C, max ambient

Control Drawing: 71097/1216

Ui = 30 V, Ii = 120 mA, Pi = 0.82 W, Li = 108 µH, Ci = 0 µF

Factory Mutual (FM) Non-Incendive Approval

I5 Project ID: 3024095

Non-Incendive for Class I, Div. 2, Groups A, B, C and D
Non-Incendive for Class I, Zone 2, AEx nA IIC
Temperature Code: T4 at +60°C, max ambient
Temperature Code: T6 at +55°C, max ambient

Control Drawing: 71097/1216

Ui = 30 V, Ii = 120 mA, Pi = 0.82 W, Li = 108 µH, Ci = 0 µF

Canadian Standards Association (CSA) Approvals

Canadian Standards Association (CSA) Intrinsically Safe Approval

I6 Project ID: 07 CSA 1878089

Intrinsically Safe for Class I, Div. 1, Groups A, B, C, and D
Intrinsically Safe for Class 1, Zone 0, Ex ia IIC
Temperature Code:
T4 (T_{amb} -40°C to +60°C)
T6 (T_{amb} -40°C to +55°C)

Control Drawing: 71097/1216

Ui = 30 V, Ii = 120 mA, Pi = 0.82 W, Li = 108 µH, Ci = 0 µF

Canadian Standards Association (CSA) Non-Incendive Approval

i6 Project ID: 07 CSA 1878089

Non-Incendive for Class I, Div. 2, Groups A, B, C, and D
Non-Incendive for Class I, Zone 2, Ex nL IIC
Temperature Code:
T4 (T_{amb} -40°C to +60°C)
T6 (T_{amb} -40°C to +55°C)

Control Drawing: 71097/1216

Ui = 30 V, Ii = 120 mA, Pi = 0.82 W, Li = 108 µH, Ci = 0 µF

Rosemount 3100 Series

ATEX Intrinsically Safe Approval

- 11 Certificate: Sira 06ATEX2260X
Intrinsically Safe for II 1 G, EEx ia IIC
Temperature Class
T4 (T_{amb} -40°C to +60°C)
T6 (T_{amb} -40°C to +55°C)

$U_i = 30\text{ V}$, $I_i = 120\text{ mA}$, $P_i = 0.82\text{ W}$, $L_i = 108\text{ }\mu\text{H}$, $C_i = 0\text{ }\mu\text{F}$

Special conditions for safe use:

- 1 All transmitter models have external plastic parts, which could present a risk of ignition due to electrostatic charge build-up. They shall not be directly installed in any process where its enclosure might be charged by the rapid flow of non-conductive media.
- 2 All transmitter models shall only be cleaned with a damp cloth.
- 3 When the transmitter housing uses aluminum alloy in its construction, this presents a risk of ignition due to impact and shall be taken into consideration on installation and use.

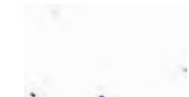
IECEx Approval

- 17 Certificate: IECEx SIR 06.0068X
Intrinsically Safe for Zone 0, Ex ia IIC
Temperature Class:
T4 (T_{amb} -40°C to +60°C)
T6 (T_{amb} -40°C to +55°C)

$U_i = 30\text{ V}$, $I_i = 120\text{ mA}$, $P_i = 0.82\text{ W}$, $L_i = 108\text{ }\mu\text{H}$, $C_i = 0\text{ }\mu\text{F}$

