

Omar Said

Oil and Gas Flow Meters Selection Criteria

**Research Paper
(postgraduate)**

YOUR KNOWLEDGE HAS VALUE



- We will publish your bachelor's and master's thesis, essays and papers
- Your own eBook and book - sold worldwide in all relevant shops
- Earn money with each sale

Upload your text at www.GRIN.com
and publish for free



Bibliographic information published by the German National Library:

The German National Library lists this publication in the National Bibliography; detailed bibliographic data are available on the Internet at <http://dnb.dnb.de> .

This book is copyright material and must not be copied, reproduced, transferred, distributed, leased, licensed or publicly performed or used in any way except as specifically permitted in writing by the publishers, as allowed under the terms and conditions under which it was purchased or as strictly permitted by applicable copyright law. Any unauthorized distribution or use of this text may be a direct infringement of the author s and publisher s rights and those responsible may be liable in law accordingly.

Imprint:

Copyright © 2017 GRIN Verlag
ISBN: 9783668464780

This book at GRIN:

<https://www.grin.com/document/366484>

Omar Said

Oil and Gas Flow Meters Selection Criteria

GRIN - Your knowledge has value

Since its foundation in 1998, GRIN has specialized in publishing academic texts by students, college teachers and other academics as e-book and printed book. The website www.grin.com is an ideal platform for presenting term papers, final papers, scientific essays, dissertations and specialist books.

Visit us on the internet:

<http://www.grin.com/>

<http://www.facebook.com/grincom>

http://www.twitter.com/grin_com

OIL AND GAS FLOW METERS SELECTION CRITERIA

Omar Said, Abdullah Musbahi and Hassan Milad

Department of Electrical and Computer Engineering, University of Elmergib,
Algaraboli, Libya

Abstract – Accurate measurement of liquid/gas flow rate in oil and gas industry is significantly important. There are several types of flow meters used for this purpose. Selecting the most appropriate flow meter is sometimes a bewildering task. The aim of this work is to study different types of flow meters used in oil and gas industry and create a selection criteria based on several factors such as flow meter principle, pipe size, conductivity, meter position, fluid type, accuracy and some others.

Index Terms – flow, meter, selection criteria

I. INTRODUCTION

Industrial flow measurements include measuring of flow rate of liquids and gases. There are two basic ways of measuring flow, volumetrically or by mass. Volumetric flow is expressed in volume units (barrel/day, gallon/hour, liters/minute, etc.) whereas mass flow is expressed in mass units (Tonnes/hour, Kg/minute, etc.) [1].

Flow meters are devices used to measure the rate of flow of fluid and gas. These devices are generally classified into four groups (i.e. differential pressure flow meters, electronic flow meters, mass flow meters and mechanical flow meters) [1].

Characteristics of each flow meter type make it special for a particular application. One of the most important fluid characteristics affecting flow measurement is the shape of the velocity profile in the direction of flow. Flow measurement is also affected by Viscosity which is a measure of a fluid's internal friction. The more "viscous" a fluid is the "thicker" it is

when stirred. Clean water is an example of a low-viscosity liquid, while honey at room temperature is an example of a high-viscosity liquid [2].

II. FLOW METER TYPES

A study was made for the following flow meter types:

- Orifice Plate
- Venturi Tube
- V-cone
- Variable Area
- Ultrasonic
- Vortex
- Electro-magnetic
- Coriolis
- Turbine
- Positive Displacement

III. METERS ADVANTAGES AND DISADVANTAGES

The advantages and disadvantages of the above mentioned flow meters have been gathered in table 1 and were taken into consideration when creating the selection criteria.

IV. SELECTION CRITERIA

The selection of a flow meter for an industrial application is influenced by complex desired data. Table 2 shows the flow meters selection criteria based on several factors.

