

**Unchallengeable ADD VALUE Performance
on Liquid Density Measurement**



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QINGDAO ADD VALUE

KDM

Online Vibrating Tube Liquid Density Meter

Offer Comprehensive Solutions to Oils Tank Change, Oils Stratification



QINGDAO ADD VALUE FLOW METERING CO., LTD.

COMPANY PROFILE

Qingdao Add Value Flow Metering Co., Ltd. is located in Qingdao Free Trade Zone. It is a high-tech enterprise integrating R&D, production, sales and service. Since its establishment, Qingdao Add Value has always focused on the R&D and manufacturing of flow metering products, and has independently developed two series of products: Coriolis Mass Flow Meter and Online Vibrating Tube Liquid Density Meter, which have obtained national invention patents. With advanced equipment and a perfect production inspection system, the company has successfully passed the ISO9001 quality management system and ISO14001 environmental management system certification. At present, our products are widely used in Sinopec, PetroChina and major refineries for automation quantitative loading, quality control in chemistry, etc. Our stable and accurate fluid metering services have been well admired by our customers.

Add Value is committed to innovation, upholds the business philosophy of “stability forging excellent quality,” and focuses on core competitiveness. The original core technology has perfectly solved the problem of zero drift, effectively ensuring long-term stable performance of the products.

We look forward to becoming your trusted partner!

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PRODUCT DESCRIPTION

KDM online vibrating tube liquid density meter is a high-precision online density measuring instrument with independent intellectual property rights. It is independently developed by Qingdao Add Value Flow Metering Co., Ltd. The density of the medium can be obtained by measuring the resonant frequency of the vibrating tube without the conversion of intermediate variables, avoiding the error generated by the conversion, thus achieving accurate measurement. The online vibrating tube liquid density meter is mainly composed of two parts: sensor and transmitter, equipped with optional audible and visible alarm module and remote monitoring software.

Product Principle

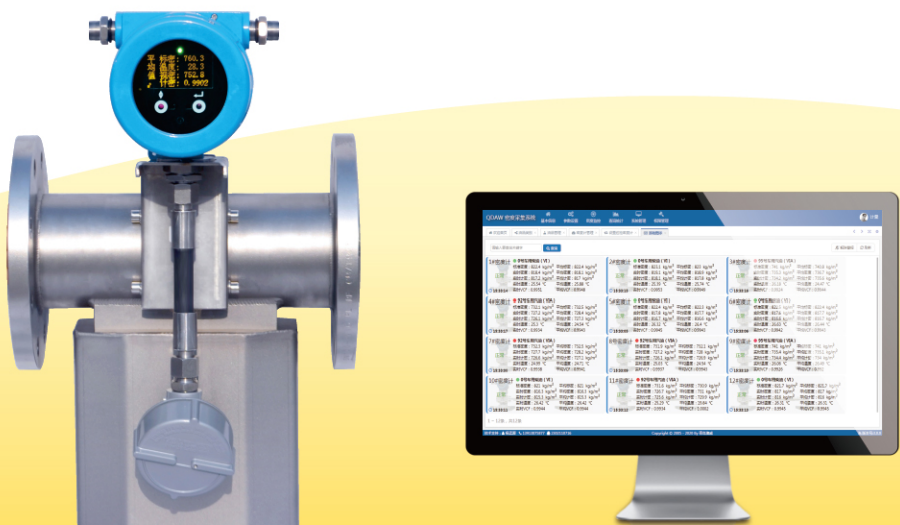
The vibrating tube of the online vibrating tube liquid density meter is equivalent to a spring, while the vibrating tube and the medium inside is equivalent to a weight. As the stiffness of the vibrating tube remains unchanged, the mass of the medium contained in the fixed volume of the vibrating tube (density) is the only variable that affects the vibration frequency. Therefore, the vibration frequency is directly related to the density. For the sensor with known structure and material, the density of the medium can be uniquely determined as long as the resonant frequency of the vibration tube is measured.

The relationship between the medium density inside the pipe of the online vibrating tube liquid density meter and vibration tube resonance period (the inverse of the resonant frequency):

$$\rho = K_1 T^2 + K_2 T + K_0$$

! ρ : Liquid Density K_1 , K_2 , K_0 : Meter Coefficient T : Period

! Note: For the same system, if the load mass increases, the vibration frequency decreases; if the load mass decreases, the vibration frequency increases.



DYNAMIC MEASUREMENT

Gb/T 9109.5-2017 Dynamic Measurement of Petroleum and Liquid Petroleum Products Part V: Oil Meter

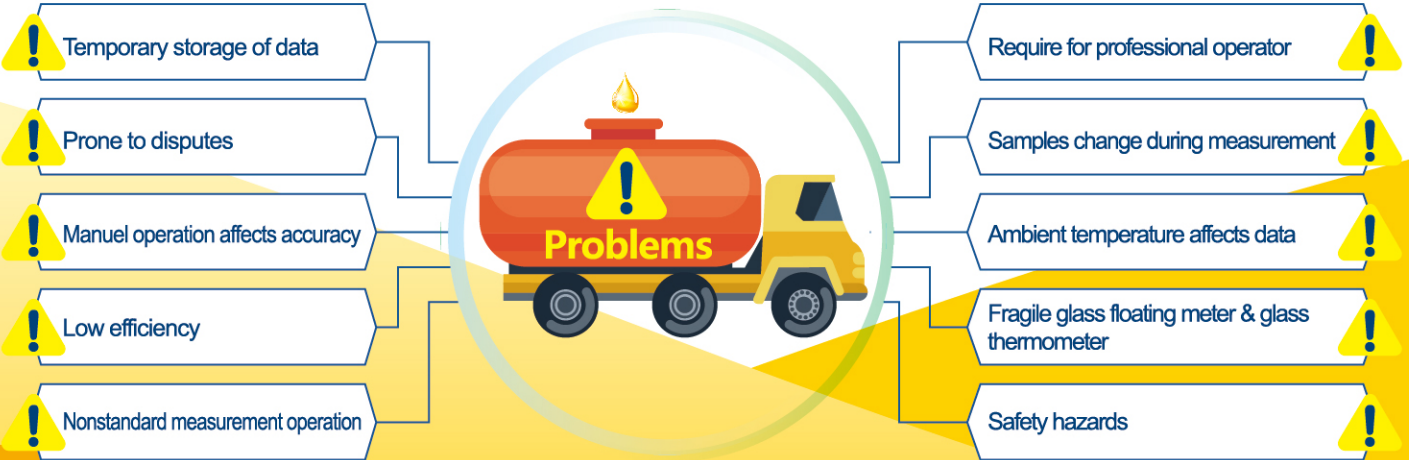
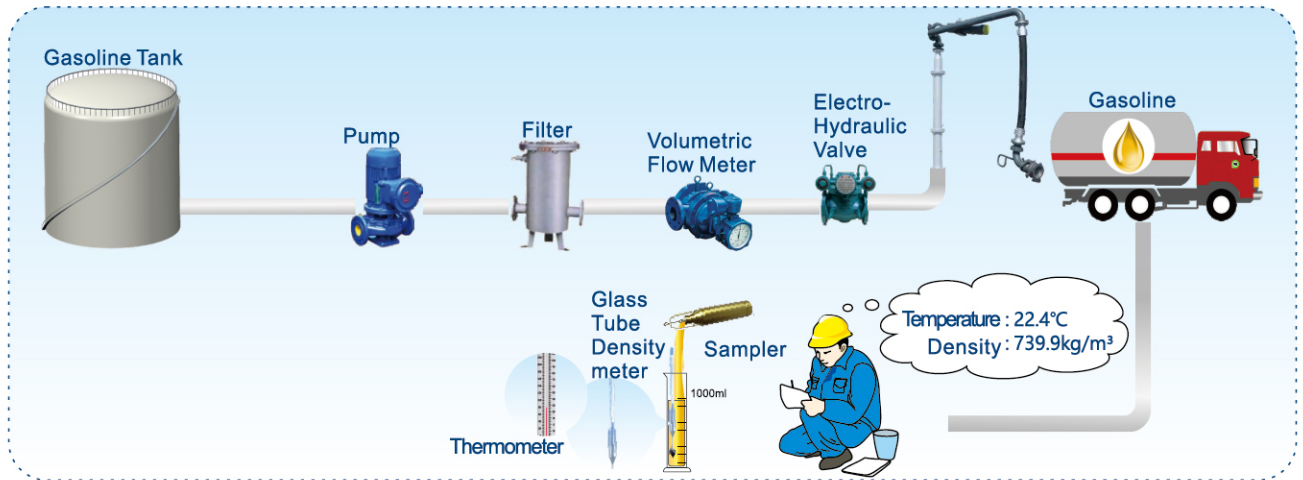
In order to obtain accurate results of the quantity (volume or mass) of oils measured by the flowmeter, the basic data for calculating the amount of oil (e.g.: flowmeter indicating volume, measurement temperature, measurement pressure, density and water content, etc.) should be firstly ensured that it is obtained according to the standard method (or protocol), and recorded in the corresponding measurement bills or measurement statements.

The standard reference conditions of the referred oil volume calculation: temperature of 20 °C, pressure of 101.325 kPa.

