HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Presentation Overview

1. Who is Hoffer Flow Controls?
2. Show me the money (benefits)!
3. Aren't there other flow meters that are better?
4. How Hoffer flow meters can help you.

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Hoffer has supplied flow meters for BOP's.

In fact, we have supplied well over 200 meters for BOP's alone!

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Hoffer has supplied flow meters for use on subsea ROV's.

Flowmeters monitor hydraulic fluid system performance

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Hoffer has supplied subsea flow meters for a wide variety of tooling skids.

Hydrate remediation skid

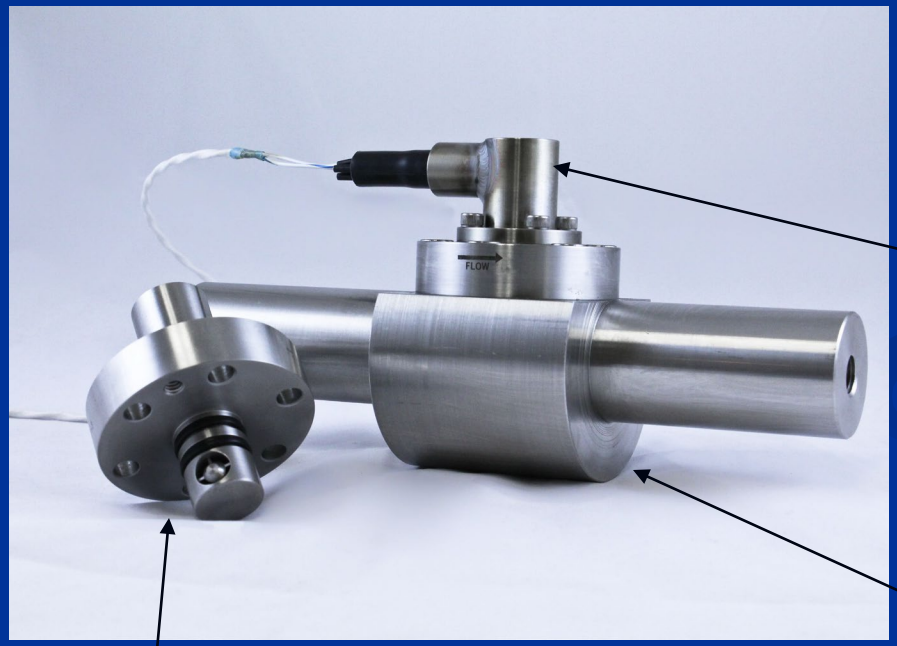
BOP Intervention Skid

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Hoffer flow meters are used on Drill Ship Pacific Santa Ana with ABS-CDS approval

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Hoffer flow meters are used on a wide variety of subsea tools and are designed to be application specific