TABLE 1: FLOW METERS ADVANTAGES AND DISADVANTAGES

Meter Type	Orifice Plate	Venturi Tube	V-cone	Variable Area	Ultrasonic
Advantages	No moving parts, large range of sizes, suitable for most gases and liquids as well as steam.	Relatively high accuracy; better than $\pm 0.75\%$ over the orifice, requires less straight pipe.	Wide flow range, low maintenance, turndown ratio 10:1, requires minimal straight pipe.	Easy visualization of flow, ease of installation and maintenance; simplicity, low cost.	Suitable for large diameter pipes, no obstructions, no pressure loss, no moving parts, transducers may be installed on existing pipelines.
Disadvantages	Inaccuracy 2 to 3%, Low turndown ratio, requires straight pipe runs.	More expensive, requires large section for installation.	Not suited for high viscosity fluids, higher differential pressure losses.	limited accuracy, fluid must be clean, no solids content.	Fluid must be transparent, expensive, pipeline must be full.
Meter Type	Vortex	Electro-magnetic	Coriolis	Turbine	Positive Displacement
Advantages	Relatively wide rangeability, no moving parts in contact with the flowing stream.	No moving parts, bidirectional, unaffected by variation in viscosity, pressure and temperature. Capable of handling low flows.	Accurate mass flow of both liquids and gases, measurement independent of temperature, pressure, viscosity, conductivity and density of the medium.	Suitable for very low flow rates, wide rangeability, wide range of temperature applications.	High accuracy, high repeatability, high operating pressure.
Disadvantages	Not suitable for high viscosity, can be affected by vibration in the pipe.	Can not be used for gases, only for fluids which have electrical conductivity.	Expensive, many models are affected by vibration.	Not for high viscous fluids, only suitable for clean liquid/gas, pipe system must not vibrate.	Accuracy dependent on viscosity, moving parts, monitoring and maintenance

TABLE 2: FLOW METERS SELECTION CRITERIA

Flow Meter Type	Steam	Gas	Liquid						High Temperature	Cryogenic	Semi-filled pipes	Reverse flow	Accuracy (%)	Rangeability
			Clean	Dirty	Viscous		Corrosive	Low Conductivity						
					Low	High								
Orifice Plate	Y	Y	Y	N	Y	A	Y	Y	Y	Y	N	A	2	4:1
Venturi	Y	Y	Y	Y	A	A	A	Y	A	A	N	N	0.75	5:1
V-cone	Y	Y	Y	Y	Y	A	A	Y	Y	Y	N	N	0.5	10:1
Variable Area	Y	Y	Y	N	A	N	A	Y	Y	A	N	N	2	10:1
Ultrasonic	N	Y	Y	N	A	A	Y	Y	N	Y	N	Y	1	20:1
Vortex	Y	Y	Y	A	A	N	Y	Y	A	A	N	N	0.75	10:1
Electro-magnetic	N	N	Y	Y	Y	A	Y	N	A	A	A	Y	0.5	10:1
Coriolis	N	Y	Y	Y	Y	Y	A	Y	A	A	N	A	0.1	20:1
Turbine	N	Y	Y	N	A	N	A	Y	A	Y	N	N	0.2	20:1
Positive Displacement	N	N	Y	N	A	Y	A	Y	Y	A	N	N	0.5	100:1

Y: Suitable A: Applicable for the service under certain conditions, consult manufacturer N: Not suitable

CONCLUSION

Due to the variety of oil and gas flow meters, attempt was made through this paper to simplify the flow meter selection task. The generated selection criterion helps, to some extent, the instrumentation and control engineers in choosing the most suitable flow meter. Consulting flow meters manufacturers by providing them all relating process and piping data is sometimes still required. For some applications, there might be more than one suitable flow meter, but usually there is only one type which has the best suitability.

There are many companies that compete in the field of flow meter design. Each type of these devices has a series of designs which intend to overcome some of the disadvantages and give it extra features.

REFERENCES

- [1] K. Krishnamurthy and S Vijayachitra, *Industrial Instrumentation*, 2005.
- [2] Tony R. Kuphaldt, *Lessons in Industrial Instrumentation*, Version 4, Released January 11, 2009.
- [3] Michael Anthony Crabtree, *Industrial Flow Measurement*, University of Huddersfield, June 2009.
- [4] John G. Webster, *Measurement Instrumentation and Sensors Handbook*, 1999.
- [5] Roger C. Baker, *Flow Measurement Handbook*, 2005.
- [6] Beta G. Liptak, *Process Measurement and Analysis*, ISBN 0-8493-1082-0 (V-1), 1995.
- [7] PIP PCEFL001, *Flow Measurement Guidelines*, August 2006.

YOUR KNOWLEDGE HAS VALUE



- We will publish your bachelor's and master's thesis, essays and papers
- Your own eBook and book - sold worldwide in all relevant shops
- Earn money with each sale

Upload your text at www.GRIN.com
and publish for free