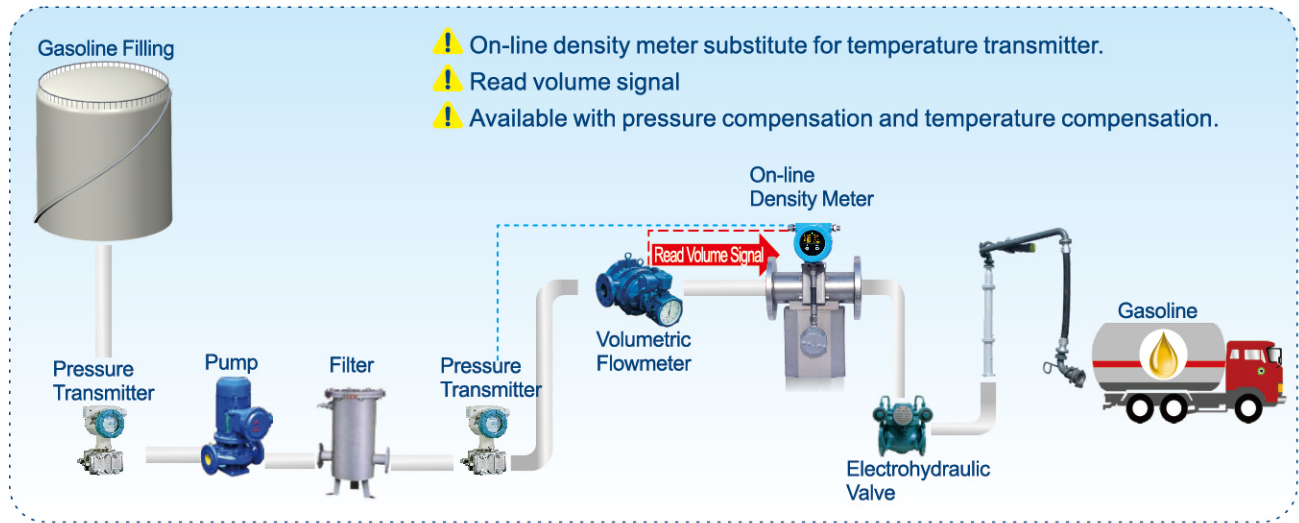
! Currently, the volume value is generally obtained by the volume flowmeter, while temperature, pressure, density is obtained by converting manual measurement.

KDM online vibrating tube liquid density meter can measure density and temperature in real time, and convert standard density in real time. In addition, it can read the volume flow signal and pressure signal for calculation compensation, thus to ensure the measurement accuracy and simplify the operation process, which is in line with the dynamic measurement standards.

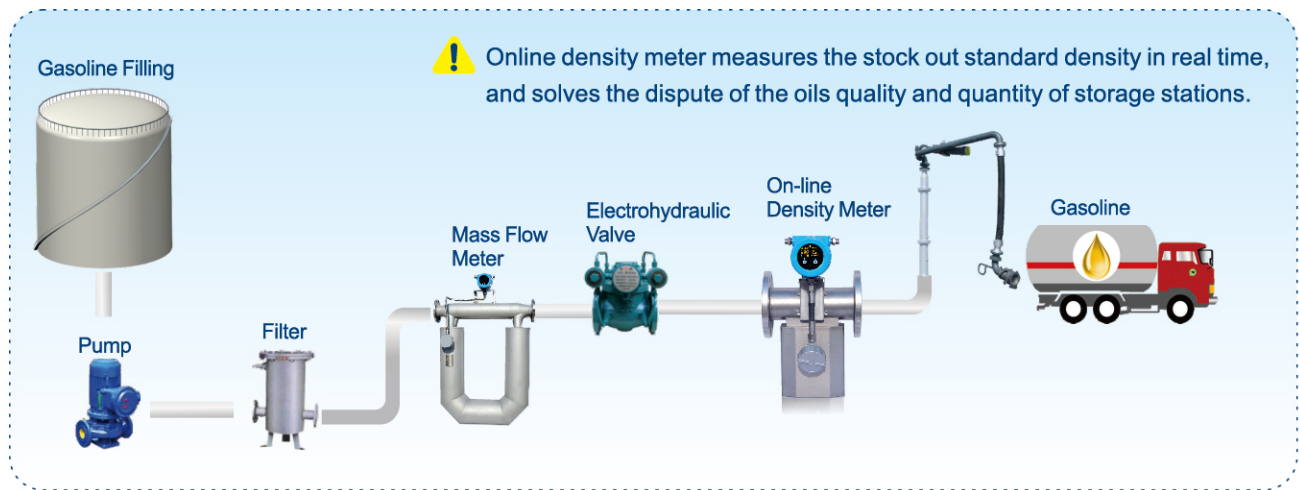
Flow Meter Combined with Glass Float Meter



Flow Meter Combined with Online Density Meter



Mass Flow Meter Combined with Online Density Meter

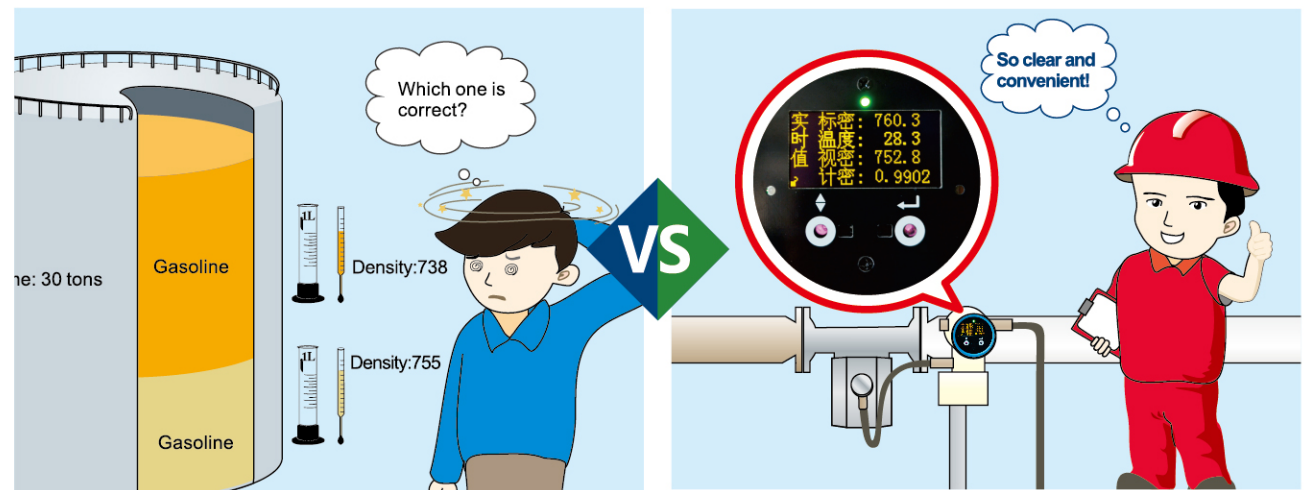


METER CHARACTERISTICS

1. Dynamic Measurement, Offer Solutions to Oils Stratification and Tank Changing

Oils stratification results in uneven density and tank changing results in turbidity of the oils. Density measurement in this case, small amount of manual sampling is difficult to represent the true value, which is easy to cause deviations, and is unfavorable for oils control. If we wait for the oil to be mixed evenly, it will be inefficient and loss customers.

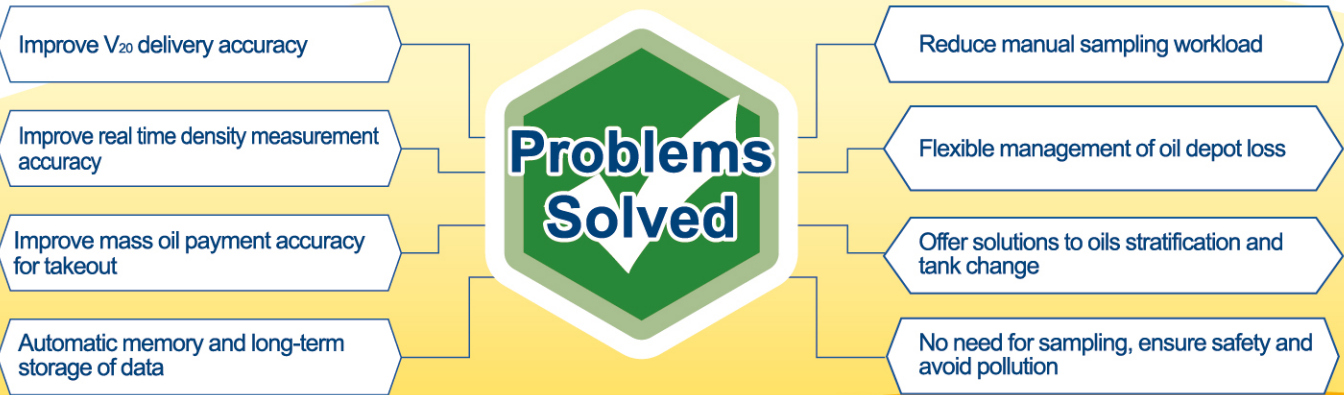
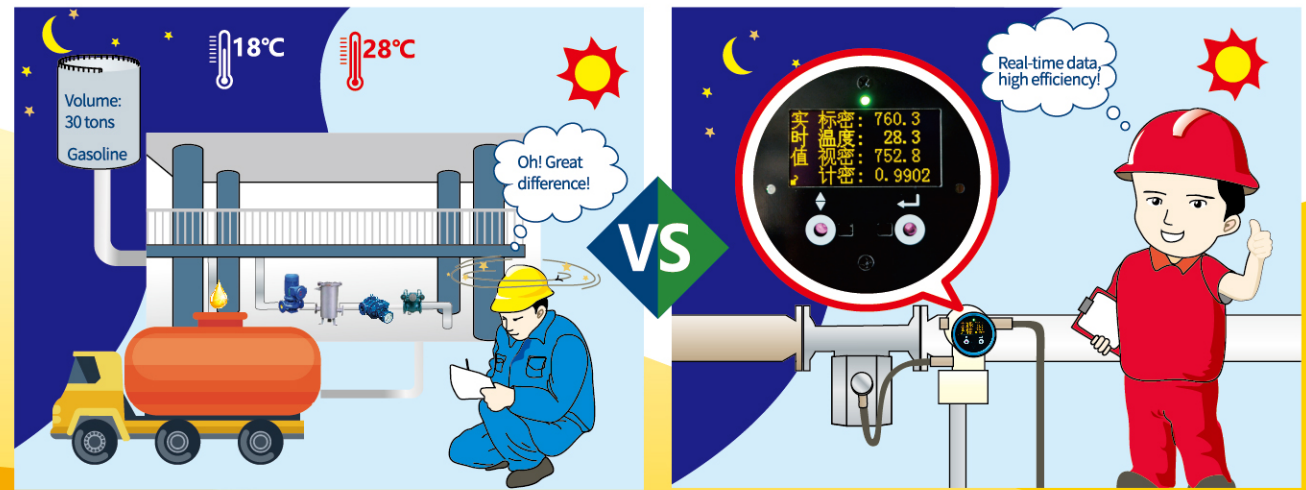
KDM online vibrating tube liquid density meter can realize real-time detection of density value in the process of whole-truck oil-filling, and finally output accurate average density value of the whole truck through built-in algorithm. No need to wait, continue oil filling when there is oils stratification and tank change, improve efficiency and increase effectiveness.