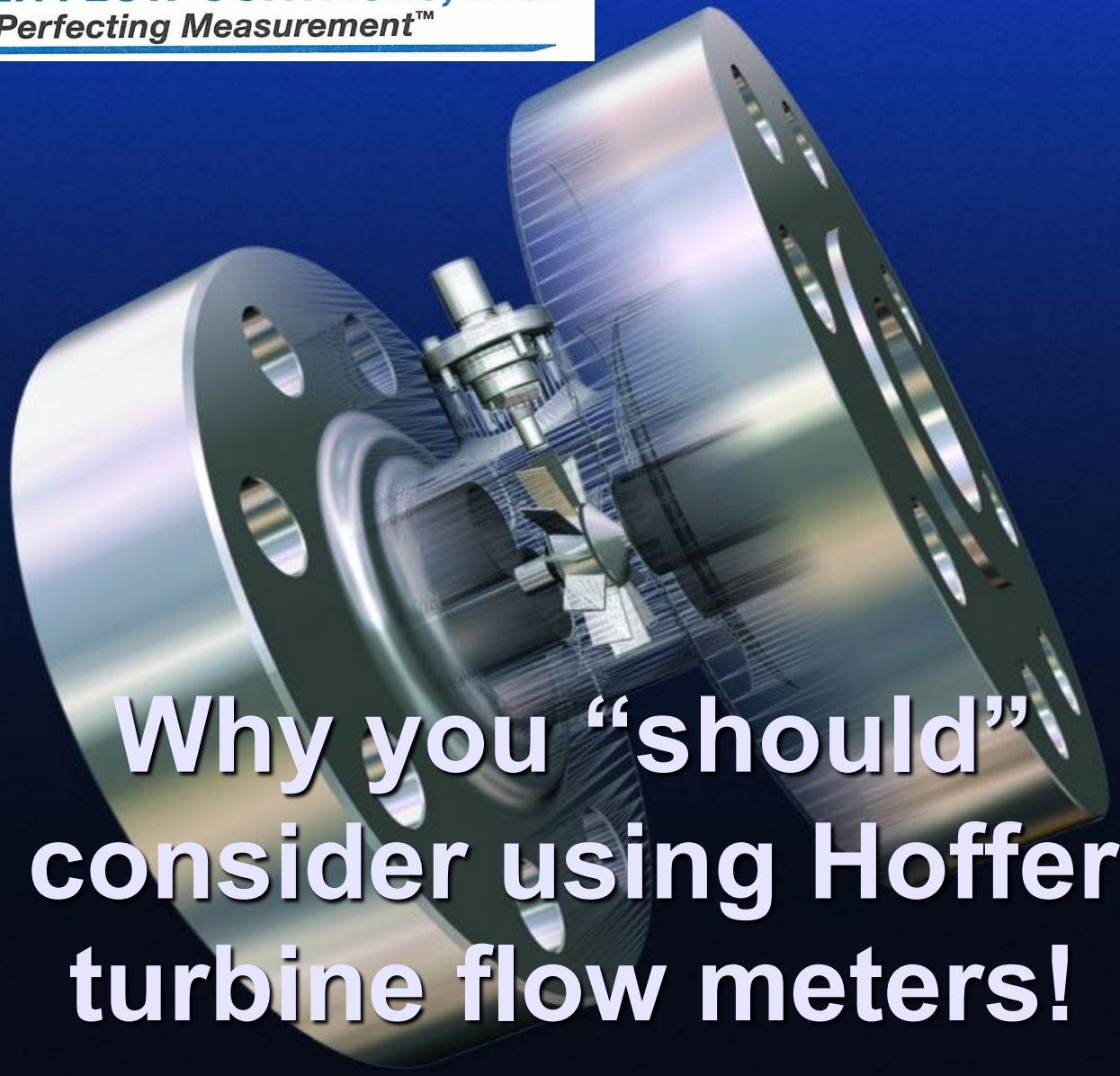


Subsea connector
Located at 90 degrees due to space limitations on a subsea tool

Housing fixture for calibration test purposes only

This is an “insertion style” flow meter designed for a working pressure of 15,000 PSI

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™



Why you “should” consider using Hoffer turbine flow meters!

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Hoffer Flow Controls

- Providing flow solutions to industry for 45 years.
- Privately-held corporation located in Elizabeth City, NC.
- Noted manufacturer of turbine flowmeters for liquid, gas and cryogenic flow measurement.

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Rotor Manufacturing

Hoffer uses two different methods for fabricating rotor assemblies

- Machine rotor "hub" and fusion weld blades into the hub face material.
- Machine rotor using EDM machine from solid round bar stock.

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Rotor Manufacturing

In wire electrical discharge machining (WEDM), also known as wire-cut EDM and wire cutting, a thin single-strand metal wire, usually brass, is fed through the workpiece, submerged in a tank of dielectric fluid, typically deionized water.

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Hoffer Flow Controls

- Recognized for being able to design and build custom flow meters in a short time.
- Examples of custom design requirements include high pressure requirements (as much as 60,000 PSIG), exotic alloys, ultra-high velocity flow measurement applications (Mach 0.5) and designs for harsh environments (subsea to 15,000 FT).

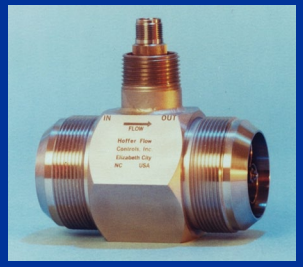
HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Providing "Application Specific" flow solutions for our customers is the key.

Mini-Flowmeters for low flow liquid and gas applications.

"Premier Natural Gas Series" for custody transfer of natural gas.

HO Series with MS Flared fittings commonly used in industry.



Sanitary Flowmeters for food, beverage, pharmaceutical and bio-tech.

