



Offshore Design Section
Engineering Services
ISO – 9001:2008

**FUNCTIONAL SPECIFICATION
FOR
“CONE METER”**

Spec. No. 3214

Rev. No. 01

Discipline Instt

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1.0 SCOPE OF THIS DOCUMENT:

- 1.1** This functional specification describes the essential design considerations for the selection of Cone flow meters for the intended service.

2.0 CODES & STANDARDS:

2.1 Applicable Codes & Standards:

- i. API MPMS 22.2 : Protocol for Differential Pressure Flow Measurement.
- ii. Latest editions of applicable codes & standards as enlisted in Cl. 3.6.3.1, Instrumentation Design Criteria

2.2 Applicable Documents and Specifications:

- a) Basic Bid Work
- b) Design Criteria - Process & Instrumentation
- c) Project P & IDs
- d) Process Data Sheets for Instruments

3.0 SCOPE OF SUPPLY:

- 3.1** The quantity to be supplied and installed shall be as per the requirements indicated in the Basic Bid Work, Design Criteria and the P & IDs.
- 3.2** The vendor shall be responsible for the selection of the Cone as a primary element & accessories suitable for its intended application, its procurement, tagging, packing, testing & calibration, preparation for shipment, along with accessories, spares, and assistance where required for its installation & commissioning at site.

4.0 CONE METERS:

4.1 Application:

- 4.1.1** Cones shall be used as a flow-measuring element as per specified in P&IDs & Scope Of work.
- 4.1.2** Cone meter shall be designed for the min. rangeability of 10:1. In case of flow rangeability higher than 10: 1, Two / More cone meters shall be provided.

4.2 General:

- 4.2.1** Cone beta ratio in general shall be between 0.45 and 0.80.
- 4.2.2** It shall be provided with min. 5D upstream & 3D downstream straight lengths.
- 4.2.3** The static pressure element shall be connected to the upstream pressure tap on liquid /gas flow measurement.
- 4.2.4** Differential ranges for Cone meters shall not exceed 5000 mm (200 inches) of water. Head loss across the meter shall be minimum.
- 4.2.5** Cone meter maximum shall be at least 5% higher than the maximum flow rate.
- 4.2.6** Cone shall be flanged meter with Welded Fixed Cone construction-
- 4.2.7** Temperature transmitter/sensor shall be placed within 3D downstream / upstream of cone meter.
- 4.2.8** Cone Meter shall be installed horizontally. Accuracy of the meter shall be min 0.5% or better & repeatability shall be min 0.1 % or better.



4.2.9 Cone shall be suitably marked with Tag Nos. Beta ratio, Cone diameter, Coefficient of discharge, Flow direction & direction of mounting. Cones shall be checked visually for nameplate data indicating Differential Pressure range.

4.3 Cone :

4.3.1 Cone shall have provision to equalize the pressure between inside & outside to prevent collapsing under pressure.

4.3.2 Where the cone meter is greater than six inch line size, the cone shall be supported with gusset, gusset shall be suitably placed so that it shall not disturb the flow conditioning of the cone.

4.4 Accessories :

5 Valve manifold for DP transmitter, Flow computer shall be supplied as an accessories to cone meter.

4.4.1 Manifold for DP Transmitter :

4.4.1.1 5 Valve Manifold for DP Transmitter shall be provided which shall be supplied by transmitter manufacturer.

4.4.2 Flow Computer :

4.4.2.1 The purpose of a Flow Computer is to perform flow calculations with temperature & pressure compensation, data archival, data retrieval and data transmission to the required destination. It shall be supplied by cone meter manufacturer.

4.4.2.2 Flow computer shall be Microprocessor based, It shall be suitable for Field/Panel mounting. This flow computer shall able to calculate the Coefficient of discharge for the cone meter at site for process fluid.

4.4.2.3 Field mounted Flow computer shall be suitable for CL 1 Div 1 Grp C&D , T3 hazardous area & with min IP 65/ NEMA 4X protection. Panel mounted flow computer shall have IP min 42 or better.

4.4.2.4 CPU, all electronic cards, Power Supply cards, etc shall have conformal coating with compliance to G3 (Harsh environment) requirements as per ISA S-71.04 Table 3 / Class 3 (Heavy Contamination) requirements as per 645-4 IEC / equivalent national or international standards. These electronic cards shall be provided with the 'protective coating' for complying with above standards and shall be certified by statutory bodies / authority for compliance.

4.4.2.5 Flow computer shall be suitable for unmanned platform. It shall have low power consumption.

4.4.2.6 Flow computer shall operate on 24 / 12 V DC power supply. It shall also have the integral lithium battery having life of min 2 years.

4.4.2.7 Output of flow computer shall have 4-20mA, Serial outputs as minimum unless otherwise specified.

4.4.2.8 It shall able to calculate density & compressibility factor using AGA8/ NX 19.

4.4.3 Flow computer shall provide instantaneous flow, compensated flow, cumulative flow and compensation parameters. It shall have non volatile memory to retain the data in case of power failure for min 15 days.

