

Over Gear Flowmeter



Summary

DTO oval gear flowmeter is a kind of direct-reading accumulating liquid flowmeter. DTO oval gear flowmeter adds transmitter mechanism on the basic of DTO flowmeter. It can be equipped flux and instant flux. It possesses many virtues such as large testing range, high precision etc.. It is widely used in flux measurement in industrial field such as oil development, oil refining, chemical, commerce, oil storage.

Operation Principle

Measurement is made in the testing room. There is a pair of oval gear in it. The pair of oval gear will keep rotating on the axis under the role of liquid pressure difference between inlet and outlet. Liquid flux through the flowmeter will be known by testing gears' rotation number

As it is showed in picture 1(a), the inlet and outlet are separated by a pair of oval gear A and B. There is crescent-shaped space between Gear A and inner wall of the testing room (It is showed as shadow in the picture). There is a rotating torque while the total torque on Gear B is zero. Gear B will be rotated by driven of Gear A. The picture 1(b) shows the middle position of the two gears. When the gears turn to the position showed in the picture 1(c), Gear A will lose rotating torque while Gear B will gain rotating torque. Gear A will be rotated by driven of Gear B. It is showed in the picture 1(d).



Operation Principle Picture

Structure

The Model DTO oval gear flowmeter mainly consists of testing room, sealing mechanism and counting mechanism.

1. Testing room: outcover(1) of instrument (see picture 2,3; same as pictures later) is made by cast iron. Inner space and the board (4) consists of the testing room. There are 2 stainless steel axes (2) and a pair of oval gear(3) is sleeved on the axes.. The liquid from the inlet will be sent to the outlet through the crescent-shaped space by the gears' turn which is driven by pressure difference between inlet and outlet in flowmeter. Four times volume of crescent-shaped space will be accumulated while the gear makes one revolution round. The space between oval gear and inner wall of the testing room is very small with tens of micro-mete only to decrease leak of the instrument.

2. Sealing mechanism: The testing room is sealed. The permanent magnetic sealing.

Mechanism is adopted on the small caliber flowmeter(See picture 2).The partition (8) separates the active and passive permanent magnet (6) (7). Sensitivity Of the structure is high and seal is solid. Polytetrafluoroethylene plastic is used as packing seal for the big caliber fowmeter (See picture 3). The sealing lining (6) will be extended to seal by change of spring (7) compression through adjusting the nut(8). The structure is rather simple and convenient for adjustment.

3. Counting mechanism: It includes driving wheel speed ratio adjusting mechanism and recokoning mechanism. The total rotation number and speed of a pair of gears will be passed to the needle and wording wheel of recokoning mechanism(11).after speed changed caused by driving wheel. The total liquid volume and instant flux through the pipe will be known. Speed ratio adjusting mechanism is used for adjusting and correcting errors of instrument.

Oval gear flowmeter is installed electrical impulses signal transmitter in the counting mechanism of the DTO oval gear flowmeter.I.E. one permanent magnet disk is fixed on the transducer is installed on the counter. The transducer possesses merits such as long life, strong capacity of anti interference, wide working frequency, no spark, fearless of oil, grease and dust, small measurement, convenient installation. The solid testing signals can be got without contact when the magnet accesses to the induction surface with the action distances.

Permanent magnet driving block diagram of Model DTO flowmeter

Polytetrafluoroethylene seal driving diagram of Model DTO flowmeter

Main technical data

Basic errors allowance ± 0.5 (± 0.2)

Max working pressure(Mpa)1.6

Connecting flange of pipe GB2555-81

Viscosity of liquid (MPa.s) 0.6-250 (up to 2000mPa.s, Pease specify in order)

Temperature of tested medium -30-160

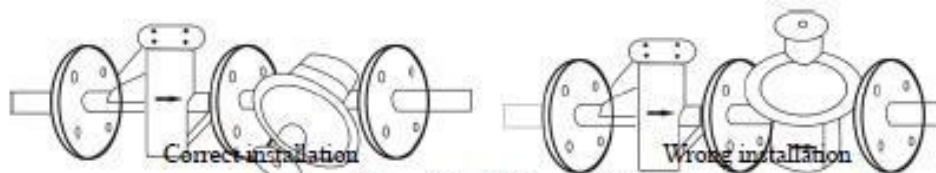
Specification of oval gear flowmeter and scope of flux