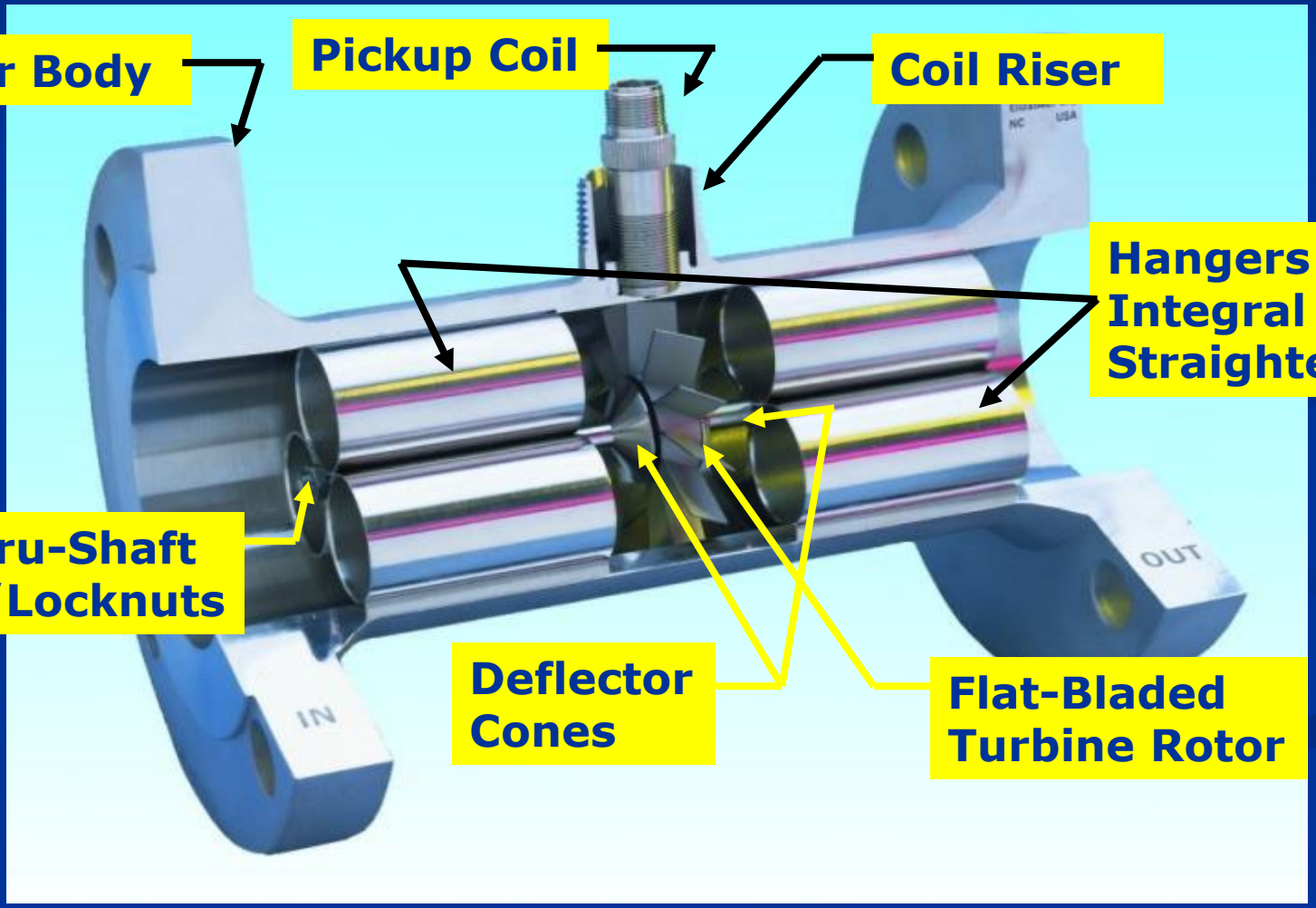
HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

w Meters

- Turbine flow meters measure velocity.
- They work well in clean, low to mid-viscosity applications.
- Liquid meters typically designed to measure up to 20 feet per second.
- Gas meters are designed to measure velocities as high as 250 feet per second.

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Basic Principle of Operation



HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Basic Definitions

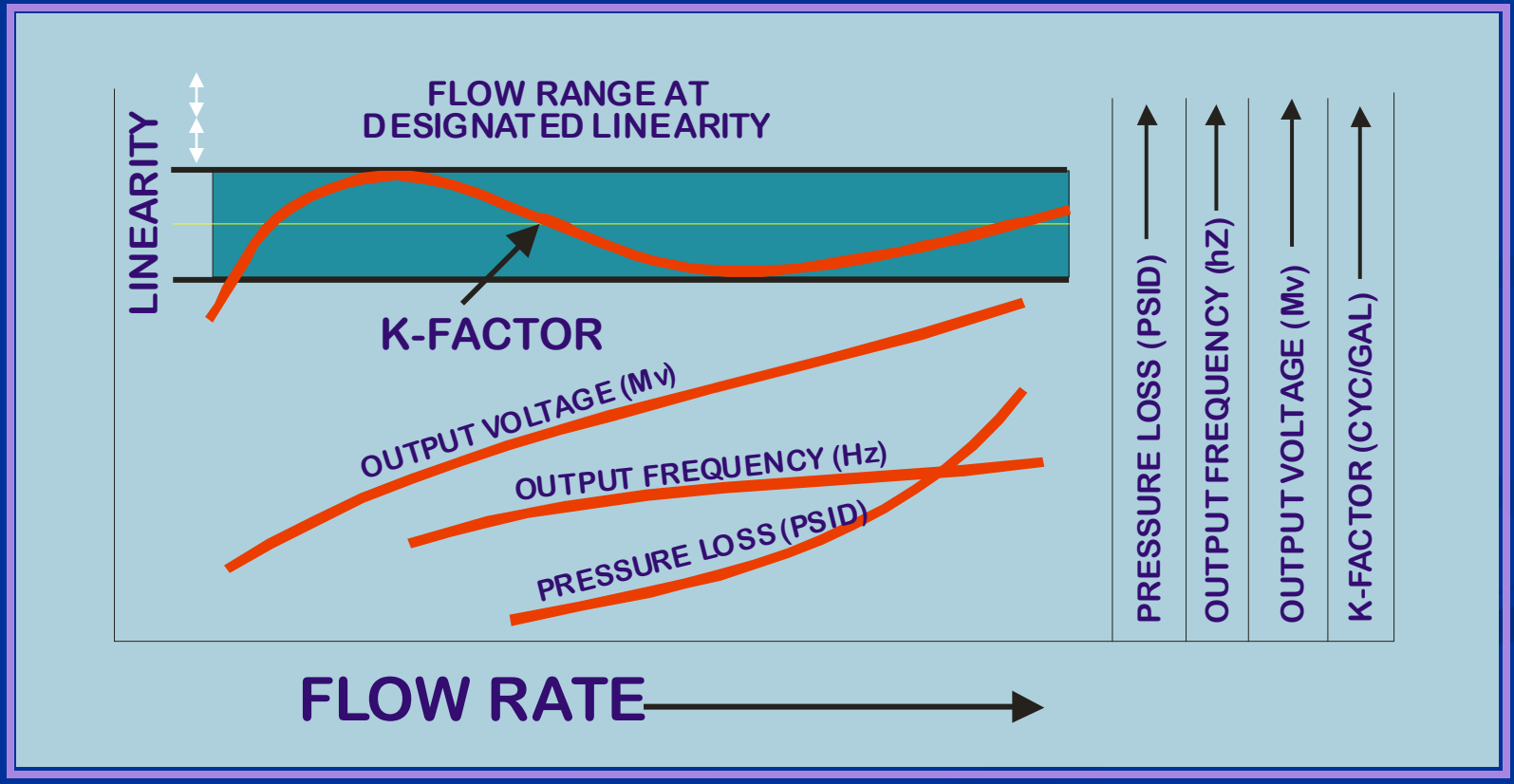
LINEARITY: A measure of the accuracy of the device which is the maximum percentage deviation from the average K-Factor.

K-FACTOR: The number of output pulses the flowmeter produces per engineering unit of the volume throughput.

REPEATABILITY: A statement of the ability of a measuring device to display the same value of a measured variable under identical conditions.

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Turbine Flow meter Performance Characteristics



HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Why use Hoffer turbine meters?

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Important Features

1. Wide turndown flow ranges available (100:1)
2. Incorporate subsea connector customer has standardized on into meter design
3. Meet industry/regulatory standards
4. Factory calibrated with traceability to NIST

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Important Features

5. High performance (good accuracy)
6. Dynamic response time measured in milliseconds
7. Suitable for use on applications with shock, vibration and temperature extremes
8. Robust design

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Important Features

9. Flowmeter housing is custom designed to fit almost any footprint
10. Large selection of flowmeter end connections available
11. ABS-CDS, DNV, Lloyd's and other certification compliance available

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Turbine Meter Advantages – *Wide Rangeability*

- Flowmeters can be configured to provide repeatable flow ranges with up to 100:1 turndown ratios.

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Liquid Size Selector

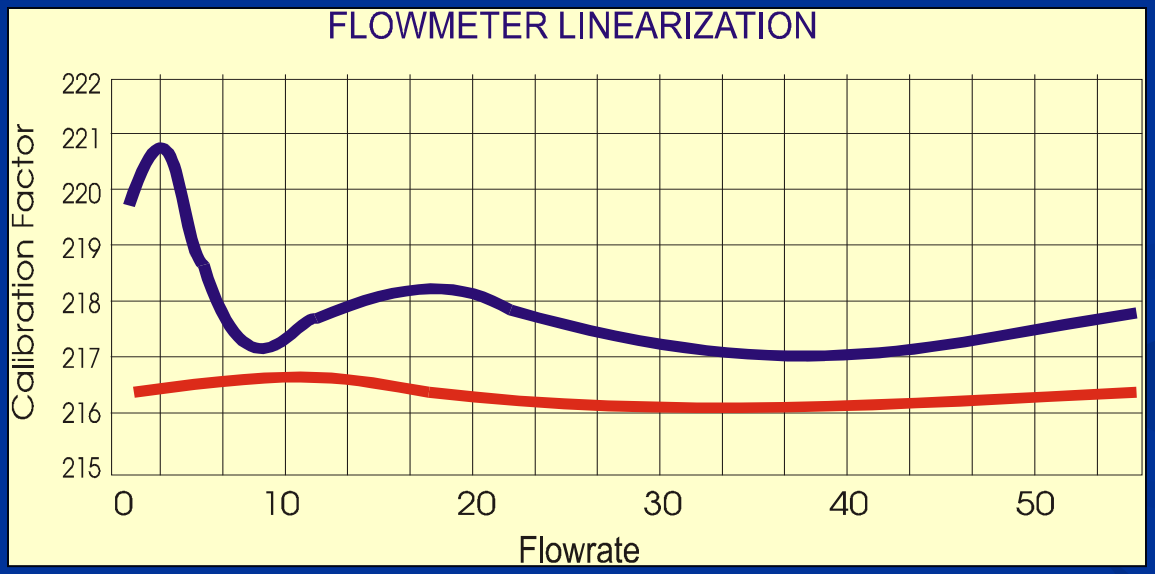
For Standard HO Series Turbine Flowmeters

