

Manufacturing Certificate  
CMC Shanghai No.02220105

# Instruction Manual

**TYPE LB**

**Rotary Vane Flow Meter**



 **SHANGHAI No.9 AUTOMATION INSTRUMENTATION Co., Ltd.**

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GLJ-B0026-C-Z

# CONTENTS

1. General Description .....	1
2. Type Selection Code .....	2
3. Technical Specifications .....	3
4. Working Principle & Fundamental Structure .....	4
5. Dimensions & Installation Reference .....	6
6. Installation.....	8
7. Operation.....	12
8. Maintenance & Cares.....	15
9. Transportation & Storage.....	18
10. Key Points for Ordering.....	18
11. Package Contents .....	19

# 1. General Description

This manual is for the installation, application and maintenance of Type LB Rotary Vane Flow Meter designed and made by SAIC No.9 .

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**The company reserves the rights to the explanation and modification of this manual, which is subject to change without prior notice.**

LB Rotary Vane Flow Meter (hereinafter refer to as Rotary Vane Flow Meter or Flow Meter) is a certain kind of volumetric flow measuring meter, used in enclosed pipeline that is fully filled with continuous flow of liquid. The flow meter is attached with on-site mechanical counter and with no electrical supply, from which readings of volumetric flow in total can be directly and clearly obtained. It is easy and reliable in operation with high measuring accuracy, and it is also robust and durable. Among others, each set of flow meter is equipped with unified rotating- round- number output shift, it can be used with Optical-Electrical Pulse Convertor this company may supply as complementary item to output electrical pulse signal or standard DC signals. Furthermore, if attached with Digital Flow Totalizer, accumulated data remote reading and surveillance are applicable.

It is mainly used in accurate measuring for crude oil and petrol items.

Fluids that are suitable to be measured by Rotary Vane Flow Meter shall be:

- Basically, fluids are non-corrosive to the Flow Meter wetted parts (which are mainly made of cast steel and cast iron);
- Comparatively, fluids with high viscosity (3mPa.s-500mPa.s)
- For other fluid parameters, please refer to Section 3 “Technical specifications” in this Manual;

Product Standard: Q/TDSM01-2014

Anything related with installation, operation, requisition or any comments for improving form the user that are different from what is described in this Manual, please don't hesitate to contact this company.

To ensuring product quality, the some components of Flow Meter has been run in, and tested,so the number of the no-reset totalizer is nonzero, it's highest number is not less than 1.

## 2. Type Selection Code

Item & Contents	CODE							Example
<b>Rotary Vane Flow Meter</b>	LB-							<b>LB-</b>
<b>Nominal Diameter (mm)</b>								
50		50						<b>50</b>
80		80						
100		100						
150		150						
200		200						
250		250						
300		300						
<b>Feature Code</b>								
Regular			A					<b>A</b>
Stainless Steel			F					
<b>Materials</b> (determined by Feature Code)								
Special needs				0				<b>0</b>
				9				
<b>Nominal Pressure</b>								
PN1.6				A				<b>B</b>
PN2.5				B				
PN4.0				C				
PN6.3				D				
PN2.0				E				
PN5.0				F				
<b>Accuracy</b>								
Class 0.2					2			<b>2</b>
Class 0.5					3			
<b>Output</b>								
None						A		<b>A</b>
Pulse Output (Optional LPJ-120D)						B		
4-20mA Output (Optional LPJ-120D/FI)						C		
<b>Display</b>								
Big Character Wheel Counter							3	<b>3</b>

**Example: LB-50A0B2A3** denoting: Rotary Vane Flow Meter; **Nominal Diameter:** 50mm;  
**Feature Code:** Regular; **Nominal Pressure:** PN2.5MPa; **Accuracy:** Class 0.2;  
**Output:** none; **Display:** Big Character Wheel

### 3. Technical Specifications

This Flow Meter is made with specifications below, unless otherwise stated or being specially needed:

- 1) Type, Nominal Diameter: see Table 1
- 2) Medium to be measured: liquid
- 3) Medium Viscosity range: 3 mPa.s to 500mPa.s
- 4) Medium Temperature range: 0°C to 80°C, or 0°C to 120°C (special order)
- 5) Maximum Pressure loss: <0.04MPa, when viscosity is 3mPa.s
- 6) Ambient Temperature: -20°C to 60°C
- 7) Flow Meter Installation Style: Upright
- 8) Connection: Flange; Flange standard and main specification see Section 5 “Dimensions & Installation Reference”
- 9) Materials of Wetted Parts:
  - Housing, Up-cover, Low-cover: Cast Steel
  - Rotor: Cast Iron
  - Paddle: Aluminum Alloy (after special treatment for surface)
  - Seal Ring: Oil-durable rubber

Table 1

Model	Nominal Diameter	Nominal Pressure PN(MPa)	Maximum Flow Rate Q <sub>max</sub> (m <sup>3</sup> /h)	Tolerance		Remote Output- Shift Rotating Speed m <sup>3</sup> /r	Pulse Equivalent L/P
	DN(mm)			Range Ratio			
				5:1	10:1		
LB-50	50	1.6 2.5 4.0 6.3	25	±0.2%	±0.5%	0.01	0.01
LB-80	80		60			0.01	0.01
LB-100	100		100			0.01	0.01
LB-150	150		250			0.1	0.1
LB-200	200		400			0.1	0.1
LB-250	250		600			0.1	0.1
LB-300	300		1000			0.1	0.1

Note: Pulse Equivalent is designated to the Pulse Equivalent of LPJ-12 Series Optical-Electrical Converter made by this company as complementary device to this flow meter; input 1 rotating round to LPJ-12 Converter, it outputs 1000 pulses

## 4. Working Principle & Fundamental Structure

### 1) Working Principle:

As shown on Fig.1, the measuring chamber of Rotary Vane Flow Meter is composed of rotor, paddle, inner housing, up-cover and low-cover (not appear on the Fig.)