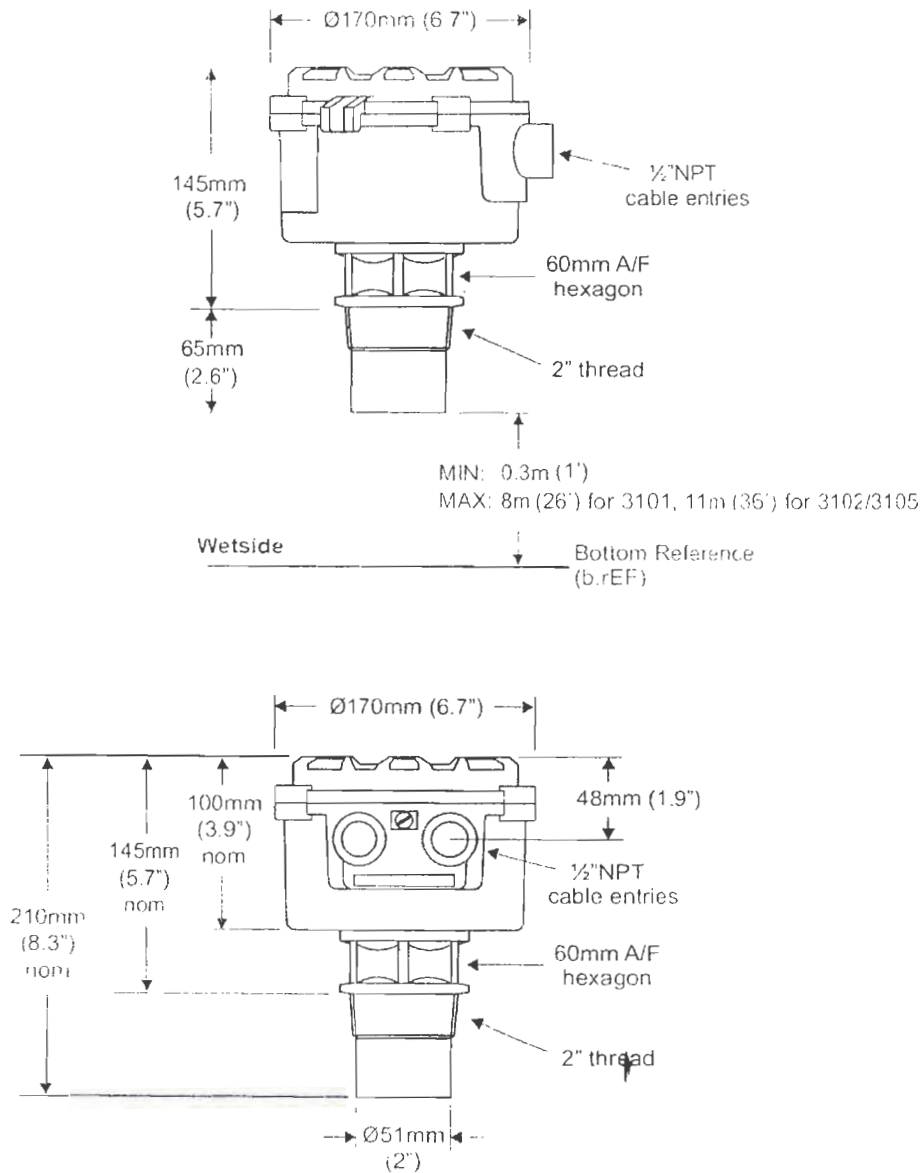
Special conditions for safe use:

- 1 All transmitter models have external plastic parts, which could present a risk of ignition due to electrostatic charge build-up. They shall not be directly installed in any process where its enclosure might be charged by the rapid flow of non-conductive media.
- 2 All transmitter models shall only be cleaned with a cloth.
- 3 When the transmitter housing uses aluminum alloy in its construction, this presents a risk of ignition due to impact and shall be taken into consideration on installation and use.



Dimensional Drawings

Threaded Mounting



Product Data Sheet

00813-0100-4840, Rev. AA

May 2007

Rosemount 3100 Series

Model Code 3102, Level, Volume or Flow of liquids

Model	Product Description
3102	Ultrasonic level transmitter with 2 integral relays
Code	Signal Output
H	4-20 mA with HART [®] communication
Code	Housing Material
A	Polyurethane-covered Aluminum
Code	Conduit / Cable Threads
1	½ - 14 NPT
2	M20 x 1.5 adaptor
Code	Wet-side material
F	PVDF
Code	Process Connection
RC	2" NPT thread ⁽¹⁾
SC	2" BSPT thread ⁽²⁾
Code	Certificates
NA	No certification
G5	FM Ordinary Location
G6	CSA Ordinary Location
Code	Options
Alarms	
C4	Namur alarm and saturation levels; high alarm.
C5	Namur alarm and saturation levels; low alarm.
C6	Low alarm setting with standard Rosemount alarm and saturation levels.
Tag Plate	
ST	Stainless Steel engraved tag plate
VVT	Laminated paper tag plate

⁽¹⁾ Choosing this option implies US (Imperial) units of measurement are required for the default configuration.

⁽²⁾ Choosing this option implies Metric units of measurement are required for the default configuration

Example model order code: 3102-H-A-1-F-RC-G5-C4-ST



REPLIES TO THE COMMENT ON ROTAMETER. DATA SHEET REV 00 VIDE MAIL DATED 31/08/09

PROJECT: PRAGATI-III COMBINED CYCLE POWER PROJECT 1500MW (NOMINAL)
CUSTOMER: PRAGATI POWER CORPORATION LIMITED
CONSULTANT: NTPC LIMITED, CONSULTANCY WING
BHEL DOCUMENT NO: PE-VO-314-156-A108
THERMAX DOCUMENT NO: WHJBA00015 REV.00

ROTAMETER

S.NO	COMMENT	THERMAX REPLY	REMARKS
I	Pipe material CS	Noted & data sheet is revised accordingly	
II	Tube in SS 316	Borosilicate glass is suitable for application & same is mention in data sheet	
III	Frame & wetted part is in SS 316	Rotameter is for water application. Hence frame is in MS & wetted parts is in CS is suitable for process Application.	
IV	Hosing protection class: IP-55	Noted & Confirmed	