




TD-106-1 Rev No. 5	Form No.		<p style="text-align: center;"><b>PRODUCT STANDARD</b> <b>SWITCHGEAR</b> <b>HYDERABAD</b></p>	Product STD no.	SG 80054  Rev No. 00  Page 1 of 4
COPYRIGHT AND CONFIDENTIAL  The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p style="text-align: center;"><b><u>VARIABLE AREA FLOW TRANSMITTER FOR OXYGEN SERVICE</u></b> <b><u>(Material Code: SG9780054014)</u></b></p> <p><b>1. Introduction:</b></p> <p>This Metal Variable area type flow meter is designed to measure the flowrate of air /oxygen application. It consists of a tapered metal tube, an indicating assembly and float. A magnet encapsulated in float couples with rotating magnets connected to an indicating pointer, thus the movement of the float is accurately indicated in terms of flowrate.</p> <p>The transmitter uses a unique magnetic sensor which is directly placed on the PCB. As the float moves in the taper tube, the magnetic flux around the sensor changes in accordance with the float position. This change in magnetic flux causes the change in the output of the sensor. This output is amplified and line arised using micro process based circuitry to get standard loop powered 4-20 mA DC O/P.</p> <p><b>2. Scope of Supply:</b></p> <ol style="list-style-type: none"> <li>a. This specification along-with enclosed attachments and transmitter data sheets covers minimum requirements for design, engineering, manufacturing, assembly and supply, documentation, testing at manufacture works, packing and shipping of the variable area flow transmitter for Oxygen application.</li> <li>b. Electronic field transmitters shall be supplied, complete with all accessories and associated equipment / accessories necessary for safe and trouble free continuous operation under all the operating and ambient conditions specified in the enclosed documents / attachments.</li> <li>c. In case of any conflict between this specification, enclosed data sheets, enclosed attachments, related Codes and Standards etc., Bidder shall refer the matter in writing to the Purchaser, and shall obtain clarification in writing before starting the manufacturing of the transmitters.</li> <li>d. Bidder must specify in writing specific requirements, if any, to ensure the safe and satisfactory operation of the equipment under all the operating and ambient conditions specified in the enclosed documents / attachments.</li> <li>e. Deviations, if any, from the enclosed specifications, data sheets, enclosed attachments, relevant codes &amp; standards, and/or alternative designs, materials etc. must be clearly highlighted in the offer under 'deviation list' submitted by bidder in their bid which shall be subjected to owner's approval. In absence of any written deviation specified in the deviation list, it will be considered that the offer is in full compliance with all the requirements.</li> <li>f. Bidder datasheets shall contain all the data specified in the purchaser's datasheets as a minimum requirement.</li> <li>g. Bidder is responsible for the complete design, construction, testing, packing and delivery of the transmitters and its accessories for the services and conditions specified in the requisition.</li> <li>h. In general, order of priority of the documents shall be as follows:             <ol style="list-style-type: none"> <li>i. Local regulatory and statutory requirement.</li> <li>ii. Project specification and datasheets, wherever applicable.</li> <li>iii. This specification and relevant equipment/system specification.</li> <li>iv. Codes and standards.</li> </ol> </li> </ol>			