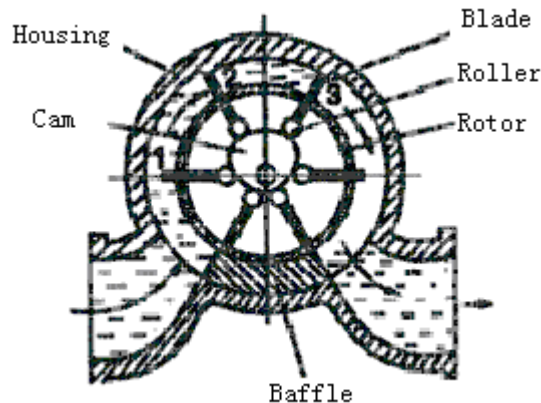


Fig. 1

When the liquid to be measured entering into the flow meter, the liquid forces the paddle rotating that makes rotor run. Within the measuring chamber, there is a fixed axis, on which a cam is mounted; rollers on the paddle are contacting with the cam; therefore when paddle/rotor rotating, the paddles, under the cam influence, make draw-out and draw-in moving action.

Refer to the Fig.1, Paddle No.2 and No.3 being completely drew out, which separate the liquid into 3 portions; two paddles and inner housing form a certain volumetric measuring chamber; when paddle rotating, paddle No.2 keeping completely draw-out, it still separating the liquid; but paddle No.3 being drew-in gradually; thus liquid that had been completely separated by measuring chamber ( that means this portion of liquid was already being measured) drains out through outlet; meanwhile, Paddle No.1 being drew-out gradually to form a new measuring chamber; so if the rotor rotating 1 round, it forms measuring chambers with certain number, which is equal to the number of paddles; when fluid is flowing, measuring chamber is being formed one after another; and the fluid after separation (measuring) is draining out via outlet continuously; because the measuring chamber volume, number of measuring chambers formed by rotor rotating per round are certainly known, the volume of fluid passing through the flow meter (total flow accumulated) is directly proportional to the rotor rotating rounds.

The rotor rotating is reduced by Gear Box, trimmed by Accuracy Trimmer (accurate gear ratio trimming), then it is transferred respectively, to the Big Character wheel Counter for accumulated flow measuring , to Optical-Electrical Gear box for standard rotating speed output.

### 2) Fundamental Structure

Rotary Vane Flow Meter consists of two big portions; namely, measuring and counting, please see Fig.2.

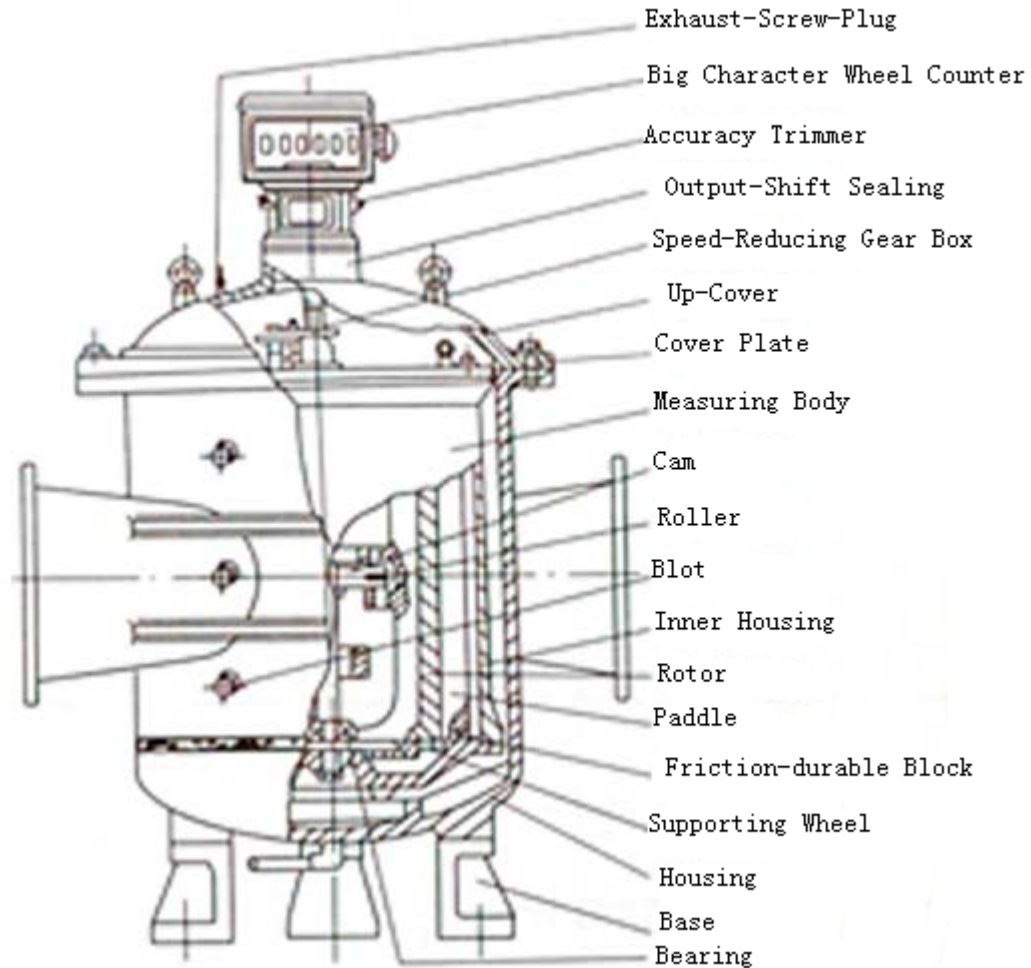


Fig. 2

Measuring portion is composed of Housing, Measuring Body, Paddles, Cam, Up-Cover, Rollers and Base.

Counting mechanism is composed of 3 parts, namely, Accuracy Trimmer, Optical-Electrical Pulse Converter adaptable Gear Box (called briefly as Optical-Electrical Gear Box) and Big Character Wheel Counter.

Accuracy Trimmer is of supper clutch style with accuracy trimming range of  $\pm 6\%$  for accuracy adjustment.

Optical-Electrical Gear Box is attached with rotating-round output shift, the shift rotating rounds is proportional to accumulated fluid flow, so the shift is used for Electrical Pulse Converter mounting.

Big Character Wheel Counter is of 2-row of digits for accumulated flow displaying, one is in big wheel, another is in small wheel; both big one and small one are rotating synchronously. The Big wheel can be cleared to ZERO; it is used in oil transferring operation within a certain period of time or just in one time for displaying period or batch volumetric flow quantity; the small wheel is used for total volumetric flow continuous calculation; ZERO returning for big wheel can be made by a manual-operated wheel available on the right of the Counter.