2. Monitor the Density of Whole-Truck Oil Filling in Real Time

The oil pipeline from the tank area to the dispatching island is too long, and the density of oils in the pipeline is affected by the change of the temperature. If oil dispatching is delayed for a long time, while the density of sampling with large tanks at this time is likely to lead to large shipping errors.

KDM online vibration tube liquid density meter is not affected by the ambient environment and temperature. It can measure the density of the whole truck during the process of oil filling in real time, and output the average density of the whole truck, thus to achieve accurate measurement.



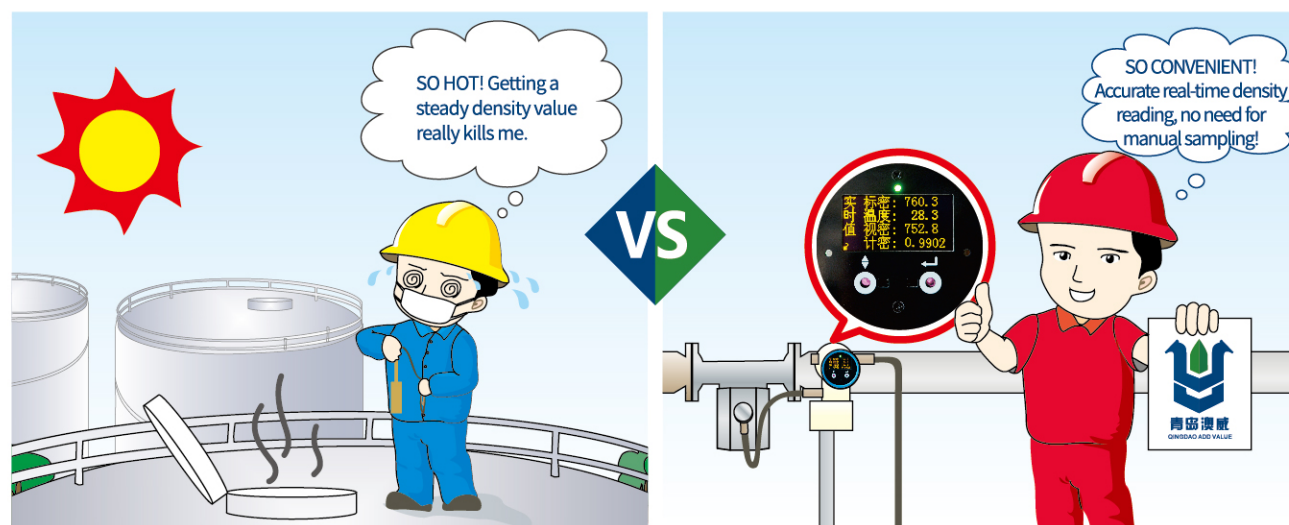
METER CHARACTERISTICS

3. Intuitive Value Reading, Accurate, Convenient and Safe

No need for sampling, intuitive value display, accurate, convenient and safe

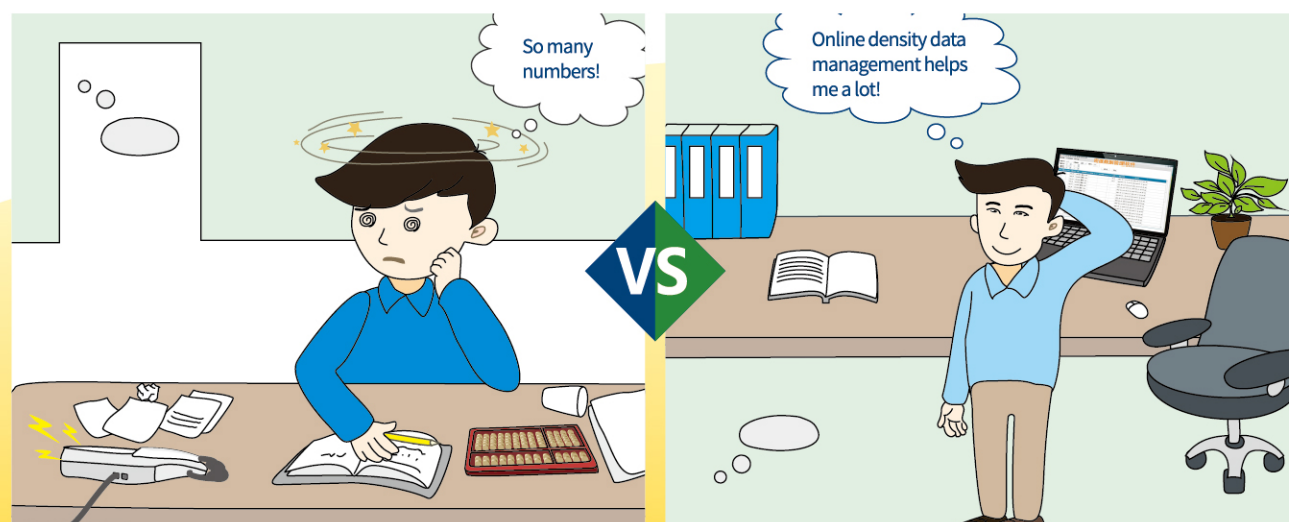
Current density measurement requires frequent manual sampling by climbing tanker, large tank, etc., while manual input of density information is required.

KDM online vibrating tube liquid density meter can detect and display the real-time density and temperature of the fluid in the pipeline online, and can set the density overrun alarm with the highest accuracy up to $\pm 0.0002\text{g/cm}^3$, which fundamentally eliminates the manual sampling error, improves efficiency, eliminates safety hazards and avoids the influence of man-made factors.



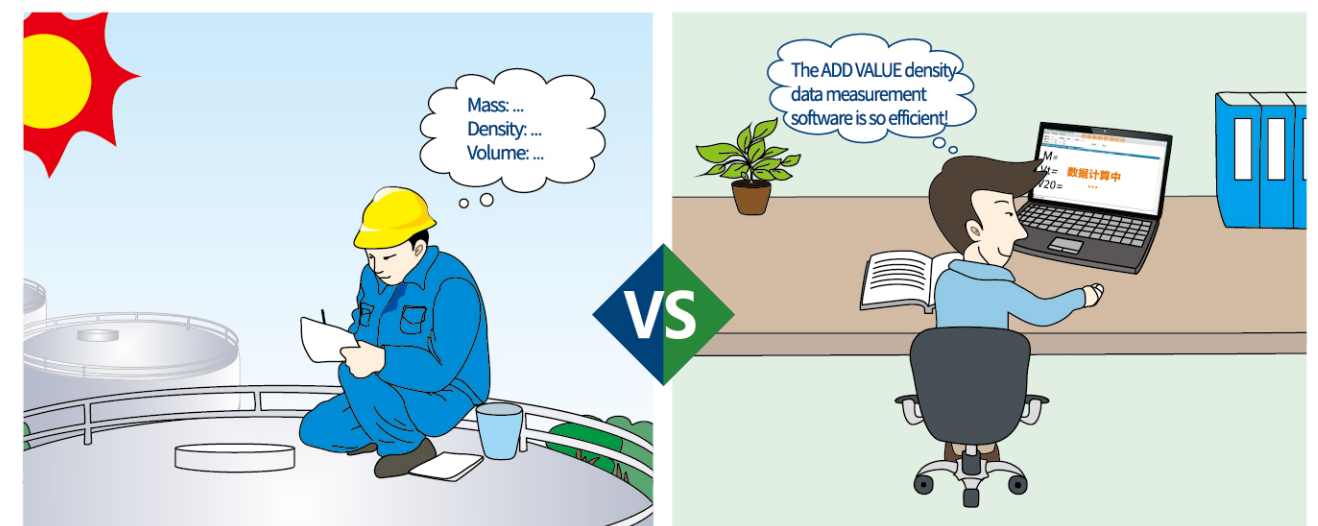
4. High Accuracy with Detailed Oil Loss Management

The density measurement accuracy is better than $\pm 0.0005\text{g/cm}^3$ (the best is $\pm 0.0002\text{g/cm}^3$). It focuses on reducing the error from the source control to provide traceable data for the docking with the receiver. At the same time, it can read code table value of the volume flow meter, thus to achieve triple checks for the oil depot out of the warehouse statistics, to provide data support, to facilitate the control management of the oil depot for the warehouse transport losses.



5. Complete Automatic Oil Loading

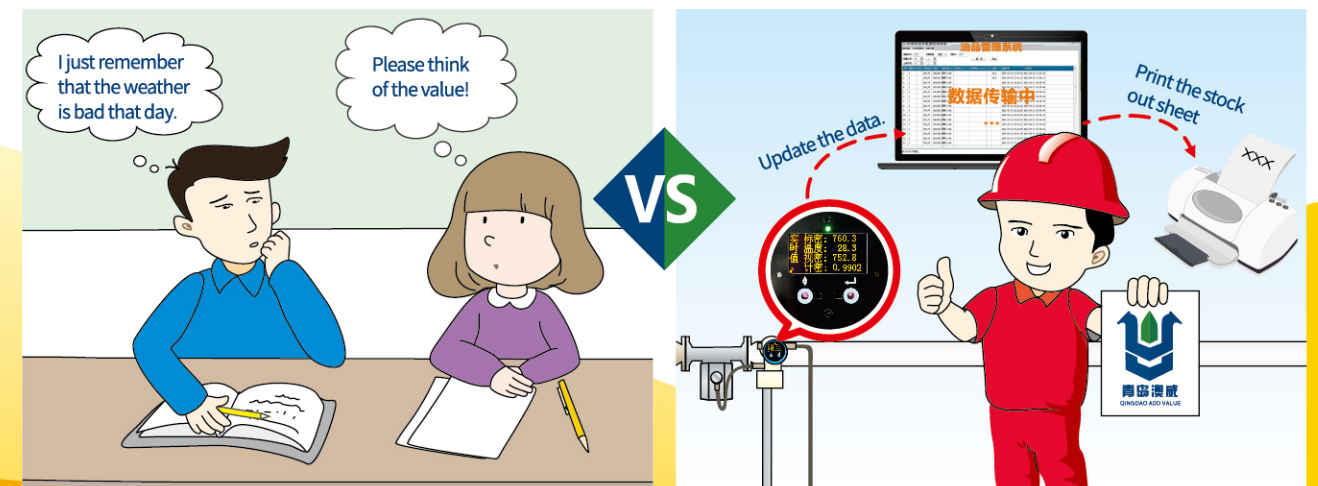
KDM online vibrating tube liquid density meter can read the number of volume code table value in real time and convert it to mass and V_{20} in real time, and upload it to oil loading system online to realize flexible conversion of mass and volume oil uploading, and there is no need to stop and double check density when there is tank change and oils stratification, which improves the efficiency of oil uploading.