Flowmeter Size	MAGNETIC PICKUP COIL				MODULATED PICKUP COIL			
Diameter (inches)	Linear Range (US GPM)	Linear Range (LPM)	Repeatable Range (US GPM)	Repeatable Range (LPM)	Linear Range (US GPM)	Linear Range (LPM)	Repeatable Range (US GPM)	Repeatable Range (LPM)
1/4*	.35-3.5	1.3-13.2	.25-4.5	.95-17	.35-3.5	1.3-13.2	.0625-4.5	.24-17
3/8*	.75-7.5	2.8-28.4	.3-9	1.1-34	.75-7.5	2.8-28.4	.075-9	.28-34
1/2	1.25-9.5	4.7-36	.6-12	2.3-45	1.25-9.5	4.7-36	.12-12	.45-45
5/8	1.75-16	6.6-60.6	.9-20	3.4-75.7	1.75-16	6.6-60.6	.2-20	.75-75.7
3/4	2.5-29	9.5-110	1.5-35	5.7-132.5	2.5-29	9.5-110	.35-35	1.3-132.5
1	**4-60**	**15-227**	**2-75**	**7.6-284**	**4-60**	**15-227**	**.75-75**	**2.8-284**
1-1/4	6-93	23-352	3-115	11.4-435	6-93	23-352	1.15-115	4.35-435
1-1/2	8-130	30.3-492	5-175	19-662	8-130	30.3-492	1.75-175	6.6-662
2	15-225	56.8-852	11-275	42-1041	15-225	56.8-852	2.75-275	10.4-1041
2-1/2	25-400	95-1514	15-500	56.8-1893	25-400	95-1514	5-500	19-1893
3	40-650	151-2460	20-800	76-3028	40-650	151-2460	8-800	30.3-3028
4	75-1250	284-4731	50-1500	189-5678	MCP not recommended in 4” and larger sizes			
5	140-2000	530-7570	100-2500	379-9463				
6	200-2900	757-10977	125-3600	473-13626				
8	330-5200	1249-19682	270-6400	1022-24224				
10	650-8000	2460-30280	540-9800	2044-37093				
12	1400-12000	5299-45420	800-15000	3028-56775				

NOTE: Performance enhancement techniques are routinely applied to produce larger linear and usable flow ranges. Consult with the applications group at Hoffer with your requirements.

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

PLOT OF TURBINE FLOWMETER CALIBRATION "K-FACTORS" (pulses/gallon)



Turbine flowmeters are highly "repeatable" (+/-.1%).
"Smart" Electronics can correct for non-linearity of the flowmeter.

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Subsea Connector Versatility