Technical data				
Type	Connection	Flow rate(L/H)		
		0.6~2map.s	2~8map.s	8~200map.s
DT-O-10	1/2"~3/8"	40~400	40~400	40~400
DT-O-15	Flange 4* Φ 14	380~1500	200~1500	150~1500
DT-O-20	Flange 4* Φ 14	750~3000	400~3000	300~3000
DT-O-25	Flange 4* Φ 14	1500~6000	800~6000	600~6000
DT-O-40	Flange 4* Φ 18	3000~15000	2000~15000	1500~15000
DT-O-50	Flange 4* Φ 18	4800~24000	3200~24000	2400~24000
DT-O-80	Flange 4* Φ 18	12000~60000	8000~60000	6000~60000
DT-O-100	Flange 4* Φ 18	20000~100000	13000~100000	10000~100000
DT-O-150	Flange 4* Φ 18	24000~120000	15000~120000	12000~120000

Note: When choosing at causticity medium, top discharge must reduce one third

Installation and usage

1. Installation shall keep the direction on the carcase of the flowmeter to be consistent with flow direction of liquid. Installation position shall be convenient for reading. (See picture 4)



Picture 4 Installation position

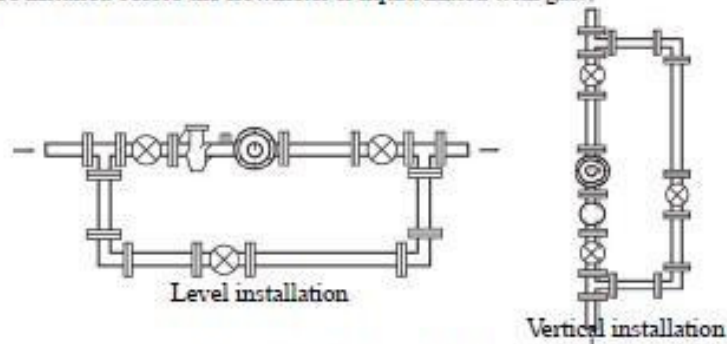
2. The flowmeter shall be installed in the normal temperature place without harmful gas and strong heat radiation to prevent the flowmeter from coming to harm.

3. The oval gear axis shall be in level position i.e. the dial shall be installed to the vertical position (graduation "0" shall be on the top) to decrease friction between oval gear and body and abrasion of spare parts. To be convenient for reading, the counter can be rotated to 90 degree or 180 degree according to the different installation position.

4. The pipes shall be completely washed before installation of flowmeter. The filter shall be installed before installation of flowmeter if filter no filter available to avoid impurity to the flowmeter.

5. The flowmeter shall be installed at the side of the pump's outlet while the flow regulating valve at the backward position of the flowmeter. First open the stop valve at the upper side, then open the flow regulating valve or stop valve slowly at the backward position. It is strictly prohibited to open or close suddenly.

6. When the flowmeter is using, the liquid shall be fully filled in the meter. No gas shall be mixed in the liquid or it won't be accurate to test with the gas and liquid mix cubage. The gas separator shall be installed before the flowmeter if liquid mixed with gas.)



Picture 5 Installation Position

7. Flow range in the pipe shall not be increased or decreased suddenly. Events shall be avoided such as shake of pipe, water hammer and sudden fluctuate of pressure etc. Or it will influence normal work of the meter.

8. Abrasion of the oval gear will be increased with high rotation speed if flux exceeds the max. flux limited. It can be used but errors will be big if the flux less than the min. flux limited. The starting flux is 2% around of the max. one. It's better that normal working flux is 70%-80% of the max. one.

9. Upon high viscosity liquid, it shall be heated to decrease viscosity first and flow in the

tube. When flowmeter, methods such as heating by steam outside the flowmeter to make liquid flow shall be done. The flowmeter can be used after liquid viscosity decreased. Or viscous liquid will "bite" driving parts and destroy the flowmeter.