6. Full Customer Satisfaction

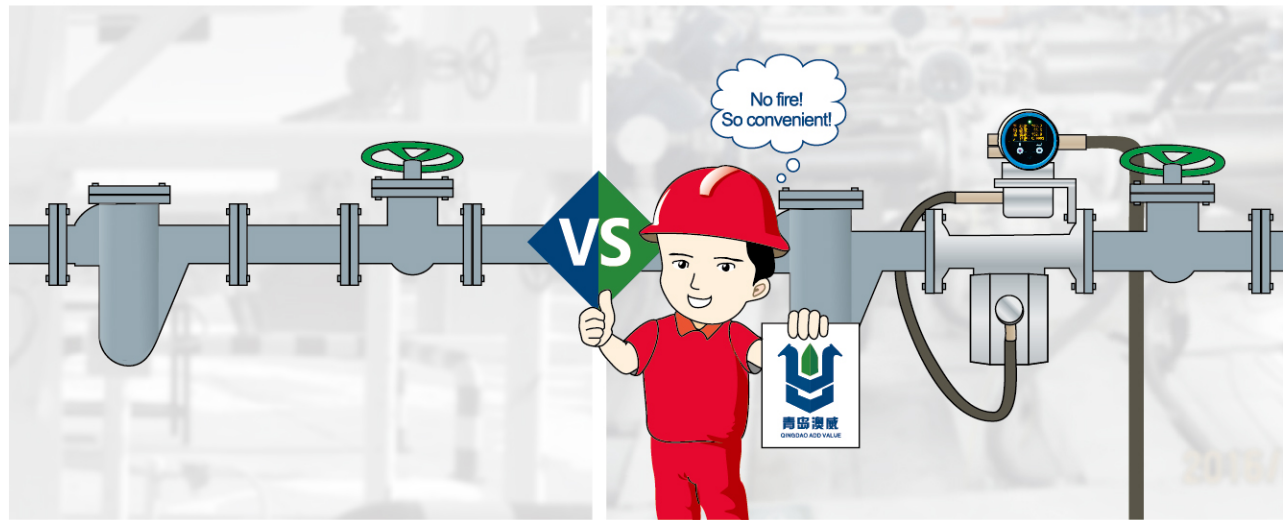
In the process of oil custody transfer, the density accuracy measured and read manually is inexact, and is influenced by weather, human interference and other factors.

KDM online vibrating tube liquid density meter can directly measure the weighted average density and temperature of each tanker, the density measurement accuracy can reach $\pm 0.0005\text{g/cm}^3$ (up to $\pm 0.0002\text{g/cm}^3$), the measurement accuracy of temperature can reach 0.2°C , the data is directly uploaded to the oil management system, which is convenient for data traceability query, reducing the disputes in the oil custody transfer process and improving the management efficiency.



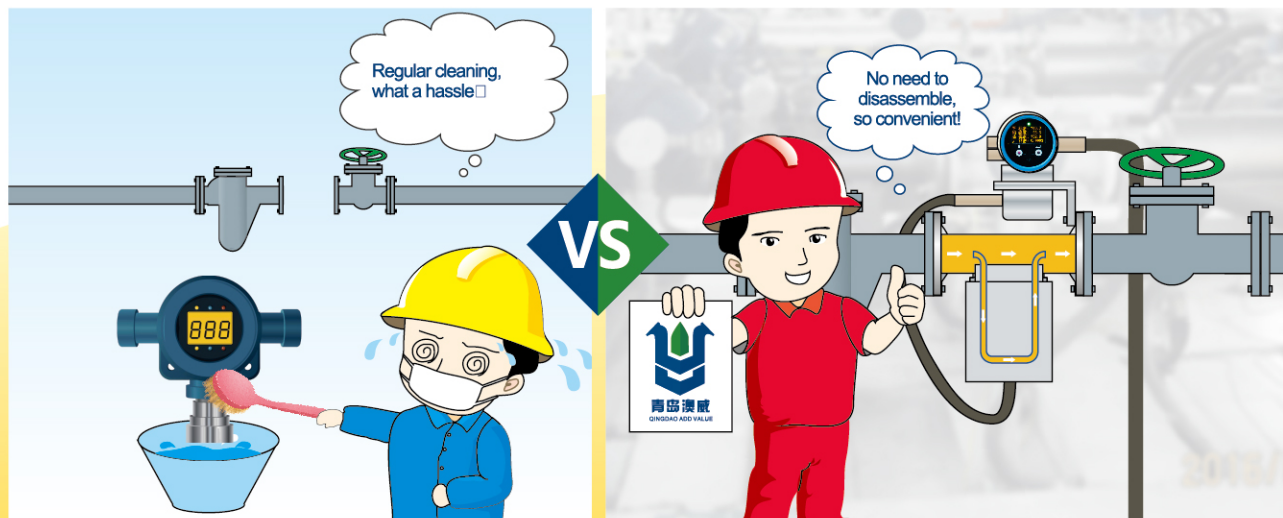
7.Zero Input, Safe, Convenient and Fast Renovation

With flange connection, length of the KDM online vibrating tube liquid density meter can be customized. In the process of transformation only the straight pipe section or the original thermometer is required to be replaced. There is no need for fire, zero input, safe, convenient, fast, causing no influence on production.



8.Long-Term Use, No Disassembly, Maintenance-Free

KDM applies the principle of vibration, thus the medium density can be obtained by measuring the vibration resonance frequency. There is no need for the intermediate variable conversion, which avoids the error generated by conversion. After renovation and installation, it can be used for a long time without disassembly and maintenance.



MAJOR FUNCTIONS

Density Measurement

- Accurately measure the real-time density of liquids, and automatically convert standard density, count density and VCF.
- Indirectly measure alcohol content, water content, etc.
- Density overrun alarm.

Water Content Alarm

- Water content alarm to ensure the quality of oil.

Temperature Measurement

- Adopt Pt100 high precision platinum resistance temperature sensor, reach an accuracy of 0.1°C, with no calibration.
- Fast response time, high accuracy, improve the accuracy of V20 delivery.

Multi-level Authority

- Metrologist authority.
- Oil depot authority.

Communication Control

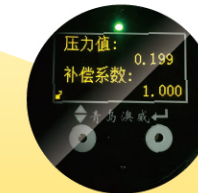
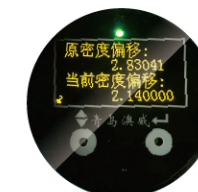
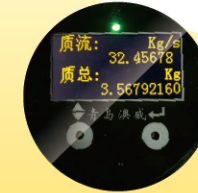
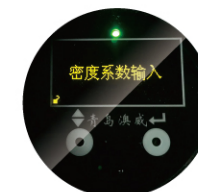
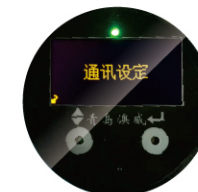
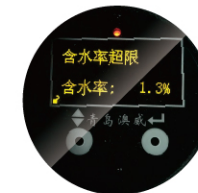
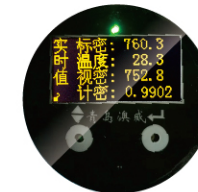
- Signal reading: can read the pulse signal of the volume flow meter.
- Signal output:
 - Can realize dual 4~20mA output, the output content can be configured and set, including density, temperature, etc..
 - Can realize pulse output, the content can be configured and set, including mass, volume, etc.
 - Can realize real-time communication with various RS485 devices, comprehensive information sharing.
- Wireless transmission

Field Operation

- Transmitter equipped with photosensitive button, available with page turning function to check various display information and judge working status. Available with density damping, making it flexible to set damping parameters.

Dynamic Metering

- Volume flow signal reading.
- Real-time collection of temperature and pressure signals.
- Adaptive temperature compensation and pressure compensation.



TECHNICAL PARAMETERS

Technical Parameters Concerning Accuracy

Model	Accuracy	Measurement Range
KDM-02	$\pm 0.0002\text{g/cm}^3$	$(0.7\sim 0.9)\text{g/cm}^3$
KDM-05	$\pm 0.0005\text{g/cm}^3$	$(0.65\sim 1.2)\text{g/cm}^3$
KDM-10	$\pm 0.001\text{g/cm}^3$	$(0.2\sim 2.0)\text{g/cm}^3$
Flange Compatibility	DN50、DN80、DN100、DN150、DN200	
KDM-01	$\pm 0.0001\text{g/cm}^3$	$(0.7\sim 1.0)\text{g/cm}^3$
Flange Compatibility	DN25	