## 5. Dimensions & Installation Reference

1) Flow Meter Dimensions, Installation Reference and Flange specifications are as shown in Fig.3 and Table 2; for Pipeline Flange, please see Standard listed in Paragraph 2 of this section.

Note: all length for the bolts to be calculated by users in view of practical application.

### 2) Pipeline Flange for Flow Meter

On Table 2 Flange Size for installation of this Flow Meter is listed; Pipeline Flange for Rotary Vane Flow Meter designed and made by this company is in compliance with the National Machinery Industry Standard below:

- a) PN1.6MPa to 2.5MPa: JB/T79.1-94 (Integral steel pipe flanges with flat face) (Series 2)
- b) PN4.0 MPa to 6.3MPa: JB/T79.1-94 (Integral steel pipe flanges with male and female face) (Series 2 for female face)

**Note: Flanges in line with other standards can also be supplied at user's options.**

### 3) Pipeline Flange for User's Pipeline

- a) PN1.6 MPa to 2.5MPa: JB/T81-94 (Slip-on-welding plate steel pipe flanges with raised face) (Series 2)  
Or JB/T82.1-94 (Steel pipe welding neck flanges with raised face) (Series 2)
- b) PN4.0 MPa to 6.3 MPa: JB/T82.2-94 (Steel pipe welding neck flanges with male and female face) (Series 2)

### 4) User may follow the following standard for Flange sealing gasket:

JB/T87-94(Asbestos-rubber gasket for pipeline flange):  
Asbestos-rubber gasket for raised face pipe flange or male and female face pipe flange.



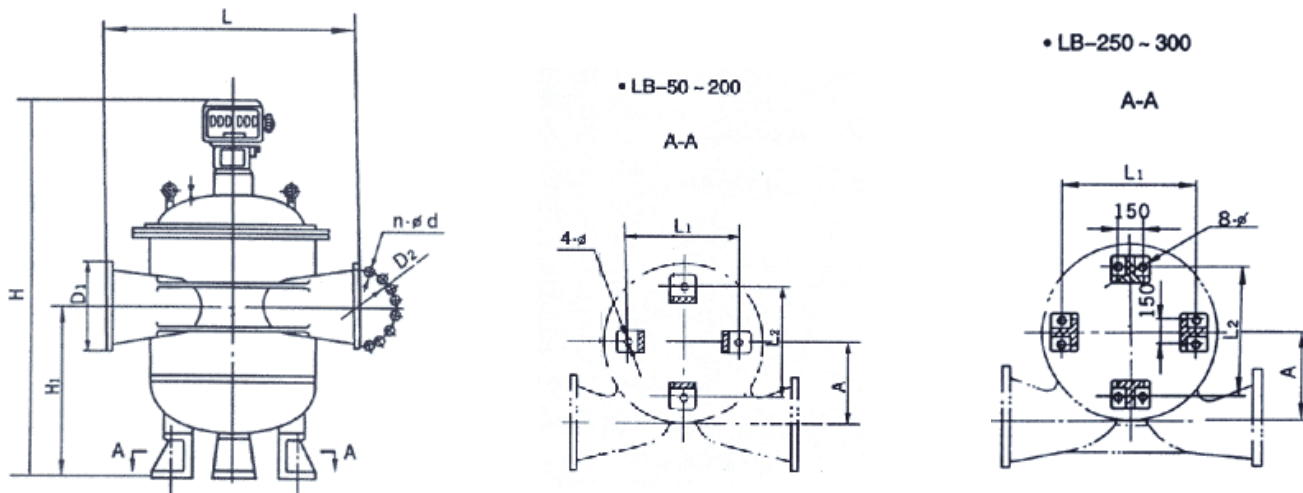


Fig. 3

Table 2

Modle	Nominal Pressure	Height	Center Height	Base	Base Bolt	Base Bolt Hole	Flange Distance	Flange Out-Diameter	Bolt Hole Center Circle	Bolt Hole	Connection Bolt
	PN MPa	H mm	H <sub>1</sub> mm	A mm	L <sub>1</sub> *L <sub>2</sub> mm	φ mm	L mm	D <sub>1</sub> mm	mm	n-φd mm	n-Md <sub>1</sub>
LB-50	PN1.6	743	200	150	260×260	4-φ23	360	φ160	φ125	4-φ18	4-M16
	PN2.5							φ160	φ125	4-φ18	4-M16
	PN4.0							φ160	φ125	4-φ18	4-M16
	PN6.3							φ175	φ135	4-φ23	4-M20
LB-80	PN1.6	903	280	180	300×300	4-φ23	460	φ195	φ160	4-φ18	4-M16
	PN2.5							φ195	φ160	4-φ18	4-M16
	PN4.0							φ195	φ160	4-φ18	4-M16
	PN6.3							φ210	φ170	4-φ23	4-M20
LB-100	PN1.6	963	310	150	320×320	4-φ23	500	φ215	φ180	4-φ18	4-M16
	PN2.5							φ230	φ190	4-φ23	4-M20
	PN4.0							φ230	φ190	4-φ23	4-M20
	PN6.3							φ230	φ190	4-φ25	4-M22
LB-150	PN1.6	1263	460	190	420×420	4-φ27	650	φ280	φ240	8-φ23	8-M20
	PN2.5							φ300	φ250	8-φ25	8-M22
	PN4.0							φ300	φ250	8-φ25	8-M22
	PN6.3							φ340	φ280	8-φ34	8-M30
LB-200	PN1.6	1343	500	300	480×480	4-φ27	700	φ335	φ295	12-φ23	12-M20
	PN2.5							φ360	φ310	12-φ25	12-M22
	PN4.0							φ375	φ320	12-φ30	12-M27
	PN6.3							φ405	φ345	12-φ34	12-M30
LB-250	PN1.6	1446	576	300	560×560	8-φ23	1000	φ405	φ355	12-φ25	12-M22
	PN2.5							φ425	φ370	12-φ30	12-M27
	PN4.0							φ445	φ385	12-φ34	12-M30
	PN6.3							φ470	φ400	12-φ41	12-M36
LB-300	PN1.6	1652	680	410	660×660	8-φ23	1200	φ460	φ410	12-φ25	12-M22
	PN2.5							φ485	φ430	16-φ30	16-M27
	PN4.0							φ510	φ450	16-φ34	16-M30
	PN6.3							φ530	φ460	16-φ41	16-M36