10. Temperature of testing liquid shall not higher than limited one. If high, the flowmeter will stop to work. Change of temperature will cause additional errors of viscosity influence. Furthermore, crescent-shaped space will be large as increase of temperature and make flowmeter "walk slowly". If the testing room is made by cast iron while oval gear is cast aluminum, additional errors $+0.4\%/1000^{\circ}\text{C}$.

11. Each flowmeter will be marked by No.7 machinery oil under room temperature. Oil viscosity is 10 centipoise under normal temperature. If liquid viscosity difference is large comparing with it, double layer gear can be used to replace.

12. Hose sweeping steam and water is prohibited to flow in the meter.

Error adjustment

The basic min. and max. flow range error allowed is between $\pm 0.5\%$. The calculation of error is percentage comparing difference between accumulating flux showed and actual flux in standard container with actual flux.

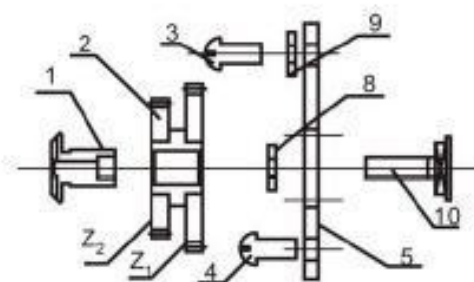
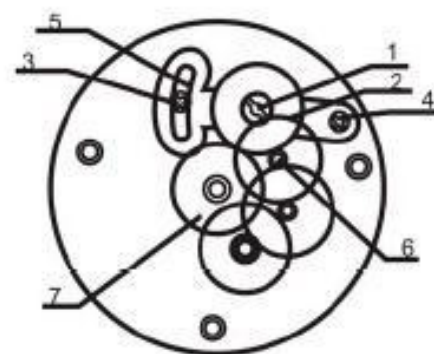
1. The standard of double layer gear designed is 38/35. If it is found the flowmeter runs fast when checking, it means "+" errors occurred. For example $+1.02\%$ (average error is $+0.66\%$). Referring to the error registration chart, replace the gears with the corresponding double layer gear 41/38 to decrease 0.62% error and change into $+0.4\%$ — -0.32% which is within the qualified scope.

2. Precision of flowmeter will be changed owing to gears' abrasion during usage and lead to ultra-error. It can be adjusted up to grade if error range is less than 1%. For example, if precision of meter declined to $+0.22\%$ — -0.64% (average error is -0.21%), first check number of teeth of original double gear. If it is 38/35, adjust as the above No.1. If it is 41/38 gear, corresponding error $+0.62\%$ shall be tread as 0, raise 0.21% to make error decline 0.21% and change into 0.41%. Referring to the error registration chart, replace 40/37 double layer gear. (Its error is 0.43% and it is most similar to 0.41%). The actual error will decline 0.19% after adjustment. Precision of meter is $+0.41\%$ — -0.45% within qualified scope.

3. Means to verify and adjust Grade 0.2 oval gear flowmeter is same as No. 1,2.

4. Take off out cover (No.9 in picture 2,3) first and loose axle sleeve(1) at the back of it (See picture 6, same below) and nuts(3),(4) replace and adjust gear(2), then turn adjusting board(5) to make adjusting gear and driving gear (6),(7) to joggle correctly, tightening axle sleeve and nuts.

Meter initial verifying results		Adjustment of gear's teeth	
first or second	error %	Z1 joggle with wear 7	Z2 joggle with wear 6
	2.63	39	35
	2.34	40	36
	2.06	41	37
	1.80	42	38
	1.55	43	39
	1.31	44	40
	1.09	45	41
	0.88	46	42
	0.74	35	32
	0.48	36	33
	0.23	37	34
	0.00	38	35
	0.22	39	36
	0.43	40	37
	0.62	41	38
	0.81	42	39
	0.99	43	40
	1.16	44	41
	1.32	45	42
	1.47	46	43
	1.54	31	29
	1.75	32	30
	1.95	33	31
	2.14	34	32
	2.31	35	33
	2.48	36	34
	1.63	37	35
	2.78	38	36
	2.92	39	37
	3.05	40	38
	3.17	41	39



