

# NDM



## Rotary Gas Meter Installation and Operation Manual

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The NMT™ NDM Rotary Displacement Gas Meter is a positive displacement type of meter which, by means of two counter-rotating impellers and a counting mechanism, measures a known volume of gas with each rotation. As a result of years of development and experience, NMT™ has been able to provide a meter of unparalleled accuracy and turn down ratio. The construction of the meter and the materials used will give years of faithful service even under very demanding conditions. The special designed coupling guarantees flexibility in functionality for the future, since indexes and electronic switches can be replaced on-site with the meter in-line.

The purpose of this manual is to provide a general guide to the installation, operation and care of a standard NMT™ NDM Rotary Displacement Gas Meter. Every effort has been made to ensure that the information contained in this manual is as accurate as possible; however, the continuous improvements which NMT™ makes to its products may result in small inconsistencies. It is therefore prudent to consult the specific technical data sheets and other documents which accompany the meter. If in any doubt, NMT™ should be consulted.

### CONTENTS

1. GENERAL DESCRIPTION
2. RECEIVING, HANDLING AND STORAGE
3. INSTALLATION
4. MAINTENANCE
5. TROUBLE SHOOTING
6. TECHNICAL DATA

### APPENDIX

- A. Installation Flow Orientation
- B. Oil Fill location
- C. Pulse Output Info

### General Description

#### Operating Principle

The NDM Rotary Meter is a positive displacement type of meter, passing pre-determined volumes of gas by means of two counter-rotating impellers. Four times per each revolution a fixed unit of volume is displaced through the measurement chambers. The flowing gas volume is proportional with the number of revolutions of the output. The output of the NDM Rotary Gas Meter is a special designed magnetic coupling where one part is fitted inside the meter body and the associated part is in the read-out unit.

The typical a-symmetric design of the impeller tips allows considerable increased turn down ratios. Since the shape of the impeller tip is at least two times larger compared to conventional impeller tips, the unregistered leakage through the meter is significantly reduced resulting in an enlarged turn down ratio whereby the meter is still less sensitive to installation stress or dirty gas.

The robust design of the NDM is quite visible:

- the shape of the meter body
- the shape of the impellers
- the design of the main shafts and its bearings
- the material selected for the meter body
- the overall dimensions of the meter
- No bending, no twisting, no torque, no vibrations.

The bearings are placed on the outside of the timing gears, which allows the connection between the impellers and the timing gears to be much stronger than conventional type of rotor meters. Consequently, the meter is far less sensitive for improper start up.

The NDM series rotary meters are designed to provide maximum comfort for the user. All functions, like index, sight glass and oil filling plugs are accessible from the front side. This also makes it possible to install the meter with the back against the wall, and as such saving space in, for instance tightly constrained installations. The mechanical index is 100% sealed avoiding condensation and accumulation of moisture.

The NDM series of rotary meters are suitable for handling most types of clean, dry, common gases at either constant or varying flow rates. **The meter is not suitable for handling liquids.** Measurement accuracy and life expectancy can be impeded by excessive deposits of dirt or other types of foreign material present in the gas stream.

Meters of standard construction are not directly suitable for handling oxygen, acetylene, biogas or sewage gas.

## Rotary Gas Meter Installation and Operation Manual

---

The NDM Series have a Maximum Allowable Operating Pressure (MAOP) rating as indicated on each meters badge. Every meter is leak tested at the factory at 1.1 times its MAOP and the static pressure is tested at the factory at 1.5 times its MAOP. All in accordance to International Standards and Codes.

**Important: The maximum working pressure of a rotary meter is limited by casing design. Meters should not be installed where line pressure can exceed the Maximum Allowable Operating Pressure. Refer to the basic meter body name plate for the MAOP.**

The standard meter operating temperature range is -22°F to 140°F (EN12480 Class TC2).

Displaced volume measurement is completely independent of the gas specific gravity, temperature and pressure. Displaced volume can be easily converted to volume at Standard conditions for elevated pressure and varying temperature by application of the Basic or Ideal Gas Laws.

### Accessories

Various accessories such as volume correctors, pressure and temperature transmitters, etc. can be fitted to the NDM. When connecting these accessories, reference should be made to the instructions and other documents accompanying these products.