4.4.3.1 It shall also provide temperature, pressure, Diff Pressure inputs separately to DCS/RTU/PLC.

4.4.3.2 It shall have LCD display with 2 lines of alphanumeric display with 16 characters per line as min.



4.4.3.3 It shall be capable of performing self-diagnostics of the electronics and of the software. It shall also provide relevant error display.

4.4.3.4 Portable configurator /Laptop Computer loaded with operating software shall be provided to change/ reconfigure of process & other parameters.

4.5 Flanges & Piping Class :

4.5.1 Mating flanges shall match the rating and facing of adjacent pipe to the Cone. Cone meter flanges and fittings shall be installed according to ANSI B16.5 or ASME standard or International Flange standard.

4.5.2 Cone meter shall be of the same class as that of piping class mentioned in P&IDs.

4.6 Calibration, Installation & Testing:

4.6.1 Each cone meter shall be calibrated in Internationally accredited (to ISO 17025) laboratory (like NEL, NIST, CEESI, NMI, TCC, SWRI or equivalent). Tests shall be opened for Third Party witnessing.

4.6.2 Tests shall be performed for Accuracy of flow indication at each test point over a range of minimum flow to maximum flow & Flow Coefficient over an approximate Reynolds Number range corresponding to the aforementioned minimum and maximum flows. A minimum of 5 test points shall be taken, evenly spaced between the highest and lowest test point.

4.6.3 Prior to installation of the Cone, it shall be checked against the Instrument Specification sheet and inspected by the Company's representative.

4.6.4 Manufacture /contractor shall be responsible for correct alignment & correct orientation, installation of Cones with respect to the process flow.

4.6.5 Dye Penetration Testing for HP & LP tapping is required. All socket-welding shall be 100% Dye penetration / Magnetic particle tested. All other welding shall be 100% radiographed.

4.7 Material:

4.7.1 The material requirements for Cone shall in general be according to clause 3.6.4.5 of Instrumentation Design Criteria. Wherever applicable the Cone meter shall be in Compliance to NACE MR-01-75 / ISO 15156 : 2009.

4.7.2 Mountings accessories required for Flow Computer shall be min SS 316. All instrument supports shall be galvanized prior to installation.

4.8 Documentation:

4.8.1.1 General arrangement drawings in accordance with any general provisions, Configuration Sheet, manufacturer's data and descriptive literature for the equipment, including Materials of Construction by ASTM reference and grade, coating(s) specifications and dimensional drawings are to be submitted.

4.8.2 Internationally accredited (to ISO 17025) laboratory traceable certified test report shall be submitted to company for each cone meter along with supply.

4.8.2.1 Sizing calculations which shall include complete process data as mentioned in Bid documents and corresponding differential pressure produced by the meter for Company's review.

4.8.2.2 Installation and Operation Manual shall be provided along with the supply.



ANNEXURE – I - Typical Data Sheet for Cone Meter

GENERAL	1	Tag Number			
	2	Line Number			
	3	Line Size & Schedule			
	4	Service			
	5	P&ID No			
METER	6	Inlet Line ID	Outlet Line ID		
	7	Diff Range In mm H ₂ O			
CONE	8	Meter Maximum			
	9	Type			
	10	Size			
	11	Cone Material			
	12	Beta Ratio			
	13	Bore Dia. 'd'			
	14	Cone Gussets (y/n, No.)			
BODY/FLANGES	15	Direction		Horizontal only	
	16	Upstream Length	Downstream Length		
	17	Type			
	18	Flange Size	Rating		
	19	Flange Material			
	20	Flange Facing & Finish			
	21	Body Material			
TAPS	22	Pipe Material	Schedule		
	23	Pipe Type – Seamless / ERW			
	24	Material			
ACCURACY	25	Tap Type	Size		
	26	Number of tap sets per flange			
	27	Accuracy			
	28	Repeatability			
MANIFOLD FOR TRANSMITTER	29	Turn Down Ratio			
	30	Calibration- Traceable to ISO 17025 Lab			
	31	5 valve Manifold	Material	Yes	Min SS316
FLOW COMPUTER	32	Power Supply	Cable Entry		
	33	Mounting		Panel/Field Mounted	
	34	Input Type	Number	4-20 mA , Pulse inputs, Digital inputs RTD inputs, 0 – 5V . Multi variable sensor input	
	35	Output Type	Number	4-20 mA , Digital output , RS 232/485 / Relay output	
	36	LCD display			
	37	In Built Permanent Type battery		Min 2 years	
	38	Data archiving capacity			
	39	Standard used for Calculation			
	40	Enclosure class			
	41	Power consumption			
	42	Accuracy	Repeatability		



SERVICE CONDITIONS	43	Fluid	State			
	44	Flow Min.	Maximum			
	45	Flow Normal				
	46	Inlet Pressure Operating	Maximum			
	47	Temperature Operating	Maximum			
	48	Sp. Gr. At Oper. Temp.	15 °C			
	49	Molecular Weight	Cp / Cv			
	50	Operating Viscosity (Cp)				
	51	Compressibility Factor				
	52	Pipe Reynolds Number				
ITEM DETAILS	53	IBR Certification				
	54	Manufacturer				
Other	55	Model Number				
	56	Integral RTD (Y/N) / Size / Rating				
	57	Hydro Testing / Non Destructive Tests				
	58					
	59					