## 6. Installation

### 1) Installation Site:

- a) Indoor installation for the Flow Meter is recommended; if outdoor, certain necessary protecting measures must be taken to prevent it from being damaged by raining and sun beam that will cause surface rusty, glass aging and raining leaking into the meter;
- b) To avoid installation at the place where temperature is too high or too low, humidity is high, corrosive atmosphere or strong vibration exist; in case Optical-Electrical Converter is attached to the Meter, to avoid magnetic-field interference measures shall be taken into account;
- c) Convenience access for Meter operation, reading and care shall also be considered during installation;

### 2) Complementary equipment for the Flow Meter

- a) Filter shall be installed at upstream of the Rotary Vane flow Meter; the filtering grid must be in line with flow meters; filter inlet/outlet pressure gauge measurement is surely necessary for filter blockage examining;
- c) In addition, pressure gauges are needed not only for filter but also for Flow Meter itself; Pressure gauges before and after Flow Meter are to be mounted for pressure loss check when the fluid passing through it;
- d) There is no restriction for straight pipes at up/down stream of Rotary Vane Flow Meter; So installation location and position can be determined just by operation convenience with no straight pipe limit consideration;
- e) It is better to mount a thermometer within the flow meter outlet pipe for fluid temperature monitoring;
- f) If Signal remote-transfer is needed, the Flow meter should be attached with related Optical-Electrical Pulse Convertors and secondary instruments; for this purpose, please refer to their relevant instruction manuals;
- g) For some fluids with high viscosity, when the whole pipeline operation is stopped, they might be solidified within pipeline and/or Flow Meter; so it can be considered to add externally thermal preservation for Flow Meter; or wiping off the pipeline as soon as operation stops;

### 3) Flow Meter Installation

- a) The Flow Meter pipeline arrangement is as shown in Fig.4

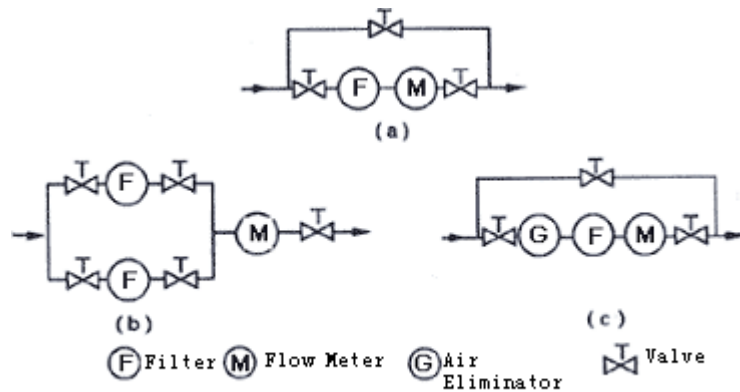


Fig. 4

To install valves at Flow Meter Up and Down Stream is necessary; the valve for flow rate adjusting should be arranged at flow meter down stream; the Rotary Vane Flow Meter must be installed upright and within horizontal pipelines only;

For operation and maintenance reason, to ensure flow in the pipeline will not be interrupted during maintenance, by-pass pipe is needed, as shown on Fig.4 (a); if there is much impurity in the fluid, the filter needs frequent cleaning; in that case, to minimize any affection to the flow meter working, two filters being installed in parallel for alternative operation and cleaning is usually required; such pipeline arrangement refers to Fig.4 b); Fig.4 c) shows Air Eliminator being installed; If flow meter no interruption measurement is required or the maximum flow rate is higher in pipeline, two or more flow meters to be installed in parallel are applicable; each flow meter can be arranged as shown on Fig.4, even with a shared by-pass pipeline;

b) Flow Meter and its Auxiliaries shall be double-checked before installation including:

- (1) Type and Specifications;
- (2) Inlet/Outlet and flow direction marks;
- (3) Out-appearance with visibly damaging that may cause malfunction in operation;
- (4) No foreign objects within the Flow Meter chamber
- (5) Rotating meter rotor by hand or with unbroken wooden stick to see if it moves nimbly, meanwhile, the Counter shall rotate too, with ZERO returning in good condition;

Important: **Safety when hand rotating**

- c) Welding for all thermo-wells, pressure gauge connections and other related pipes around the flow meter shall be finished before its installation; all equipment and pipes need cleaning before mounting; be sure no welding residues and foreign objects are left in the pipeline;
- d) Pipeline Wipe-Off should be carried out before flow meter and filter installation; Flow meter or filter can be replaced by straight pipe during the time;
- e) Flow meter must be installed both vertically and horizontally as required; Filter and Eliminator should be arranged horizontally with reference to the Flow Meter horizontal level; check flow direction marks on each equipment that must be in line with fluid actual flowing direction; Flange gap shall be evenly distributed with proper gasket thickness, gasket is not allowed to extend internally into the pipe;
- f) To avoid any additional external force from pipeline to the flow meter due to improper installation; to ensure no drawing force at the two ends of flow meter exerted by pipe line in preventing the flow meter from being deformed;
- g) Valves for flow rate adjusting should be arranged at flow meter down stream;

- h) Check the flowing direction marked on the flow meter is in line with the fluid flowing direction in the pipeline; measures for back-flow prevention are necessary so as to avoid damage caused by flowing reversing;
  - i) Valves, like by-pass valves that may affect the flow meter measuring correctness, should be cared by necessary leak-proof or other checking measures in order to secure accuracy;
- 4) Complementary Optical-Electrical Converter to be mounted

This section is only for the usage of Optical-Electrical Converter.