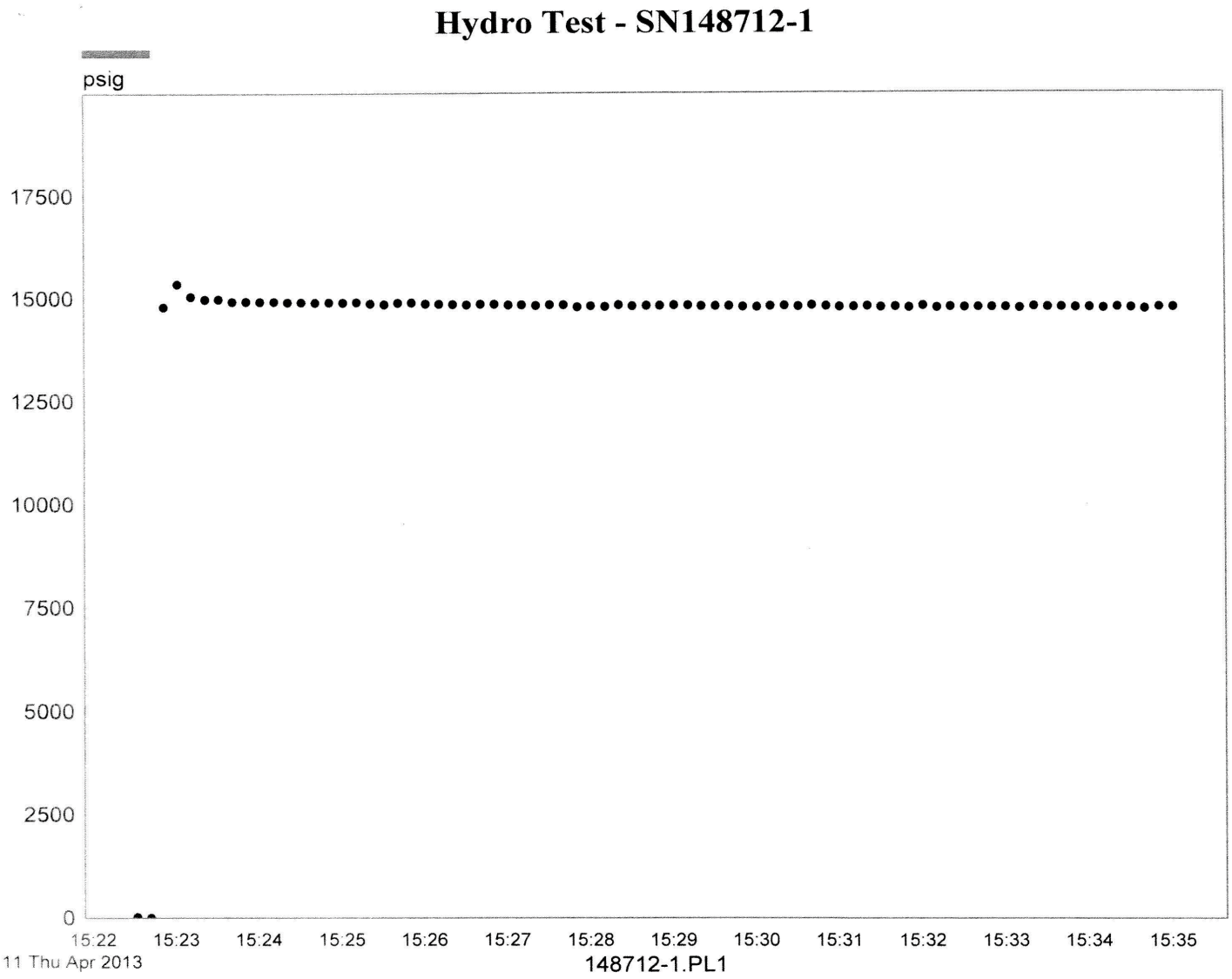
- Brantner Seacon
- Teledyne Impulse
- Shilling Seanet
- Subconn

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

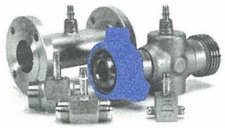
Regulatory Requirements

- Compliance with API6A – Wellhead and Christmas tree equipment
- Compliance with API17D – Design & operation of subsea systems, wellhead & tree equipment
- Compliance with API17F – Subsea Production Control Umbilicals
- ABS-CDS (American Bureau of Shipping – Certification of Drilling Systems) available
- DNV, Lloyd's and other certifications available

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™



HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™
107 Kitty Hawk Lane • P.O. Box 2145 • Elizabeth City, North Carolina 27906-2145
1-800-628-4584 • (252) 331-1997 • FAX (252) 331-2886
www.hofferflow.com • Email: info@hofferflow.com



Flowmeter Calibration Report

Model: HO2X11/2-3-130-CB-1MP12X-SAESS-SP (PART NUMBER 20088622)
Customer: NATIONAL OILWELL VARCO
Account: 10129 Date: 1/31/2013 Stand 3
Cust. PO: JB491329 Fluid: WATER
Job Number: 66300 Test range (gpm): 2.998 to 130.050
Meter S/N: 145831 Linearity (%): +/- 0.58
K' Average (pulses/gal) 230.488

Coil: 001s-024rev1 11.4mv@3gpm&22.7mv@8gpm.

	Frequency Hz	Flowrate GPM	Roshko # Hz/cSt 70F	Strouhal # pul/gal 70F	Fluid Temp Deg. F	Kin. Visc. cSt
1	11.583	2.998	10.400	231.814	64.666	1.114
2	30.740	7.997	26.753	230.640	62.538	1.149
3	30.748	7.999	26.713	230.640	62.419	1.151
4	54.442	14.160	45.874	230.632	60.364	1.187
5	78.023	20.337	65.495	230.127	60.108	1.191
6	115.273	30.061	96.349	230.017	59.804	1.196
7	154.213	40.257	128.420	229.776	59.533	1.201
8	194.384	50.823	161.634	229.417	59.425	1.202
9	269.487	70.537	223.027	229.163	59.081	1.208
10	343.836	89.976	284.108	229.216	58.965	1.210
11	422.944	110.714	348.869	229.209	58.824	1.212
12	496.794	130.049	408.901	229.203	58.667	1.215
13	496.798	130.050	409.341	229.203	58.745	1.214

Notes: 1. +/-0.32% linear over linear range of 8 to 130 gpm.
Note 2. 27deg blades/0.020 thick

SP = PASSIVATION WITH MIL CERT, MUST PRODUCE 230PPG +/- 3 PULSES

We certify that all test equipment used in calibrations are traceable to NIST, and that our quality assurance system is certified to ISO 9001-2008.