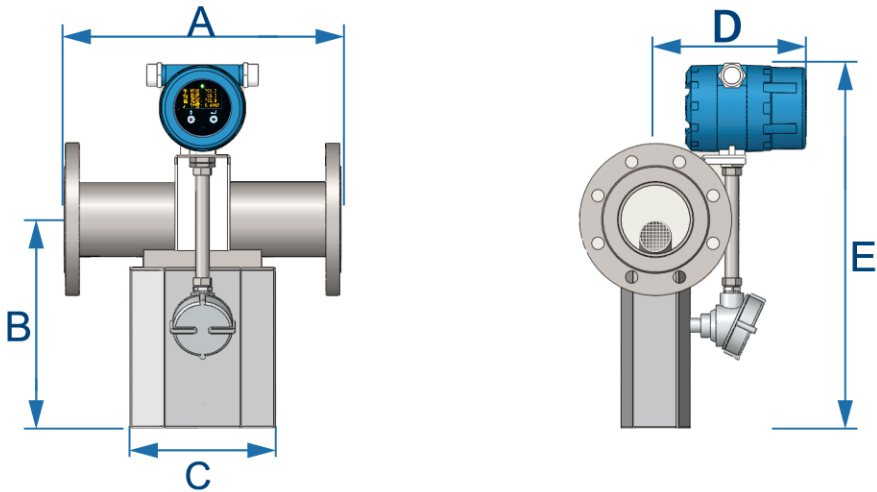
General Technical Parameters

Temperature	Measurement Range		$-40^{\circ}\text{C}\sim +204^{\circ}\text{C}$
	Accuracy		$\pm 0.1^{\circ}\text{C}$
	Repeatability		0.05°C
Electrical parameters	Power Supply		24VDC、220VAC
	Output Signal		RS-485、4-20mA、pulse
Environmental parameters	Operation Temperature		$-40^{\circ}\text{C}\sim +60^{\circ}\text{C}$
Explosion-proof	Explosion-proof Grade	Sensor	Exib IIC T1~ T6 Gb
		Transmitter	Ex d [ib] IIC T6 Gb
Protection	Protection Grade	Sensor	IP66/IP67
		Transmitter	IP66/IP67
Standard	JJG 370-2019 online vibration tube liquid density meter calibration procedures		

OUTLINE DIMENSIONS

Integrate Mount Outline Dimensions

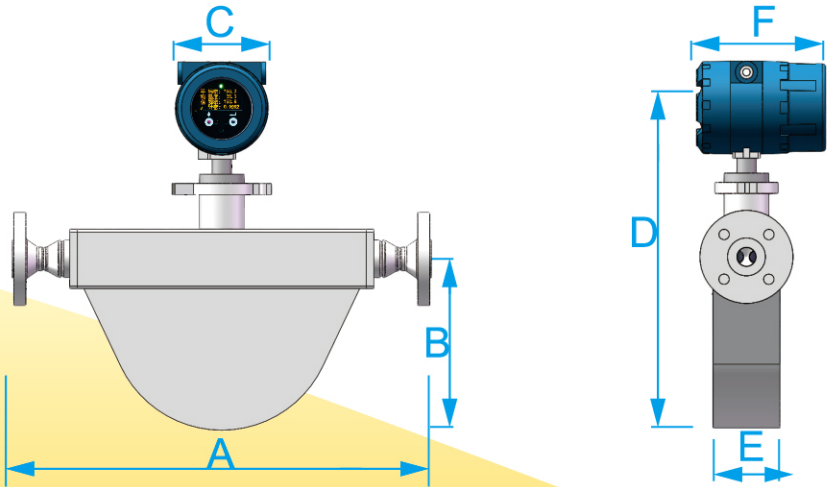
(unit: mm)



Specification	A Customizable	B	C	D		E
				Separate Mount	Integrate Mount	
DN50	300-400	278	210	160	210	530
DN80	300-400	294	210	160	210	530
DN100	300-400	305	210	160	210	530
DN150	300-400	330	210	160	—	—
DN200	300-400	365	210	160	—	—



Flange standard adopted
GB/T 9115-2010, HG/T 20592-2009.



Specification	A	B	C	D	E	F
KDM-01	556	230	165	500	90	175



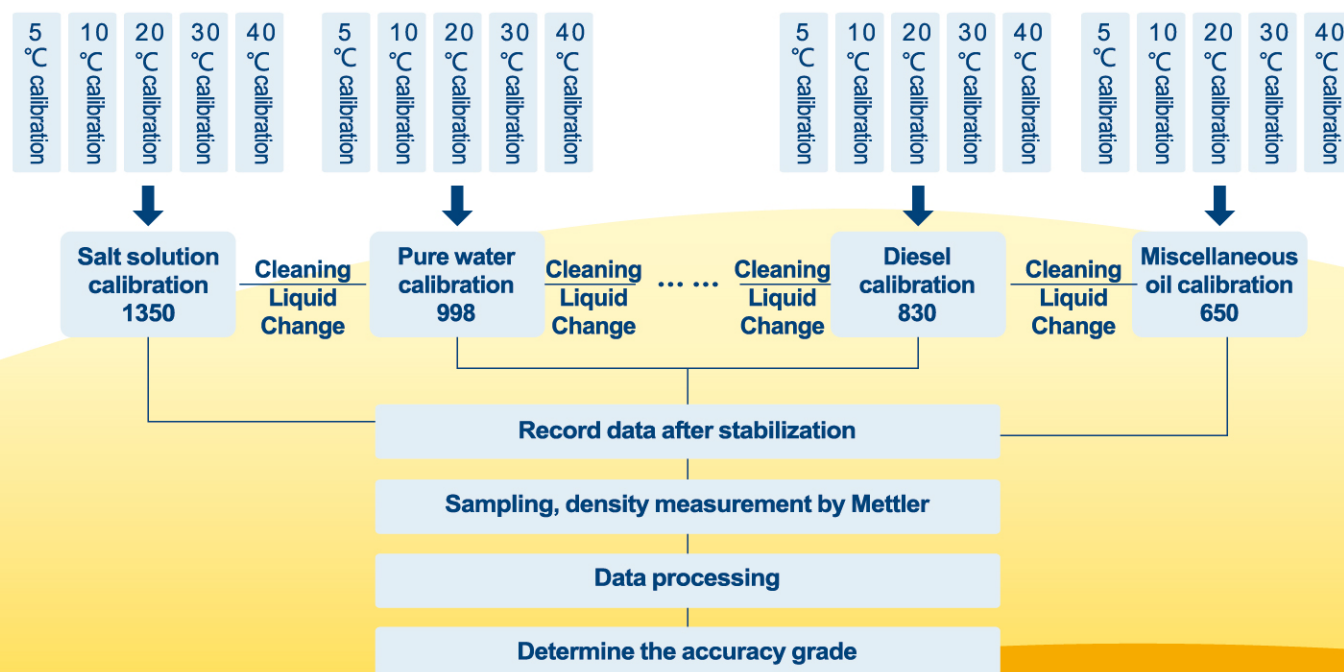
Flange standard adopted
GB/T 9115-2010, HG/T 20592-2009.

CALIBRATION SYSTEM



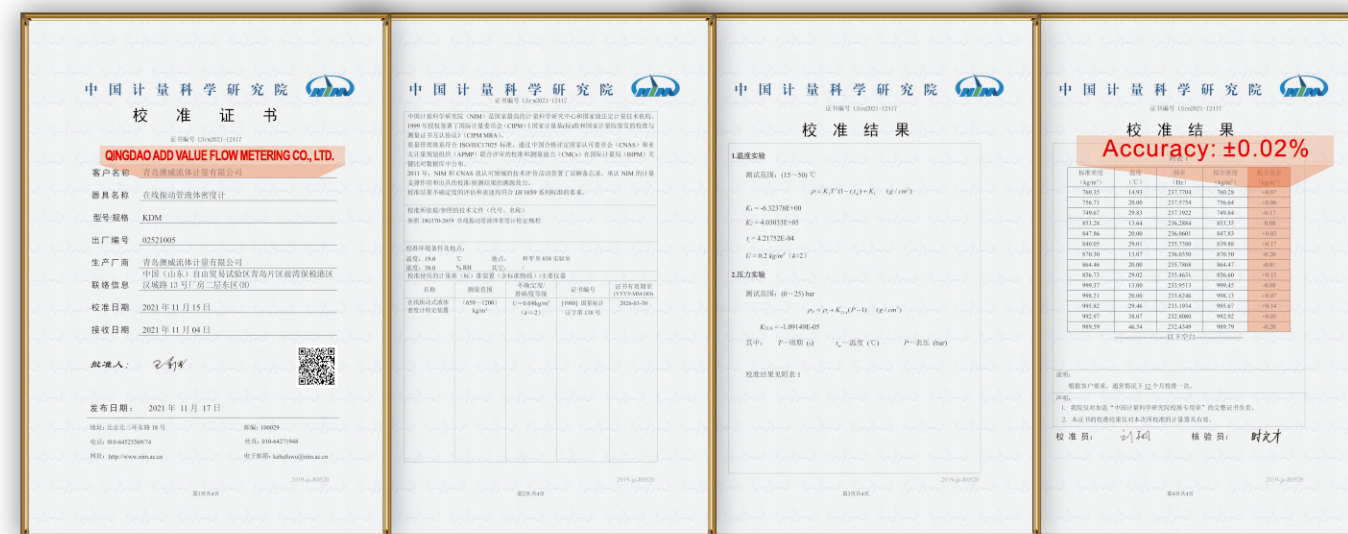
1. Each data is calibrated with five kinds of medium.
2. Each medium is calibrated with five temperature points.