**Note: Switch the Power off before Optical-Electrical Converter wiring and maintaining to avoid personal injury and equipment damage.**

- a) According to the adopted Type, wiring the terminal as shown in Fig.5
- b) For explosion-proof Optical-Electrical Converter, wiring and sealing as per explosion-proof requirements;

**Note: oppositely wriing for power, or pulse output being wrongly connected to power terminal may cause irrevocable damage; therefore, make every thing clear before wiring and double-checked prior power applying;**

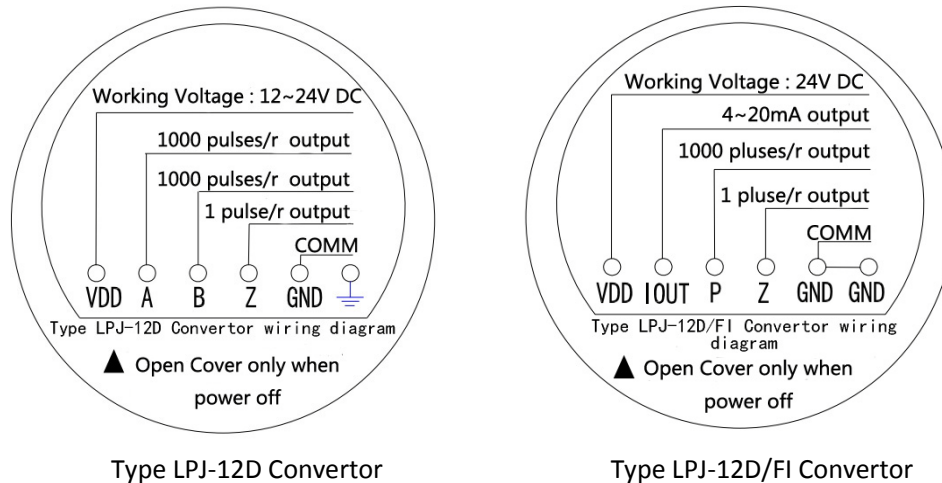


Fig. 5 Wiring Terminals for Optical-Electrical Pulse Converter

- c) to place the Converter on the Flow Meter connector carefully, as shown in Fig.6; to ensure the pin inserting into the axis slot, to align the Pin with Slot in advance; softly insert the converter connector into the connecting hole; as shown on Fig.6b, when Surface A and Surface B being contacted perfectly, it means the Pin is into the Slot, then fasten the Nut to fix the Converter; if Surface A and B do not meet (as shown in Fig.6c ), it means Pin being stalled by the Slot, take out the Converter and try to do it again;

To push the Converter in with strong force is not allowed; furthermore, to fasten the Nut before two Surfaces contacting is prohibited.

**Note: Nut is used for Converter fixing, to fasten it to the bottom just by hand turning, no tool being used;**

**Note: Converter will work improperly, or its inside components may be damaged if fastening the Nut before Surface A and B being contacted perfectly;**

- d) More details regarding the installation of Optical-Electrical Pulse Converter and other secondary instruments, please read their instruction manuals respectively;

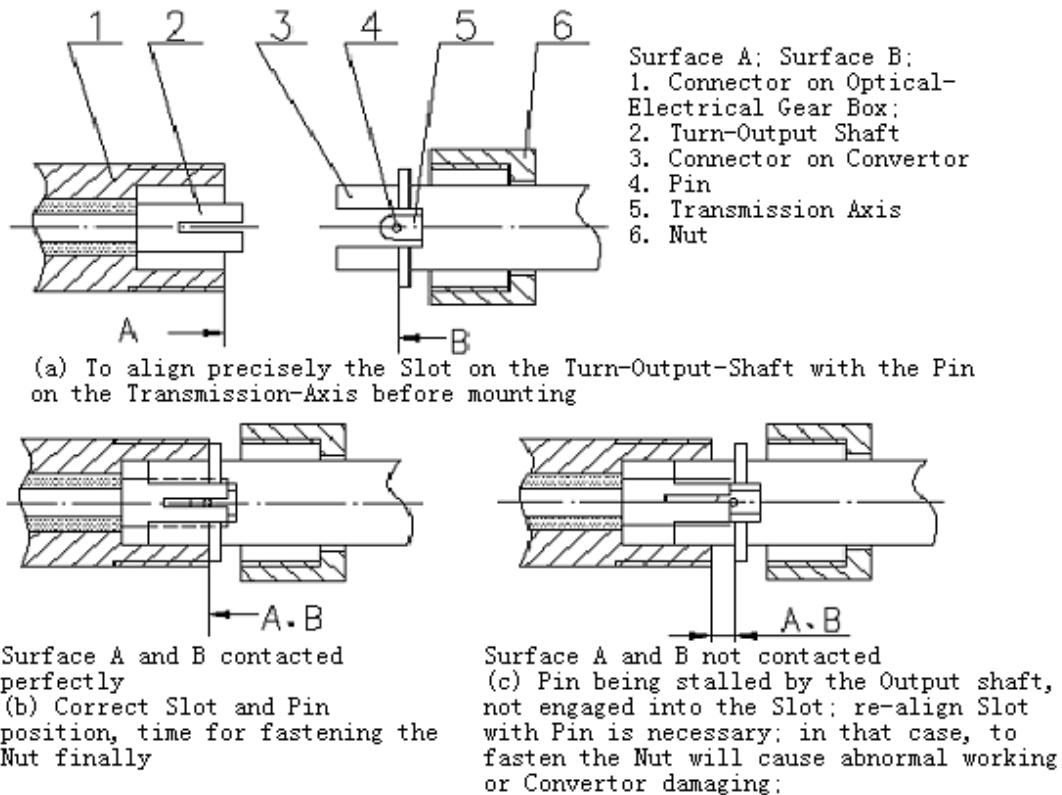


Fig. 6

## 5) Check after Installation

Check Flow Meter and its auxiliaries before actual operation;

- a) Check the Flow Meter newly-installed, adjustment with oil passing is applicable; if by-pass pipe available; let the fluid pass through it first; when dirty fluid is almost passing away, then switching the fluid to the Flow Meter; if by-pass pipe is not available, appropriate measures should be taken during adjustment of oil passing, such as just to replace the flow meter by straight pipe, then restore it after dirty fluid is over;
- b) If secondary instruments are equipped, their wiring correctness and reliability need check; when explosion-proof optical-electrical converter is used, carefully check the following items, like sealing device, leading cable sealing, rubber ring, explosion-proof terminal box, switch and cables to ensure they are perfect, no damage, no electrical leakage, and all in good contact condition;
- c) Check Flow Meter working properly; per its flow range, checking it from low to high flow rate by listening to its working sound, which should be smooth and not too noisy, checking its Counter, pulse convertor and secondary instrument, all of which should be in good condition;
- d) Check other equipment within the pipeline to be sure they are all working properly;
- e) Check by-pass valve and other valves, any leakage of which may affect the flow meter measuring correctness;
- f) Check the Counter ZERO return performance when operation stops;
- g) If on-site calibration equipment is available and on-line calibration is needed, on-line calibration can be made;

**Note: Flow Meter Calibration and Sealing Test by Water are not allowed.**

## 7. Operation

To understand Flow Meter technical performance and application rules is necessary before operation.