- 1.axle sleeve 2.adjusting gear
3,4.nuts 5.adjusting board
6,7.driving gear 8,9.washer
10.bolt

Fault examination and clearing

Phenomena		Reason	Measures	Remark
1.Oval gear stops tuning		1.Impurity mixed in the meter and the oval gear blocked	Unpick and wash reinstall as marke on the oval gear.	New meter easy to happen,oval gear laied as marks.
		2.There is mixture in liquid tested,filter filled with impurity	Wash filoter and clear impurity	
		3.Pressure of liquid tested is too low	Increase pressure	
2.Oval tear turns while needle doesn't turn		1. Drive wheel blocked	Clear impurity aned add lubricant	
		2.Loose of gear riveting	Rereviet gear	
3.Joffling when needle turns back		Flux exceed th3e max. specified flux	Adjust the flux to specified value.	
4.Offinormal nloise during turning of oval gear		Flux exceed the max. specified flux	Adjust the flux to specified value.	
5.Needle reverse turn		Direction of flow is opposite to the arrow direction marked on the out cover.of meter	Unpick and reinstall according to the direction marked.	
6.Large error	Minus error	1.Flux less than min. specified valus.	Replace flowmeter with small caliber	
		2. Leakage of bypass	Check bypass to prevent leakage	
		3. Much abration of oval gear as long time usage	Replace adjusting gear as per change value of error	Buy adjusting gear to the manufacturer or send to repair
	Plus error	4.Gas included in liquid	Install gas separetor before meter and prevent leakage at the join of flange	
		5.Viscosity difference between liquid tested and verified	Replace adjusting gear as per change value of erro	Buy adjusting gear to the manufacturer or send to repair

Technological parameter of DTO flowmeter

1. Wire splice:

There are No.1,2,3 marks on connection plug. No.1,2 connects with 12VDC(No.1 with anode while No.2 with cathode) No.3 connects with input single of microcomputer

2. Technological parameter:

Working voltage: 12VDC

Life: 10^7 times

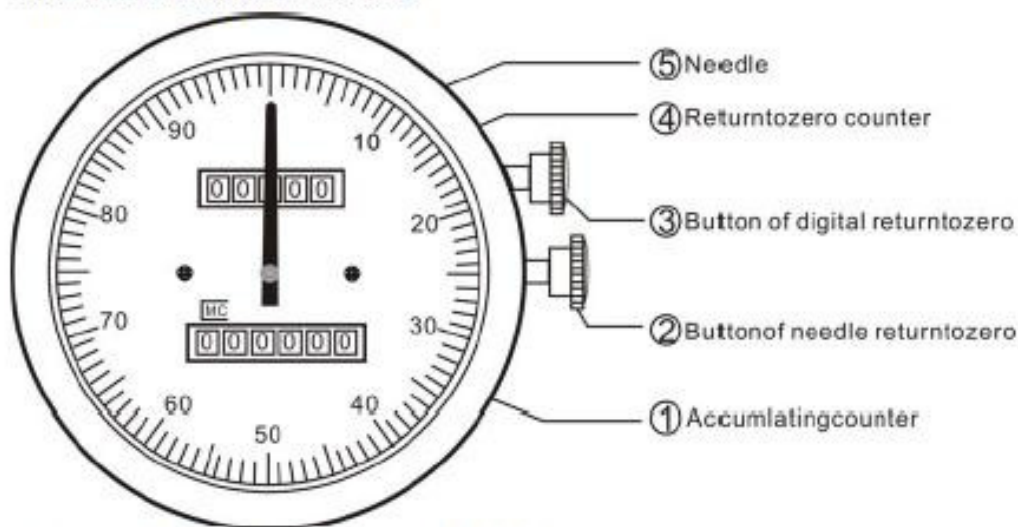
Working temperature: -10-+55C

working frequency: _pulse/Liter

Power: less than 90mW

Meter No:

Brief introduction of re-set flowmeter

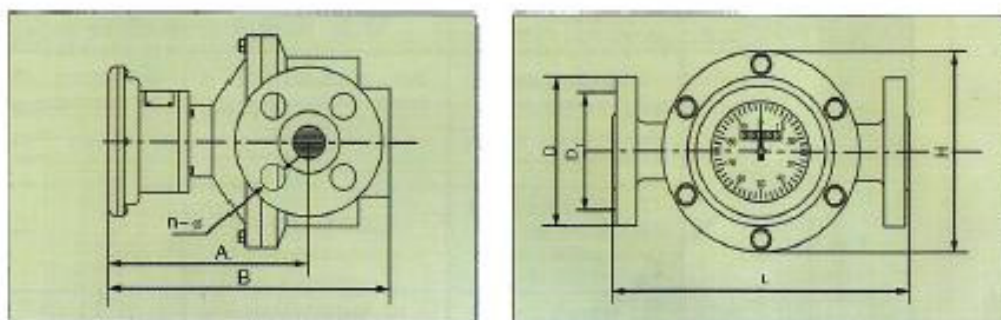


1-accumulating counter 2-button of needle re-set

2-button of digital return to zero 4-return to zero counter 5- needle

Return to zero flowmeter adds a set of zero adjustment counter on the DTO flowmeter. Turn (3) clockwise can make counter return to zero. Push (2) anticlockwise can make needle return to zero to make counter counting without influence of accumulating counter.

Profile and installation



DTD series oval gear flowmeter exterior size (cast iron\cast steel\stainless steel)

Model	Dg	L	H	B	A	D	D1	n-φ
DTD -15 -15	15	180	124	205	158	95	65	4-φ 14
DTD -20 -20	20	180	124	225	168	105	75	4-φ 14
DTD -25 -25	25	245	184	240	171	115	85	4-φ 14
DTD -40 -40	40	250	184	170	187	145	110	4-φ 18
DTD -50 -50	50	340	240	305	210	160	125	4-φ 18
DTD -65 -65	65	340	253	310	213	180	145	4-φ 18
DTD -80 -80	80	420	310	390	260	195	160	8-φ 18
DTD -100 -100	100	440	330	440	280	215	180	8-φ 18
DTD -150 -150	150	450	360	470	290	285	240	8-φ 22

LPG series filter exterior size

Model	Dg	L	H	B	D	D1	n-φ
LPG-15	15	150	95	130	95	65	4-φ 14
LPG-20	20	180	105	155	105	75	4-φ 14
LPG-25	25	180	115	160	115	85	4-φ 14
LPG-40	40	255	145	240	145	110	4-φ 18
LPG-50	50	305	165	295	160	125	4-φ 18
LPG-65	65	340	200	305	180	145	4-φ 18
LPG-80	80	360	212	350	195	160	8-φ 18
LPG-100	100	410	240	420	215	180	8-φ 18
LPG-150	150	495	370	520	285	240	8-φ 22

LCD indicator for Oval Gear Flowmeter

(4-20mA or 1-5V or pulse output)

1. Features:

- High reliability
- High accuracy
- Lower Power consumption
- Easy operation. Only 1 magnetic stick can do following jobs
To switch between instant flow / batch flow / total flow.
To reset batch flow to zero



2. Main Technical data:

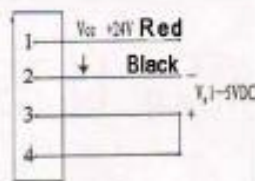
- LCD working conditions: -10°C - $+55^{\circ}\text{C}$
- Power consumption: during operation $<450\mu\text{A}$, during static status $<\mu\text{A}$
- Protection: IP54
- Anti-explosion: ibIIBT6
- Display range
Batch flow (resettable): P00000.00~P0000000 Liters (or cubic meters)
Instant flow: F00000.00~F000000L/M
Total Flow (not resettable): 000000.00~00000000 Liters (or cubic meters)
- Output signal
 - voltage pulse output: $V_{CC}=12\text{V}$ $V_L 0.5\text{A}$ $V_H > 11\text{V}$ see wiring figure 1
 - Current output: 4-20mA DC output, $V_{CC}=24\text{V}$ Load resistance 550ohm, see figure 2
 - Voltage output: $V_O 1-5\text{V}$ output, see figure 3



1-figure1



2-figure2



3-figure3

- Transmittance distance: 1KM. Please select RVVP4X28/0.15 4-core shielded cable with resistance less than 39ohm
- Outline figure