KDM online density meter calibration process flow chart



CALIBRATION CERTIFICATE

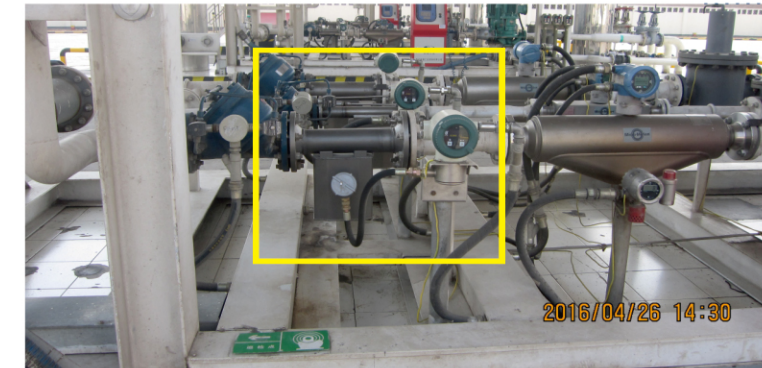
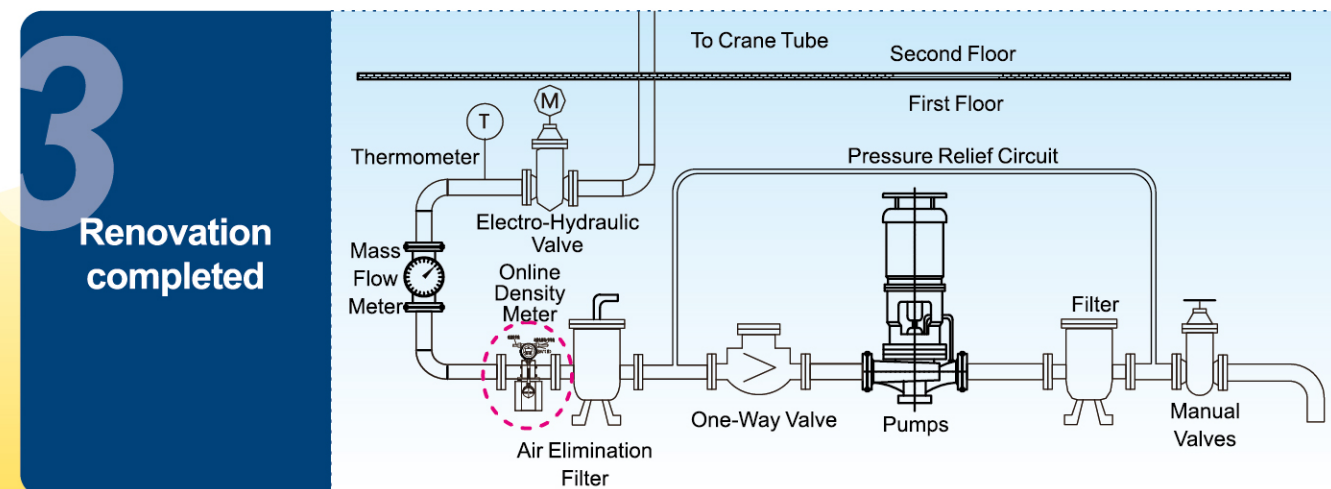
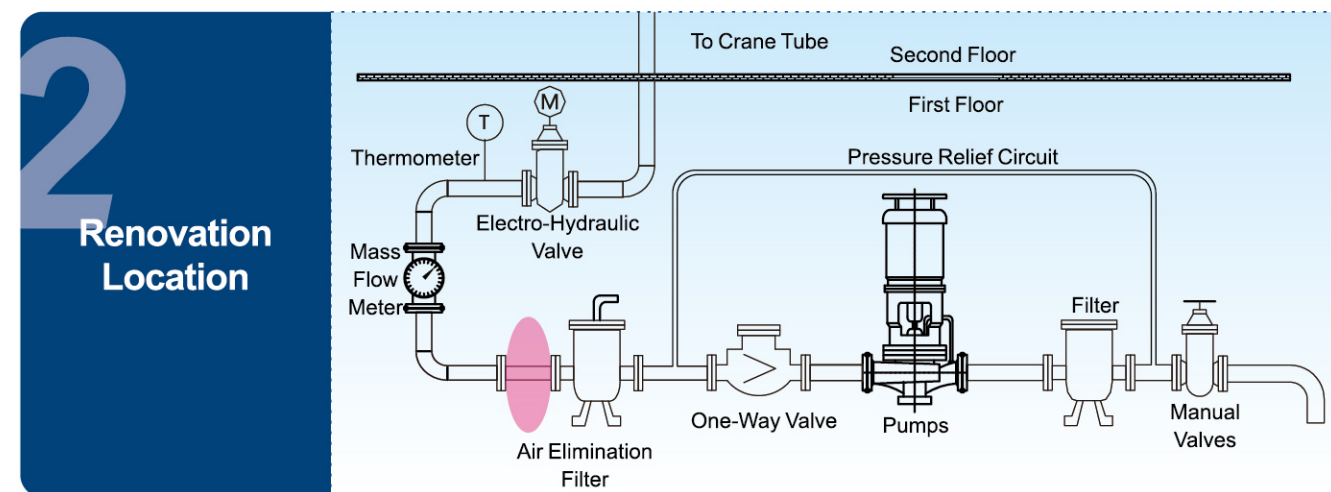
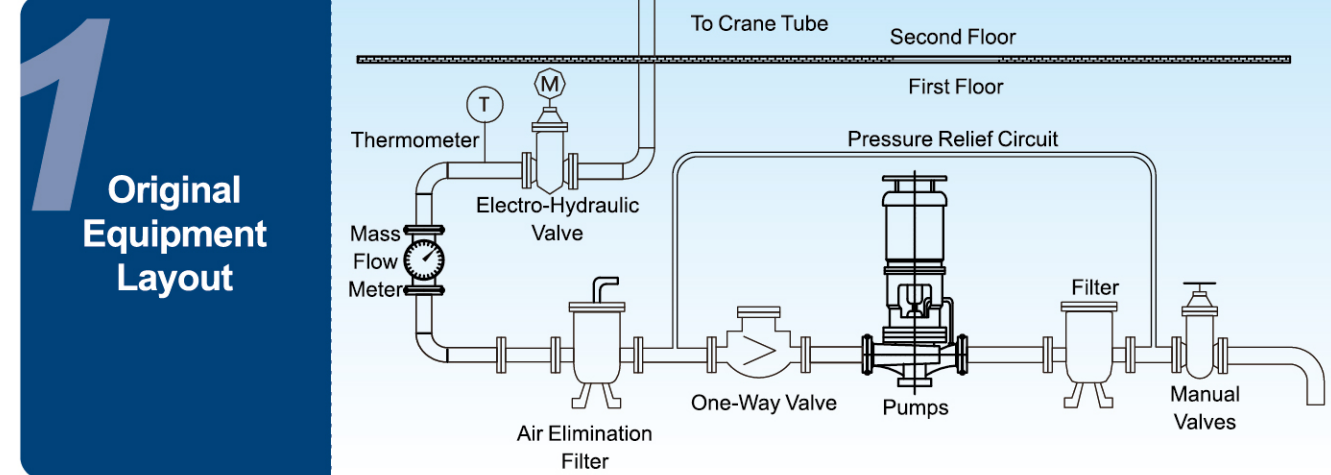
The test is based on **JJG 370-2019 online vibrating tube liquid density meter test procedure** and obtains the online vibrating tube liquid density meter test certificate issued by China Academy of Metrology.



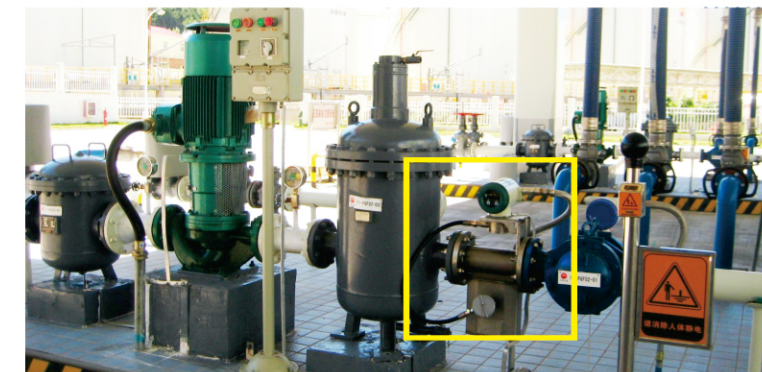
JJG 370-2019 online vibrating tube liquid density meter testing procedures is the only procedure for testing online density meter with liquid in the flowing state.



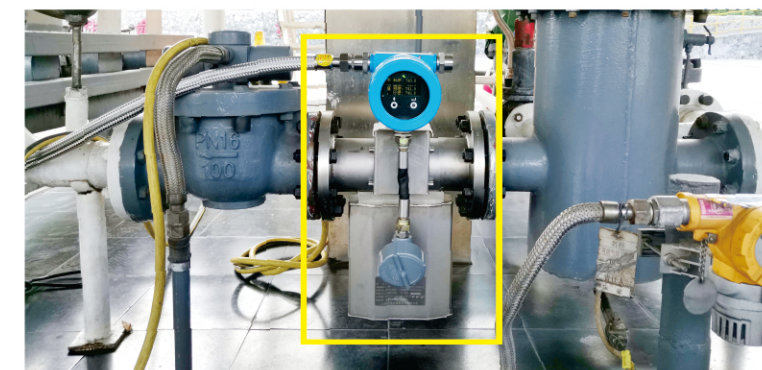
SITE RENOVATION CASE



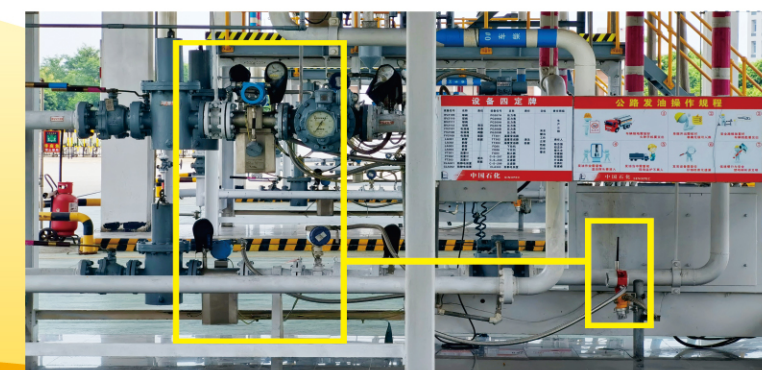
1 Online density meter directly replaces a suitable length of straight pipe section