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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<p><b>1. <u>GUARANTEE AND WARRANTY:</u></b></p> <p>1.1. Bidder shall guarantee the supply against defective materials, design and workmanship as specified in the general purchase conditions.</p> <p>1.2. Field transmitter's performance shall be guaranteed in accordance with requirements of applicable specifications and codes at conditions indicated in relevant equipment datasheets.</p> <p>1.3. If the stated performances are not achieved, Bidder shall, at his own expenses, make necessary repairs, modifications and replacements to the supply to enable the performance to be achieved.</p> <p><b>2. <u>DESIGN REQUIREMENTS:</u></b></p> <p>2.1. The transmitter shall provide 4-20mA proportional signal to the measured flow.</p> <p>2.2. The transmitter shall be provided with an integral indicator. Operation of the transmitter shall not be affected by removal or malfunctioning of the integral meter.</p> <p>2.3. Transmitters shall be microprocessor based and it shall incorporate a non-volatile memory which shall store complete configuration data of the transmitter. All necessary signal conversions, including conversion to produce output with the required protocol shall be carried out in the transmitter electronics.</p> <p>2.4. Body and wetted parts of the transmitter shall be SS316 as minimum. Other material such as Hastelloy, Monel or Titanium shall be used as per process requirements. Electronic housing material shall be epoxy coated Die cast Aluminium OR ABS plastic.</p> <p>2.5. Threaded end connections shall be to NPT as per ANSI B 1.20.1 and flanged end connections shall be as per ANSI B 16.5.</p> <p>2.6. Flowmeter body shall be equipped with inlet and outlet float stops and, where feasible, cleanout plugs, which may be utilized as connection taps.</p> <p>2.7. External devices for indicating or transmitting shall be magnetically coupled to the float or extension. Magnetic coupling shall be glandless type.</p> <p>2.8. The transmitter accuracy shall be 1.6% of full range as per VDI / VDE 3513.</p> <p>2.9. Vendor shall indicate the minimum &amp; maximum flow possible for the specified flowmeter size. The exact flow range shall be provided during detail engineering. Vendor to note that this shall not have any delivery or commercial implications on BHEL.</p> <p><b>3. <u>INSPECTION AND TESTING (refer attached ITP):</u></b></p> <p>3.1. Refer inspection and test plan attached with this specification.</p> <p>3.2. The following test shall be carried out on the transmitters and test report / certificates shall be provided.</p> <ol style="list-style-type: none"> <li>Calibration test.</li> <li>Functional Test.</li> <li>Material test certificates for all wetted parts.</li> <li>Hydro test.</li> </ol> <p><b>4. <u>NAME PLATE:</u></b></p> <p>4.1. Field Transmitters shall have a corrosion resistant stainless steel Nameplate with stamped or engraved tag number. This tag plate shall be fixed to the instrument by means of screws, rivets etc.</p>			

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4.2. The name plate shall include as a minimum;

- BHEL material code.
- Transmitter Tag number.
- Manufacturers Name, Model number.
- Serial numbers.
- Body material.
- Calibrated Range and Instrument Range.

4.3. Individual accessories (if supplied with transmitter) shall also be tagged.

**5. DOCUMENTATION:**

5.1. Bidder shall furnish at least following documents for information / review.

- Along with offer
- Technical catalogues / literature.
- Drawing showing, mounting details.
- Specification sheet/ Data sheet as per attached format.
- Sizing Sheet for the applicable Flow Meter with minimum & maximum p
- After placement of order.
- Curves for flow measurement vs. accuracy and rangeability.
- Operation and Maintenance manual.
- Inspection and Test certificates.
- Guarantee certificate.
- Calibration procedures for flow meter.

**6. PACKING:**

The material shall be properly packed to ensure that it is capable of withstanding transit risks without damage.

**7. VARIANT TABLE-1: 4-20mA**

Var. No	Description	Measurement Range (Nominal)	NACE / H2 Service	Process connection	Material Code
01	VARIABLE AREA FLOW TRANSMITER 1" 150#RF,4-20mA	1000LPM	NO	1"150#RF	SG9780054014

**8. ATTACHMENTS:**

- Datasheet.
- ITP for Flowmeters.

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# वेरिएबल एरिया फलोमीटरों के लिए निरीक्षण व परीक्षण योजना

## INSPECTION AND TEST PLAN FOR VARIABLE AREA FLOW METERS

3	20.09.2013	Revised and Reissued	MJ	RS	SEG	DM
2	22.02.2012	Revised and Reissued	MJ	GS	AKC	DM
1	22.01.2008	Revised and Reissued	AKG	PPM	MVKK	VC
0	30.04.2002	Issued for implementation	RG	AKC	AK	GRR
Rev. No.	Date	Purpose	Prepared By	Checked by	Standards Committee Convenor	Standards Bureau Chairman
Approved by						

**INSPECTION AND TEST PLAN  
FOR  
VARIABLE AREA FLOW METERS**

STANDARD SPECIFICATION NO.