Operator: MRR Final Approval:

1. **Meters supplied with NIST traceable calibration.**
2. **Notice calibration is provided over flow range defined in flowmeter model number.**

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Turbine Meter Advantages – *Performance*

- High degree of accuracy (+/-.25% of reading) and great repeatability (+/-.1%)
- Suitable for "custody" transfer

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Turbine Meter Advantages – *Response Time*

- Fast, dynamic response time
- Measured in milliseconds!
- Commonly used for rocket propulsion

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Turbine Meter Advantages –
Shock, vibration & temp extremes

- We pioneered the use of turbine flowmeters on cryogenic delivery trucks in the 1970's
- Suitable for installation on trucks subject to shock & vibration
- Subject to wide operating temperature extremes
- Our flow system is the "cash register" on many bulk delivery cryogenic trucks domestically and internationally

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Turbine Meter Advantages – *Reliability*

- Metering control fluid on a BOP
- Hoffer replaced "leaking" mag meters supplied by another vendor
- High "internal" & "external pressures"

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Turbine Meter Advantages – *Robust Design*

- Flowmeter "internals" designed to meet "high shock" and "vibration" MIL standards for US Navy.
- For use on every "class" of US Navy ships. Applications include fuel measurement and RO water systems (seawater).

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Turbine Meter Advantages

Robust Design

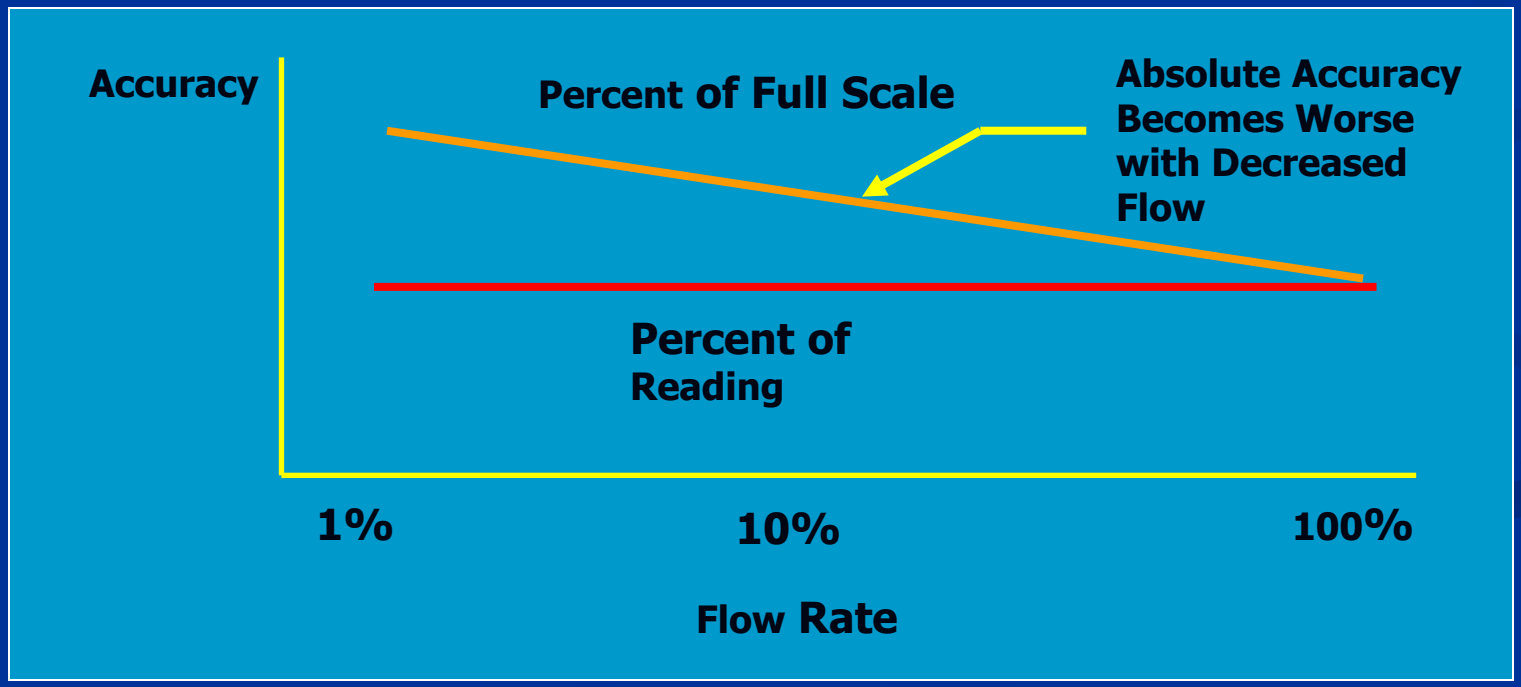
Flowmeter Internals

Threaded Insert

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Turbine Meter Advantages –
Of Reading vs. Percent of Full Scale

Linearity and repeatability are expressed in terms of "percent of reading" rather than "percent of full scale" such as a differential pressure flowmeter.



HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

All "turbine flowmeters" are not created equal -

Some are plastic

There are many different designs of "Turbine meters"

Some are molded