- 1) Flow Meter attached with Big Character Wheel Counter, clear the counter to zero prior to use; at the time, counter displays 0 (up-row 7-digits counter not influenced)  
**Note: Without Zero return, Counter works improperly;  
 No Zero Return, when Counter operation is going on;**
- 2) If secondary instrument is attached to the flow meter, switch the power on to instrument first;
- 3) Open the flow meter inlet valve first, let the fluid fully fill in the pipe and flow meter, then open the outlet valve gently to see whether the flow meter working properly; if yes, to increase the flow to the required rate gradually;  
**Note: In some cases, solidified fluid may fully fill within the pipeline, it takes time for melting; flow meter will work properly only when melting fluid is flowing; it usually takes a long time.**  
**Note: To ensure the fluid fully filling in the measuring pipe of flow meter, it is necessary to fully open its inlet valve; adjusting flow rate by outlet valve and keep certain pressure in the flow meter outlet.**
- 4) During operation, gas within the flow meter measuring chamber must be eliminated; otherwise its measuring accuracy will be affected; loosing the gas exhaust- screw- plug for gas exhausting (see Fig.2); when gas being completely exhausted, softly turn the Plug in until no liquid overflowing can be see; not turn the plug too tight that will cause sealing surface damaging.
- 5) be sure flow rate is within its measuring range, fluid pressure/temperature are also within their maximum working ratings;

**Note: when Series LPJ-12 Optical-Electrical Pulse Convector is used, listed below is a Table for reference Flow Meter maximum flow rate vs. output pulse frequency:**

Table 3

Type		LB-50	LB-80	LB-100	LB-150	LB-200	LB-250	LB-300
Max	m <sup>3</sup> /h	25	60	100	250	400	600	1000
Flow Rate	L/s	6.94	16.67	27.78	69.44	111.11	166.67	277.78
Max Frequency	Hz	694	1667	2778	694	1111	1667	2778

If on-site display only, running watch can be used for maximum flow calculation;

**Note: Optimum flow rate working range is 20%-80% of the maximum flow rate;**

- 6) To lubricate the Accuracy Trimmer, by frequently filling 20# Mechanical Lubricating Oil into the Spring cap type lubricating cup; Oil filling interval is about 36 working hours.If flow meter not working for long time, lubricating it first;
- 7) For the hydraulic oil nipple on the Output Shift Sealing Mechanism, it needs glycerol to be pressured in, in 48 hours each time with 2ml glycerol. Oil Gun, glycerols are packed with Flow Meter as accessories Ex-works;

- 8) Filter needs frequent cleaning to avoid blockage and pressure loss; cleaning interval may be determined by its inlet/outlet pressure difference; if any grid broken is found, replace it in time;
- 9) If operation stop is required, to shut off the outlet valve first to prevent flow meter from being damaged by reversing fluid flow;

Note: At any time, opening or closing valves softly to avoid impact to Flow Meter and its auxiliaries caused by fluid flow rate sudden change;

- 10) What Rotary Vane Flow Meter displays is volumetric total flow of fluid under measuring conditions; if the temperature or pressure changes considerably during measuring, additional deviation occurs; if the compression or expansion coefficient for the Fluid is known, revision can be made as following;

Fluid Volume-Temperature revision by formula below:

$$Q_{ts} = Q_i \times [1 - \alpha (t_i - t_s)] \dots \dots \dots (1)$$

where

- $Q_{ts}$  is the Fluid volume in standard temperature
- $Q_i$  is the Fluid volume in measuring (in working status during measuring)
- $\alpha$  is the volume expansion coefficient of the liquid to be measure; unit  $1/^\circ\text{C}$
- $t_i$  is the liquid temperature in measuring status; unit:  $^\circ\text{C}$
- $t_s$  is the liquid temperature in standard status; unit:  $^\circ\text{C}$

In general, for mineral oil, volumetric expansion coefficient  $\alpha = 6.4 \times 10^{-4} (1/^\circ\text{C})$ , It shows temperature variation has big influence on fluid volume; because  $10^\circ\text{C}$  temperature changing will cause about 0.64% volume change for the fluids with same mass;

Fluid Volume-Pressure revision by formula below:

$$Q_{ps} = Q_i \times [1 + \gamma (P_i - P_s)] \dots \dots \dots (2)$$

where

- $Q_{ps}$  is the Fluid Volume at standard pressure
- $Q_i$  is the Fluid Volume when measuring (under measuring condition)
- $\gamma$  is the compression coefficient of liquid to be measured; Unit:  $1/\text{Pa}$  or  $\text{m}^3/\text{N}$
- $P_i$  is the Liquid pressure under measuring condition; Unit: Pa
- $P_s$  is the Standard pressure: Unit: Pa

In general, for liquid, volumetric compression coefficient  $\gamma = 6 \times 10^{-10} (1/\text{Pa})$ , It shows pressure changing of 1Mpa will cause about 0.06% volume change for the fluids with same mass;

Note:

- (1) Standard Pressure and Temperature normally refer to  $P_s = 0.101325 \text{MPa}$  (absolute pressure);  $t_s = 293.15 \text{K}$  (absolute temperature) =  $20^\circ\text{C}$
- (2) For  $\alpha$  and  $\gamma$  of different fluid, please refer to related manual or materials;
- (3) Revision for both temperature and pressure at the same time are applicable;

For much higher accuracy measuring, in addition to temperature and pressure revision, deviation trimming can also be made through deviation trimming formula below:

$$Q_i' = Q_i \times (1 - E) \dots \dots \dots (3)$$

where

- $Q_i'$  is the Volume reading after trimming
- $Q_i$  is the Fluid Volume when measuring

E is the Flow Deviation at the measuring point, measuring points beyond calibration points can be obtained by interpolation method in mathematics;

- 11) during operation, surveillance is needed, like listening to the flow meter working sound in checking if it is in normal running; if it sounds abnormal, or its Counter is stalling, hopping or not running, stop the operation immediately;
- 12) Periodically cleaning, Flow Meter calibration after a period time of working are necessary, calibration cycle generally is once one year. During cleaning if part wearing or tearing is found, repair or part replacement must be made; re-calibration is necessary after that;
- 13) Accuracy trimming:

If accuracy is found declining in calibration, accuracy trimming to the flow meter can be made; turn off two screws on the fixing cover on the right of accuracy trimmer (with lead-sealing), take off cover, turn the adjusting pole by screw driver for trimming as per “+”, “-“ directions (see Fig.7) The trimming resolution is 0.06% per grid and 1.08% per turn; according to the trimming quantity to adjust it with corresponding turns and grids; being satisfied, put the cover on and fasten the screws;

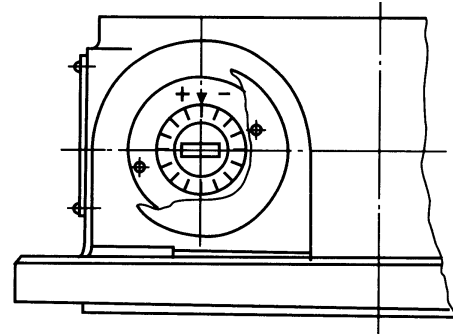


Fig. 7

*Note:*

*What we mentioned here for the accuracy trimming is actually the adjusting of Deviation Curve position for the whole flow meter; it means to add an trimming quantity on the reading of each flow measuring point, however it does not change the fundamental deviation of the flow meter; for instance, a flow meter, its 3 flowing points are 20%Q<sub>max</sub>, 40%Q<sub>max</sub> and Q<sub>max</sub> with deviation of -0.6%, -0.3% and -0.5% respectively; trimming for it now is +0.45%; after trimming, deviations for these 3 points are changed into -0.15%, +0.15%, and -0.05%, it conforms with Accuracy Class 0.2 for the flow meter;*

*In our technical terms, accuracy over tolerance refers the difference between maximum and minimum deviation is bigger than 0.4% (for Class 0.2) or bigger than 1% (for Class 0.5); under such circumstance, it is not possible to adjust the deviation to the extent that makes it be within fundamental tolerance in accuracy trimming; at this point, flow meter cleaning and maintenance seems necessary; so it doesn't make sense in assuming that the flow meter deviation is over its tolerance in case that just one flowing point for the flow meter being calibrated;*

**Note: Flow Meter calibration shall be made only by qualified quantitative management institute or organization; re-sealed by lead-seal after accuracy trimming.**



## 8. Maintenance & Cares

### 1) Daily cares

Please refer to 6) & 7) in Section 7 for oil lubrication and glycerol filling;

### 2) Maintenance

Flow Meter installing/dismantling and maintenance must be carried out by professionals or those who are well trained in this respect, otherwise equipment damage and even personal injury may happen;

Flow Meter trouble may be caused by several different reasons, which should be attentively checked and analyzed; especially some trouble may be caused by trouble of other parts; for instance, Big Character Wheel gear broken is usually caused by Wheel stall; if same trouble occurs frequently it means actual trouble reason has not been found finally, Further analysis is necessary;

If fluid can not pass through the flow meter, Counter can not count or run, the steps below may be taken for pipeline and flow meter check and repair:

- a) If no medium passing or abnormal counting: check the power supply first; if power failure, the pump being stopped for a long time or the pipeline with no thermal keeping, medium was solidified that caused the flow meter abnormal working; in this case, warming-up and wiping-off in the pipeline and fixing the power for pump on;
- b) Check the pump output capacity, if no good, replace it;
- c) Check filter if it is blocked by misled objects with no medium passing, if it is, cleaning the filter;
- d) Disassemble and check the flow meter per the procedures below, possible troubles and their shooting, please see attached Table 4;

Dismount Big Character Wheel Counter; turn its input shift to check counting;

Dismount Optical-Electrical Gear Box and check; its shift shall rotate nimbly;

connectors no loosing; Bevel Gear properly meshing;

Dismount Accuracy Trimmer: check no stalling;

Dismount output-shift sealing mechanism from Up-cover: check shift; it shall rotate with slight damping, Up & Low Moving Fork Seat no loosing;

Dismount Up-cover: check Gear Transmission at the up part of Measuring Body, no loosing and stalling;

Take off Housing external bolts, take out the Measuring Body; dismount the Gear Transmission on it; take off Fixing Nut on the shift and up-cover bolts, take off up-cover plate, then check the Gear Transmission fixed on the up-cover plate;

Turn the Rotor; it should rotate nimbly, Paddles can draw-out and draw-in freely; there should be no any scratch among Paddles, Rotor, Inner Housing, Base and Baffle;

Take off Fixing Axis Nuts at the bottom of Measuring Body; take out Rotor with Axis from the Measuring Body, put it upside down; take off Cover Plate (mark it for restore orientation purpose); check Bearings condition on Cover Plate; Bearing Rollers and Balls shall rotate nimbly; check if any touching between Paddle Bottoms and Cover Plate; if yes, adjusting Thread Pole to make the Balls be high over the Cover Plate within 0.1-0.2mm, then fasten the Nut;

Take out Axis and Paddles (make corresponding positions mark between Paddles and Slots); check Paddles; trimming the scratches on Paddles; check Roller, it shall rotate nimbly;

check Rotor Bearing; it shall also rotate nimbly; check Rotor Slot, to eliminate burrs and scratches inside it;

- e) After troubled parts mending or replacing, clean up each part of flow meter (by gasoline or kerosene contented cleaning solution is suitable), reassemble and restore it step by step; continuously use it or just keep it as needed;

During restore, be sure, to return Paddles into their original slots on the Rotor, restore the cover per original position; when return the Rotor with Axis back to the Housing, pay attention that the Key on the Axis shall be aligned with Key Slot on the Base;

When Cover Plate returning back to the Housing, the adjustment of up or down position for the Rotor within the inner Housing can be made by Thread Pole; for adjusting just loosening the up-Nut first, then turn the lower Nut for up/down adjustment of Rotor in the inner Housing, check the Rotor rotating whether in the nimblest condition for getting the optimum adjusting position; finish the adjusting by fastening the up-Nut;

O-rings for every part may easily wear and tear although they are made of Oil-durable rubber; due to the long time pressing they are aging and deforming; poor sealing causes Medium leaking; so they need to be replaced in time; All O-rings adopted by this Rotary Vane Flow Meter are standardized that are commercially available on the market;