2 Online density meter can replace the temperature transmitter (length can be customized)



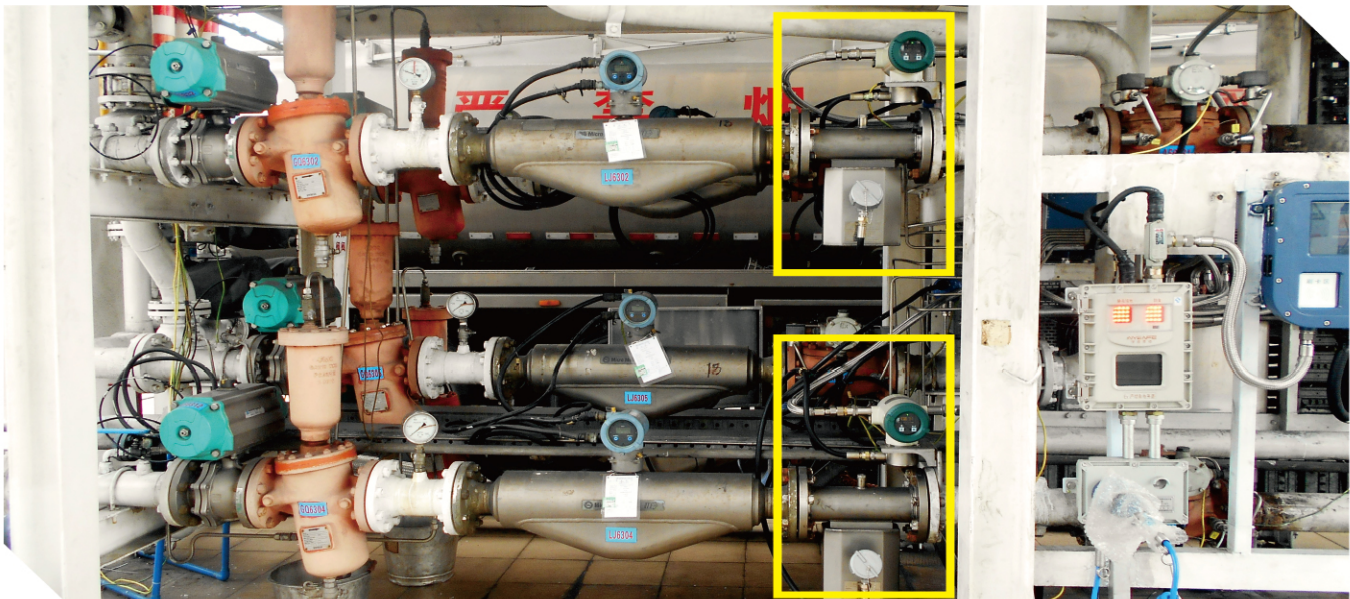
3 Cut off the straight section of the transformation formula pro



4 Online density meter transmits wirelessly without wires

APPLICATION CASE

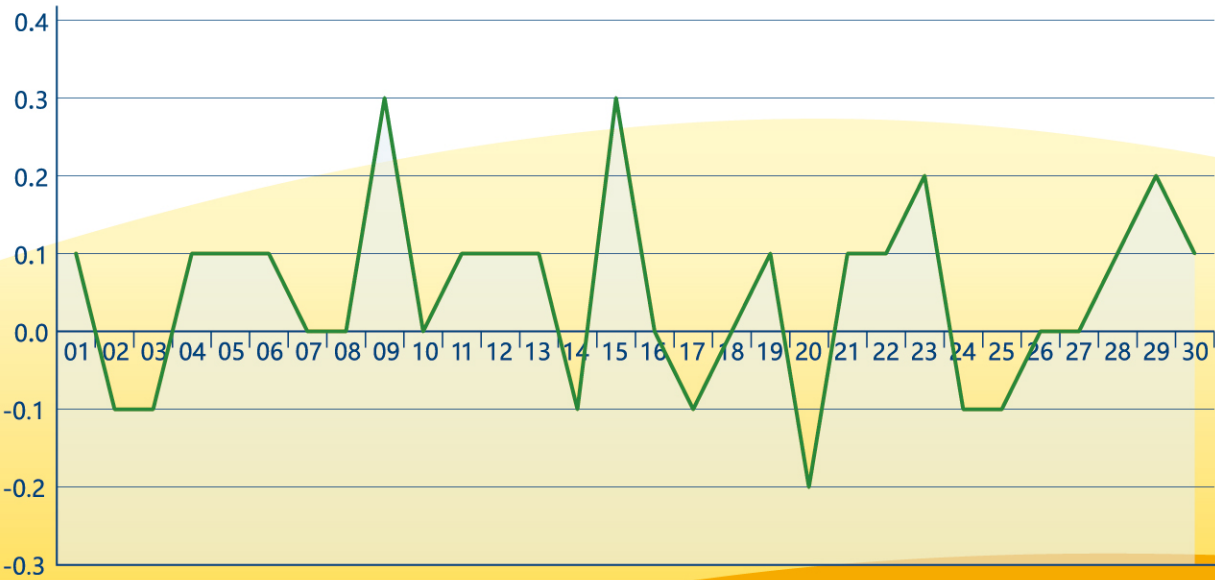
Sinopec Guangdong Xiaohu Island Oil Depot



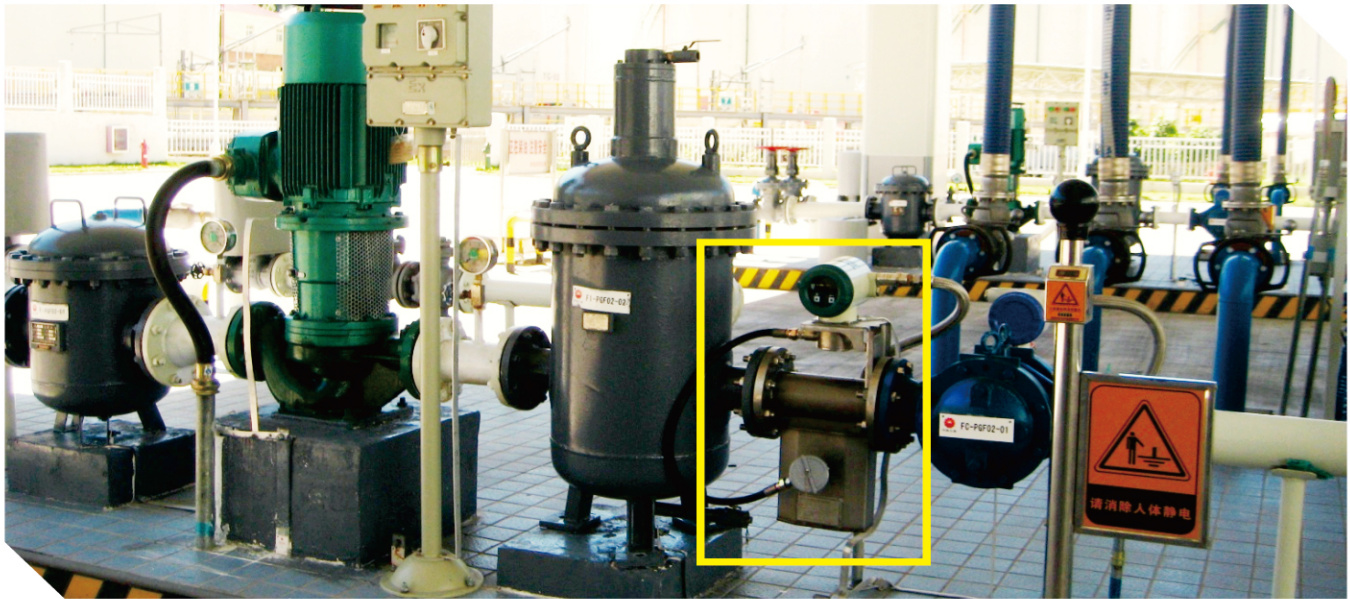
Note: This oil depot has a large volume of oil dispensed and adopts automatic oil dispensing system, but there is no automatic product to measure oil density, which still needs to be manually collected and manually entered into the information management system, which seriously affects the efficiency of the oil depot and the level of automation management, and also has the risk of entry errors.

Therefore, KDM online vibrating tube liquid density meter is added to replace the manual measurement, and the measured density information is directly transferred to the information management platform to realize the complete automation of oil dispensing process.

Density error graph (kg/m³)



China National Petroleum Hebei Kunheng Oil Depot



Note: By using KDM type online vibration tube liquid density meter and volume flowmeter in series to realize the mass oil payment, V. oil payment, V oil payment switch of various oil payment methods, improve the efficiency of oil payment and tanker automation management level, reduce the investment, at the same time, through the KDM online vibration tube liquid density meter to upload the standard density, temperature and real-time density to the tanker management system in real time, directly print out the storage order, to achieve dispute free handover with gas stations.

Automatic real-time conversion of ρ_{20} , $\rho_{(rou)}$

付油密度通知单编号	计量时间	业务类型	规格名称	油种	流量计号	油温(℃)	T _{oil} (℃)	Vt(kg/m³)	ρ_{20} (kg/m³)	$\rho_{(rou)}$ (kg/m³)	流量计修正系数(±0.5)	体积修正系数 VCF	换算系数 k
108201900006682	2019-05-10 14:18:02	批发	92号车用汽油(VIA)			17.58	18.1	742.6	740.9	741.2	1	1.0019	1.3492
108201900006681	2019-05-10 14:10:01	批发	0号车用柴油(VI)			17.58	17.56	833.2	831.4	832	1	1.0019	1.3492
108201900006680	2019-05-10 14:02:59	批发	92号车用汽油(VIA)			17.4	18.24	742.5	740.9	741.2	1	1.0021	1.3492
108201900006679	2019-05-10 13:36:53	批发	0号车用柴油(VI)			17.4	17.47	833.2	831.4	832	1	1.0023	1.3496
108201900006678	2019-05-10 12:55:43	批发	92号车用汽油(VIA)			16.8	18.31	742.4	740.9	741.5	1	1.0038	1.333
108201900006677	2019-05-10 12:32:38	批发	95号车用汽油(VIA)			17.6	16.89	751.2	748.5	750.2	1	1.001	1.2032
108201900006676	2019-05-10 12:19:35	批发	0号车用柴油(VI)			17.6	17.82	833	831.4	831.1	1	1.0027	1.2013
108201900006675	2019-05-10 12:18:35	批发	0号车用柴油(VI)			17.6	17.28	833.3	831.3	832.4	1	1.0019	1.3492
108201900006674	2019-05-10 11:24:23	批发	92号车用汽油(VIA)			17.6	18.36	742.4	740.9	741.2	1	1.0038	1.3492
108201900006673	2019-05-10 11:20:22	批发	95号车用汽油(VIA)			17.6	17.81	742.9	740.9	741.7	1	1.0029	1.3479
108201900006671	2019-05-10 11:03:19	批发	92号车用汽油(VIA)			17.7	16.38	751.6	748.4	750.2	1	1.0022	1.2019
108201900006670	2019-05-10 10:55:17	批发	0号车用柴油(VI)			17.4	17.73	743	740.9	741.9	1	1.0029	1.3479
108201900006669	2019-05-10 10:39:13	批发	92号车用汽油(VIA)			17.5	17.46	833.2	831.3	832	1	1.0029	1.3479
108201900006668	2019-05-10 10:26:10	批发	92号车用汽油(VIA)			17.4	17.56	743.1	740.9	741.9	1	1.0029	1.3479
							17.46	743.2	740.9	741.9			