## RECEIVING, HANDLING AND STORAGE

NDM Rotary Meters are precision measurement instruments. Although of very rugged construction, reasonable care should be given during handling and storage.

At time of delivery:

1. Check the packing list to account for all items received.
2. Inspect each item for damage.
3. Record any visible damage or shortages on the delivery record.
  - File a claim with the carrier
  - Notify NMT™ or representative immediately
  - Do not accept any shipment with evidence of mishandling in transit without making an immediate inspection for damage and checking each meter for free rotation of the impellers. All new meters should be checked for free rotation after arrival since damage to internal working parts can exist without obvious external evidence.
  - Should any serious problems be encountered during installation or initial operation of the meter, notify NMT™ or representative immediately.

## Rotary Gas Meter Installation and Operation Manual

---

**Do not attempt repairs or adjustments, as doing so is a basis for voiding all claims for warranty.**

- If the meter is not tested or installed soon after receipt, store in a dry location. Leave the protective caps or tape installed at the meter flanges. The caps or tape will provide reasonable protection against atmospheric moisture.
- Do not add oil to the meter until after the meter has been installed in a permanent installation and is ready for service.
- When reporting a suspected problem, please provide the following information:
  - Your sales order number and/or NMT™ order number.
  - Meter model, serial number.
  - Description of the problem
  - Application information such as gas type, pressure, temperature and flow characteristics.

***Authorization for return is required for all NMT™ Products shipped to the Factory for repair, calibration, warranty, exchange or credit. To obtain authorization for return of NMT™ products purchased from an NMT™ Distributor or Representative, please contact the Distributor or Representative from whom the product was purchased.***

## **METER INSTALLATION**

**Reference Appendix A:** The NDM rotary meters may be installed in either a Top/Bottom Inlet (vertical) or a Side Inlet (horizontal) configuration. The preferred or recommended installation is top inlet in a vertical pipe line with gas flow downward. Although the design of the impellers tends to make the meter inherently self-cleaning, the top inlet mounting allows gravity to pass dirt, pipe scale, or other debris through the meter.

An additional recommendation is to install the meter in a side loop with a bypass adjacent to the main line. Piping should be solid and properly aligned. Eliminate piping strains on the meter body.

Do not install the meter lower than the discharge pipe run to avoid accumulation of condensate and foreign materials in the metering chamber. Use a Gasket Strainer or other V-type strainer upstream of the meter to remove liquids and foreign matter (pipe sealant, tape, weld slag, etc.) from the gas stream. **A 100 micron mesh screen(gasket strainer or equiv.) is recommended.**

Do not install a lubricated gas valve directly before a meter, as excess valve lubricant or other foreign material can stop impeller rotation.

If over-speed conditions occur, a restricting flow orifice plate should be installed 2 to 4 pipe diameters downstream of the meter outlet. Contact NMT™ for sizing.

## Rotary Gas Meter Installation and Operation Manual

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### Warranty does not cover over-speed conditions.

1) Before installing a meter:

Make sure the upstream piping is clean by partially opening the valve to let a sufficient amount of gas blow to atmosphere. Insure the impellers turn freely and no objects or contaminants are in the measuring chamber. Depending upon meter condition (for instance used meters), it may be necessary to flush the meter with an approved solvent. After flushing, drain all solvent from the front cover. Make sure the measuring chamber is clean and dry and the impellers turn freely.

2) Meter Orientation: *See Appendix A*

Connect meter inlet to the gas supply side of the line, insuring the gas flow will be in the same direction as the arrow on the meter body nameplate (i.e., arrow pointing downward for top Inlet). Turn the index in the required position.

3) Install the meter without piping strain to prevent a binding of the impellers. Use pipe supports, as required. Use necessary gaskets as required. Level the meter to within 0.25in/FT, side-to-side and front-to-back

4) Tighten flange bolts evenly in a cross-pattern. The flange bolts should intrude at least 0.625(5/8") into the meter and should have a maximum torque of:

5/8-11UNC: 30ft-lb  
3/4-10UNC: 40ft-lb

5) Connect connectors to the index according to the diaphragms accompanying the meter.