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**Abbreviations**

AS	:	Alloy Steel	MRT	:	Mechanical Run Test
BASEEFA	:	British Approval Service for Electrical Equipment in Flammable Atmospheres	MPT/MT	:	Magnetic Particle Testing
BIS	:	Bureau of Indian Standards	MTC	:	Material Test Certificates
CCE or CCOE	:	Chief Controller of Explosives	MOC	:	Material of Construction
CEIL	:	Certification Engineers International Limited	NPSH	:	Net Positive Suction Head
CIMFR	:	Central Institute of Mining & Fuel Research	NDT	:	Non Destructive Testing
CE	:	Carbon Equivalent	NEMA	:	National Electrical Manufacturers Association
DFT	:	Dry Film Thickness	PO	:	Purchase Order
DT	:	Destructive Testing	PESO	:	Petroleum Explosive Safety Organization
DP or DPT	:	Dye Penetrate Testing	PQR	:	Procedure Qualification Record
ERTL	:	Electronics Regional Test Laboratory	PR	:	Purchase Requisition
FCRI	:	Fluid Control Research Institute	PMI	:	Positive Material Identification
FM	:	Factory Mutual	PTB	:	Physikalisch-Technische Bundesanstalt
FLP	:	Flame Proof	QC	:	Quality Control
HART	:	Highway Addressable Remote Transducer	RT	:	Radiography Testing
HV	:	High Voltage	SS	:	Stainless Steel
ITP	:	Inspection and Test Plan	TC	:	Test Certificate
IP	:	Ingress Protection	TPI or TPIA	:	Third Party Inspection Agency
IC	:	Inspection Certification	UT	:	Ultrasonic Testing
IR	:	Insulation Resistance	UL	:	Under writer Laboratories
IEC	:	International Electro technical Commission	VDR	:	Vendor Data Requirement
JEC	:	Japanese Electro technical Committee	WPS	:	Welding Procedure Specification
LPT	:	Liquid Penetrate Testing	WPQ	:	Welders Performance Qualification
			XLPE	:	Cross Linked Poly Ethylene

**Inspection Standards Committee**

**Convenor :** Mr. S C Gupta

**Members:**

Mr. R.K. Singh	Mr. Rajeev Kumar	Mr. Himangshu Pal
Mr. Neeraj Mathur	Mr. T Kamalakannan	Mr. Deepak Gupta (Project)
Mr. Mayank Jain		

## 1.0 SCOPE

This Inspection and Test Plan covers the minimum inspection and testing requirements for Variable Area Flow Meters.

## 2.0 REFERENCE DOCUMENTS

PO/PR / Standards referred there in /Job specifications / Approved documents.

## 3.0 INSPECTION AND TEST REQUIREMENTS

SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
<b>1.0</b>	<b>Procedures</b>	--	--	--	--	--	--
1.1	WPS/PQR/WPQ	Welding procedure Qualification for welds as applicable	100%	WPS PQR WPQ	--	H	W (New) R (Existing)
<b>2.0</b>	<b>Material Inspection</b>						
2.1	Incoming Material like Metal tube, Spool Pipes, Flanges, Float Assembly, Float stoppers, etc.	Chemical & Mechanical Properties, HT	100%	Material Test Certificates / Test Lab Certificates	H	H	R
<b>3.0</b>	<b>In process Inspection</b>						
3.1	Machining of components and assembly	Visual, Dimensions.	100%	Supplier's Test Records	-	H	-
<b>4.0</b>	<b>Final Inspection</b>						

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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
4.1	NDT , Post Weld Heat Treatment (PWHT) ( If specified)	<ul style="list-style-type: none"> <li>• Radiography for weld joints</li> <li>• Dye Penetration test.</li> <li>• Post Weld Heat Treatment of welds,</li> </ul>	100%	NDT reports / PWHT chart	-	H	R
4.2	Final Inspection	<ul style="list-style-type: none"> <li>• Visual and dimensional check</li> <li>• Hydrostatic test of complete flow meter assembly</li> <li>• Calibration test including accuracy and repeatability</li> <li>• Functional check with Transmitter &amp; flow switches( if required )</li> </ul>	100% by supplier and on random basis by EIL/TPIA	Supplier's Test Records and Inspection Witness Record	-	H	R
4.3	Submission of certificates / Documents	<ul style="list-style-type: none"> <li>• Certificate from testing agency like BASSEFA, FM, PTB, CIMFR, etc. for transmitter/switch enclosure for use in specified hazardous area.</li> <li>• BIS approval for transmitter enclosure manufactured indigenously.</li> <li>• Statutory approval certificate for transmitter/switch enclosure from CCOE / PESO for use in specified hazardous area.</li> <li>• Degree of protection (IP) certificate for transmitter/switch enclosure.</li> </ul>	Prototype for each model	Statutory Approval Certificates / Type Test Certificates	-	H	R