**Table 4**

<b>A. Flow Meter</b>		
<b>Trouble</b>	<b>Cause</b>	<b>Shooting</b>
No liquid passing through flow meter; no counting	Filter blocked; Misled objects entering flow Meter measuring chamber Causing rotor, paddle stalling;	Filter cleaning; remove misled objects, mending rotor and paddle surface; check filtering grid, replace if damaged;
Flow meter is too noisy during working, accuracy declining	Rotor bearing damaged; Paddle or Rotor damaged by misled objects; Scratching between Rotor and Base	Replace Bearing; Mend Paddle or Rotor;  Rotor up/down gap adjusting
Leaking Seals	O-Ring aging and expired	Replace O-Ring
<b>B. Gear Transmission and Output shift sealing mechanism</b>		
<b>Trouble</b>	<b>Cause</b>	<b>Shooting</b>
No counting when flow meter is working	Gear fixing pin lost or broken; Gear and shift deadlocked;  Long shift in Output-shift sealing mechanism broken;  “Cross” style Lever being leaving Shift Seat;	Replace fixing pin;  Dismount Gear and Shift, polishing them by fine sand paper to make them match smoothly with proper gap; Replace long Shift Restore
No glycerol filling can be made for output-shift mechanism	No glycerol filling for a long time causing chamber vacancy, Medium entering and solidifying; poor Oil Gun	Clean sealing mechanism chamber, check oil nipple;  Use good one
Frequent long shift broken	Strong impact force;	Open valve gently in

in output sealing mechanism	Trouble from gauge part	operation; check and mend all items related to output shift sealing mechanism: Accuracy Trimmer, Optical-Electrical Gear Box and Big Character Wheel
Output shift sealing mechanism leaking and exposed	No frequent glycerol filling causing chamber vacancy to affect sealing; Oil Nozzle sealing rubber aging and expired; Chamber Bowl Style Seal Ring aging and expired;	frequent glycerol filling  Replace Oil Nozzle sealing rubber Replace Chamber Bowl Style Seal Ring
<b>C. Accuracy Trimming part</b>		
<b>Trouble</b>	<b>Cause</b>	<b>Shooting</b>
Flow Meter Accuracy declining, repeatable deviation bigger	Moving lever or Eccentric Lever Wearing; Cover or Base Bearing holes Wearing;	Replace Moving lever or Eccentric Lever; Replace cover and Base
Output Shift not running	The Axis on the Driving Plate being separated from Driving Plate;	Replace Driving plate;
<b>D. Flow Meter Accuracy Declining</b>		
<b>Trouble</b>	<b>Cause</b>	<b>Shooting</b>
Flow Meter Readings is less than actual value (negative deviation)	Flow being over flow range;  Medium viscosity seems lower ;  Trouble from Measuring Chamber or Trimmer parts	Use the Meter within its Range; or use Meter with bigger nominal diameter; Calibration made by liquid with similar viscosity and adjust Accuracy Trimmer;  Repair
Flow Meter Reading is more than actual value (positive deviation)	Flow with bigger fluctuation;  Medium mixed with gaseous;  Medium viscosity seems higher,	Minimize pipeline vibration to make flow stable; Equipped with Eliminator; Or repair it if existing;  Calibration made by liquid with similar viscosity and adjust Accuracy Trimmer;

## 9. Transportation & Storage

- 1) Flow Meter should be stored in the warehouse where it is dry, ventilated and without corrosive atmosphere; for flow meters with packing taken-off, be careful, no foreign objects entering into the measuring chamber and no damaging on Flange surface;
- 2) Return Transportation
  - If return flow meter for maintenance, calibration or commissioning by this company, please send it directly to us or via transportation agents;
  - a) Be attached with written documents describing return reason and purpose in details; such as for repair or calibrating, Meter Type, Serial No., application condition, trouble situation, together with contact person name, address and phone no. etc.
  - b) Properly packing the product with above documents and sending them to our Sales Department; anyway, written documents sent to us by post are also acceptable;
  - Note: use the original Ex-work packing by this company is strongly recommended**
  - c) If some parts are found missing within the return products for service, this company is entitled to complete them with new parts and appropriately charge the expense for both completion and repair, unless otherwise the user declares such parts are not needed.
  - d) Return Address:  
Sales Department Shanghai No.9 Automation Instrumentation Co., Ltd.  
No.157 Changji Rd., Anting County, Jiading District, Shanghai, PR. China  
Zip Code: 201805  
Phone: 0086-21-59577980; 0086-21-59577910  
Fax: 0086-21-59564732

## 10. Key Points for Ordering

To make sure that the fluid to be measured is suitable for Rotary Vane Flow Meter measuring; all technical specification are acceptable before ordering. You can read this Manual or consult details with our sales people and professionals in advance;

- 1) Following points shall be noted for ordering
  - a) Flow meter Type; Nominal Pressure and Accuracy
  - b) Fluid to be measured: its name, viscosity, regular pressure, temperature, flow rate, Minimum/Maximum flow rate;
  - c) Complementary equipment, like Filter, Eliminator, Optical-Electrical Pulse convertor, Totalizer etc. all of them can be ordered from us at the same time;
  - d) If you have any special needs, please contact our Sales Department for negotiation;
- 2) Complementary Products Brief Descriptions
  - a) LPG Filter: nominal diameter, nominal pressure matching
  - b) LPX Air Eliminator: nominal diameter, nominal pressure for matching  
Nominal diameter ranging:  $\varnothing 50$ - $\varnothing 300$   
Note: only PN1.6 and PN2.5 Nominal Pressure available for Eliminator; for PN4.0 and PN6.3, special order is needed;
  - c) LPJ Optical -Electrical Pulse Convertor brief description: see Table 5

d) Flow Totalizer brief description: see Table 6

Table 5

Type	Function Brief
LPJ-12D	Explosion-Proof: Output Signal: 1 pulse/round; 90° Phase- lag double-way pulse signal: 1000 pulses/round
LPJ-12D/FI	Explosion-Proof: Output Signal: 1 pulse/round and 1000 pulses/round; 4 – 20mA Current Signal

Table 6

Type	Function Brief
XSJ-39A XSJ-39AK XSJ-39AI XSJ-39AIK	Make arithmetic operation to the input flow signal (Pulse, current); simultaneously display total and instant flow; power failure protection Optional: Current output; Quantification control

## 11. Package Contents

Complete package contains:

- 1) Flow Meter                      1 set
- 2) Instruction Manual            1 Copy
- 3) Quality certificate            1 Original
- 4) High Pressure Gun for Oil Lubricating 1 set

The end.

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