出库单编号	车(船)号	卸油地点	提油截止时间	名称规格	计量单位	通知数量	前次通知数量	本次提油数量	实际提油数量	通知剩余数量	备注
XCBCCKY2201905100013	冀G66712	中国石化天然气股份有限公司内蒙古销售分公司	9999-12-31	0号 车用汽油(VI)	吨	1,400.000	288.000	1,112.000	1,112.000	288.000	p:831.4 v20:19270 vt:19226 Real Qty:16tons Designed Qty:16tons
XCBCCKY2201905100012	冀G66710	中国石化天然气股份有限公司内蒙古销售分公司	9999-12-31	92号 车用汽油(VIA)	吨	1,500.000	60.000	1,440.000	1,440.000	60.000	p:740.9 v20:13517 vt:13472 Real Qty:10tons Designed Qty:10tons
XCBCCKY2201905100011	冀G65091	中国石化天然气股份有限公司内蒙古销售分公司	9999-12-31	0号 车用柴油(VI)	吨	1,400.000	272.000	1,128.000	1,128.000	272.000	p:831.3 v20:19272 vt:19232 Real Qty:16tons Designed Qty:16tons
XCBCCKY2201905100010	冀G66712	中国石化天然气股份有限公司内蒙古销售分公司	9999-12-31	0号 车用汽油(VI)	吨	1,400.000	304.000	1,096.000	1,096.000	304.000	p:831.4 v20:19270 vt:19226 Real Qty:16tons Designed Qty:16tons
XCBCCKY2201905100009	冀G65925	中国石化天然气股份有限公司内蒙古销售分公司	9999-12-31	92号 车用汽油(VIA)	吨	1,500.000	75.000	1,425.000	1,425.000	75.000	p:740.9 v20:20276 vt:20198 Real Qty:15tons Designed Qty:15tons
XCBCCKY2201905100008	冀G66710	中国石化天然气股份有限公司内蒙古销售分公司	9999-12-31	0号 车用柴油(VI)	吨	1,400.000	352.000	1,048.000	1,048.000	352.000	p:831.3 v20:19272 vt:19219 Real Qty:16tons Designed Qty:16tons
XCBCCKY2201905100007	冀G66720	中国石化天然气股份有限公司内蒙古销售分公司	9999-12-31	0号 车用汽油(VI)	吨	1,400.000	90.000	1,310.000	1,310.000	90.000	p:831.4 v20:19270 vt:19219 Real Qty:16tons Designed Qty:16tons
XCBCCKY2201905100006	冀G65925	中国石化天然气股份有限公司内蒙古销售分公司	9999-12-31	92号 车用汽油(VIA)	吨	1,500.000	336.000	1,164.000	1,164.000	336.000	p:740.9 v20:20276 vt:20179 Real Qty:15tons Designed Qty:15tons
XCBCCKY2201905100005	冀G66712	中国石化天然气股份有限公司内蒙古销售分公司	9999-12-31	0号 车用柴油(VI)	吨	1,400.000	368.000	1,032.000	1,032.000	368.000	p:831.3 v20:19272 vt:19219 Real Qty:16tons Designed Qty:16tons
XCBCCKY2201905100004	冀G66720	中国石化天然气股份有限公司内蒙古销售分公司	9999-12-31	0号 车用汽油(VI)	吨	1,400.000	10.000	1,390.000	1,390.000	10.000	p:831.4 v20:19270 vt:19213 Real Qty:16tons Designed Qty:16tons
XCBCCKY2201905100003	冀G65902	承德永泰危险品运输有限公司	9999-12-31	0号 车用柴油(VI)	吨	10.000	10.000	0.000	0.000	10.000	p:831.3 v20:12045 vt:12006 Real Qty:10tons Designed Qty:10tons
XCBCCKY2201905100002	冀G65281	冀城满族自治县金福源销售有限公司	9999-12-31	0号 车用柴油(VI)	吨	12.000	12.000	0.000	0.000	12.000	p:831.3 v20:14454 vt:14406 Real Qty:12tons Designed Qty:12tons
XCBCCKY2201905100001	冀G68071	承德市顺金福商贸有限公司	9999-12-31	0号 车用柴油(VI)	吨	10.000	10.000	0.000	0.000	10.000	p:831.2 v20:12047 vt:11987 Real Qty:10tons Designed Qty:10tons
XCBCCKY2201905090034	冀A108FZ	北京市燕京啤酒有限公司	9999-12-31	0号 车用柴油(VI)	吨	18.000	18.000	0.000	0.000	18.000	p:831.4 v20:19270 vt:19232 Real Qty:16tons Designed Qty:16tons
XCBCCKY2201905090033	冀A4705W	河钢股份有限公司承德分公司	9999-12-31	0号 车用柴油(VI)	吨	5.000	5.000	0.000	0.000	5.000	p:831.4 v20:6022 vt:6010 Real Qty:5tons Designed Qty:5tons

- 1.Improve V20, p20, quality oil delivery
- 2. Automatic memory and long-term storage of density data

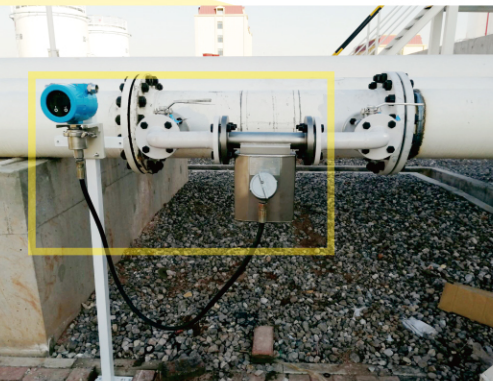
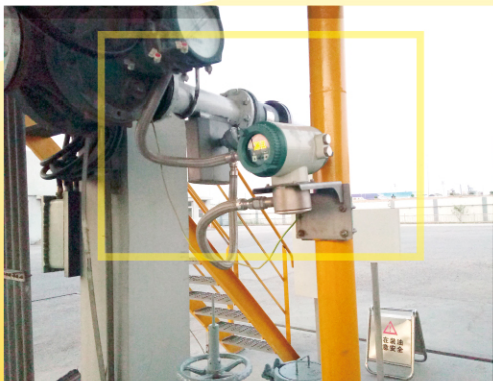
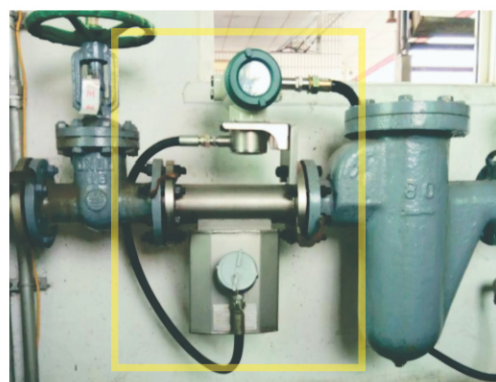
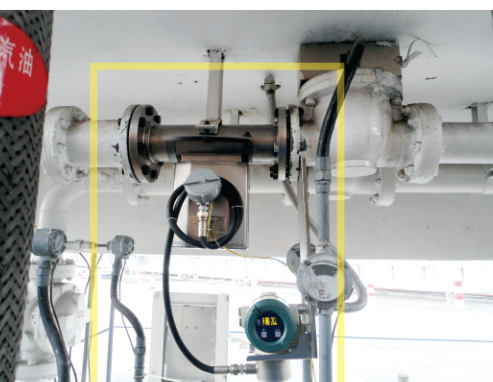
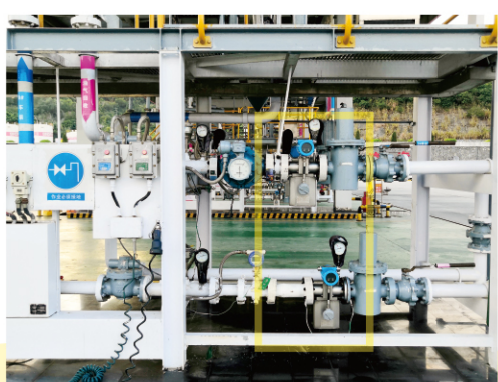
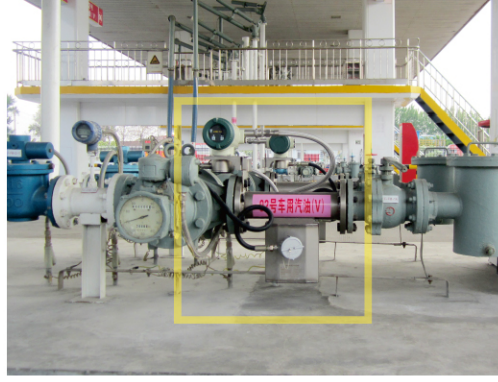
COMPANY QUALIFICATION



ACHIEVEMENTS



ACHIEVEMENTS





澳瑞德

ALLRED

2014.9.29

Qingdao Allred Electronics Co., Ltd.

Product: Infrared combustible gas alarm

www.qdallred.com

Augreener

2012.4.19

Qingdao Augreener Electronic technology Co., Ltd.

Product: Battery-free wireless doorbell

www.augreener.com

AOBO
澳波环保

2005.9.25

Qingdao AOBO-environment Technology Co., Ltd

Product: Filters for fuel dispenser

www.aobo-e.com



澳波泰克

1996.4.27

Qingdao Alptec Safety Equipment Co., Ltd

Product: Static Grounding Devices, Overfill Protection System, Personal Electrostatic Eliminating Alarm

www.alptec.com

2012.4.23



青岛澳威

QINGDAO ADD VALUE

Qingdao Add Value Flow Metering Co, Ltd.

Product: Mass Flow meter, Online Density Meter

www.addvalue.com.cn

2009.8.27



青岛澳邦

QINGDAO AUBON

Qingdao Aubon Instrument Co., Ltd.

Product: Level gauges for tanks

www.aubon.net

2005.1.31

AUTO DISP

Qingdao Autodisplay Co., Ltd.

澳地数显

Product: Price sign for gas station

www.autodisp.com