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SL NO.	STAGE/ ACTIVITY	CHARACTERISTICS	QUANTUM OF CHECK	RECORD	SCOPE OF INSPECTION		
					SUB SUPPLIER	SUPPLIER	EIL/TPIA
<b>5.0</b>	<b>Painting</b>						
5.1	Painting	<ul style="list-style-type: none"> <li>Special cleaning and packing for oxygen and chlorine services</li> <li>Pre treatment, primer and final paint, shade, thickness.</li> </ul>	100%	Test Records	-	H	-
<b>6.0</b>	<b>Documentation and IC</b>						
6.1	Documentation and IC	<ul style="list-style-type: none"> <li>Review of Internal Test Reports</li> <li>Manufacturer TC for bought out components.</li> <li>IC issuance.</li> </ul>	100%	Supplier's Test Records / Inspection Certificate	-	H	H
6.2	Final Document submission	Compilation of Inspection reports ,drawings, etc as per VDR / PR	100%	Final data folder /Completeness certificate	-	H	H

Legends: H- Hold (Do not proceed without approval), R-Review, RW-Random witness (As specified or 10 % - Samples must include min 1 No of each type), W- Witness (Give due notice, work may proceed after scheduled date).

**NOTES :-**


1. This document describes the generic test requirements. Any additional test or inspection scope if specified in contract documents shall also be applicable. (Unless otherwise agreed upon).
2. Acceptance Norms for all the activities shall be as per PO/PR/ Standards referred there in/ Job specifications /Approved documents

# Variable Area Flow Rotameters

Units : Flow → Liquid - m<sup>3</sup>/hr Gas - nm<sup>3</sup>/hr Steam - Kg/hr Pressure → Kg/cm<sup>2</sup>G Temperature → °C Level/Length → mm

General	1	Tag No.					
	2	Line No.					
	3	Service					
	4	Type					
	5	Function					
	6	Conn. Size : Size & Rating					
	7	Facing & Finish					
	8	Direction : Inlet	Outlet				
Meter	9	Tube Size	Float Guide				
	10	Tube Matl.	Float Matl.				
	11	Scale Length & Type					
	12	Scale Graduation					
	13	Range					
	14	Meter Factor					
	15	End Fitting Matl. (FLG.)					
	16	Packing or O-Ring Matl.					
Transmitter	17	Accuracy					
	18	Type (2 Wire)					
	19	Power Supply or Air Supply					
	20	Output					
	21	Electrical Area Class.					
	22	Scale Range					
	23	Enclosure					
	24	Cable Entry					
Options	25	Prot. Shield With Safety Glass					
	26	Jacketing - Medium	Conn.				
	27	Temp. °C	Pressure				
	28	Constant - Diff. Relay					
Service Conditions	29	Fluid & State					
	30	Maximum Flow					
	31	Minimum Flow					
	32	Normal Flow					
	33	Pressure - Oper.	Max.				
	34	Temp. C - Oper.	Max.				
	35	Oper. S. G	Mol. Wt				
	36	Max. Oper. Viscosity mPa.s (Cp)					
	37	Max. allowable pr. Drop					
	38	Fluid Density (Kg / m <sup>3</sup> )					
	39	Poison Ratio					
Model. No.	40	Model No.					
	41	Tube No.	Float No.				
Testing	42	IBR Certification	RADIGRAPHY				
	43						

**NOTES:** ☐ ISO Certificate  
☐ Date of Compliance, Calibration, Functional Test, Material Test  
☐ DEVIATION ☐ NO DEVIATION

<b>VENDOR DRAWING NO:</b>		<b>ORDER NO.:</b>					
<b>FILE</b>		<b>REQUISITION NO.:</b>					
	BHARAT HEAVY ELECTRICALS LTD.		<b>CLIENT :</b>		<b>DATE</b>	<b>BY</b>	<b>CHKD</b>
	HYDERABAD		<b>PLANT :</b>		<b>DATA SHEET NO.</b>		<b>APPD</b>
			<b>VENDOR:</b>				<b>REV.</b>