Some are Aluminum

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Common Design Elements – for a "high performance turbine flowmeter"

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Rotor Construction –
Precision Machined

- All Rotor assemblies are precision machined.
- Hoffer does not use cast rotors.
- Cast rotors are "heavier" than rotors machined from solid bar stock. Heavier rotors mean slower dynamic response to changes in flow rates.

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Rotor Construction – *Rotor Design*

- Hoffer uses flat rather than curved blades on its rotors
- Curved blades produce a higher pressure drop.

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Rotor Construction – *Rotor Design*

- Machined rotors can be "customized" with thicker blades for use in abrasive services
- The blade "length" may be adjusted to accommodate larger particulate. This approach is commonly utilized in the design of our oil patch flowmeters.

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Optimization of "flow range" -

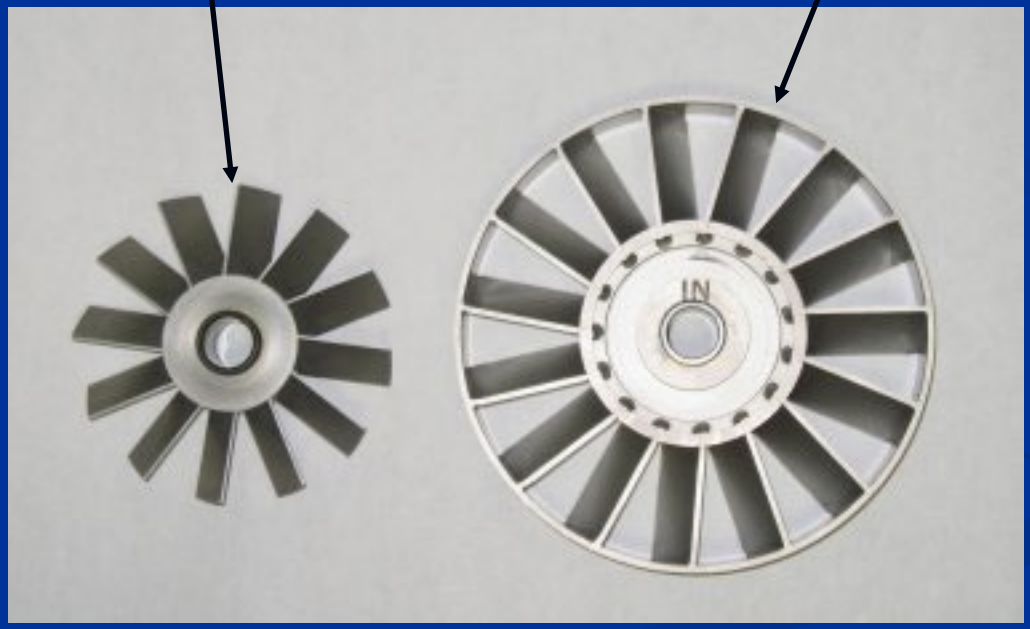
Supplying various blade angles and rotor designs

- Hoffer provides four different blade angles (15, 20, 25 & 30 degree) for each size meter within our HO Gas product line to optimize the ideal flow range selection.
- The "steeper" the blade angle; the lower the flow rate capability.
- We offer "bladed" and "rim" type rotor assemblies. Rim rotors are typically specified for custody transfer applications and produce more "pulses" (better resolution).

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

Bladed Rotor Assembly

Rim Rotor Assembly



HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

In conclusion, you should consider using Hoffer turbine flow meters if…

- Accuracy is important
- You need a robust flowmeter
- You require dynamic response to changes in flow conditions
- You require a wide flow range
- You have a specific "footprint" (space) in which the flowmeter must fit
- You want a flowmeter that is light in weight and easy to install

HOFFER FLOW CONTROLS, INC.
Perfecting Measurement™

How can we help your company take advantage of our solutions?