6) There is only one oil reservoirs in the NDM meter. Oil is shipped with each new meter in a quantity sufficient to fill the reservoir in either a Top Inlet or a Side Inlet configuration. *See Appendix B.*

7) Remove the filling plug in the front end cover. Slowly add oil to the end cover reservoir until the oil level is to the centre of the oil gauge (sight glass). *See Appendix B.* Oil capacities:

Meter Oil Capacity(ml)		15C/3M	5M	7M	11M	16M	23M	38M
Vertical		120	120	310	310	310*2	310*2	310*2
Horizontal		25	25	70	70	70	70	70

## Rotary Gas Meter Installation and Operation Manual

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### 8) Meter Start-UP

Slowly pressurize the meter in accordance with the following recommendations. Do not exceed 5 psig per second (35 kPa/second) maximum when pressurizing. Rapid pressurization can cause an over-speed condition which may damage the meter. Resulting damage is not covered by warranty.

- a) Open the bypass and outlet (downstream of meter) gas valves.
- b) Partially open the meter inlet gas valve until the meter starts operating at low speed. Throttling of the bypass valve may be necessary to initiate gas flow through the meter. Verify gas is flowing through the meter by watching for movement of index drum. If movement is present, go to step c). If the index drum is not turning, verify gas is being delivered to the meter. If gas is flowing to the meter inlet and meter is not moving, go to step e).
- c) Let the meter operate at low speed for several minutes. Listen closely for unusual scraping or knocking sounds.
- d) If operation is satisfactory, go directly to step f).
- e) If unusual sounds are present or the meter is not turning, stop the installation procedure. Slowly depressurize and vent all pressure from the meter set before checking for piping misalignment, piping strain, torsion, or other related problems. Once the problem has been resolved, repeat the start-up procedure beginning with step a).
- f) Gradually open the inlet valve until full line flow is passing through the meter and the inlet valve is fully open.
- g) Slowly close the bypass valve.
- h) Follow your company authorized procedure or common practice to leak test the meter and all connections. Soapy water and gas analyzers are commonly used for this procedure.

## MAINTENANCE

### Periodic Inspections:

Meters installed and maintained in accordance with the NMT™ recommendations can be expected to operate dependably for many years. Proper oil level and cleanliness have the greatest effect on meter life expectancy. The oil reservoir in the front cover should be visually inspected for proper mid-gauge oil levels twice a year. Add oil as necessary.

Use only Shell Morlina10 Oil or equivalent instrument grade oils approved for service by the NMT™. Oil change frequency will depend upon the cleanliness of the gas being measured. Change oil when the level increases significantly, indicating an accumulation of moisture. The NDM series of rotary meters require an oil change once every 5 to 10 years under favorable operating conditions.

## Rotary Gas Meter Installation and Operation Manual

### Cleaning and flushing:

If there is any evidence of dirt or dust in the meter a suggested method for removal is to windmill the impellers (at a speed less than the maximum capacity) by injecting controlled compressed air from a nozzle into the meter inlet. During wind milling the meter the preferred position is vertical with flow downward. Flush approximately 150 ml non-toxic, non-flammable solvent through the meter. Use compressed air to completely dry the meter.

## TROUBLE SHOOTING

During operation, irregular rotation or stoppage of the counter may indicate mechanical damage. Damage to the bearings, impeller or gears usually results in excessive noise and/or vibration.

If it is suspected that the problem is confined to the index, the index can be replaced while the line remains pressurized. Contact NMT™ or the NMT™ representative for the exchange procedures.

If an electronic output does not appear to work or does not agree with the mechanical readings, the electronic pulse box can be exchanged without removing the index. Contact NMT™ or the NMT™ representative for the exchange procedures.

Issue	Possible Cause	Remedy
No Flow Registered	<ul style="list-style-type: none"> <li>Obstruction in piping or meter.</li> </ul>	<ul style="list-style-type: none"> <li>Check piping, valves etc to assure an open flow path.</li> </ul>
Low volume registration	<ul style="list-style-type: none"> <li>Meter oversized for load.</li> <li>Leak at meter bypass.</li> <li>Meter internal friction.</li> </ul>	<ul style="list-style-type: none"> <li>Change meter size.</li> <li>Check bypass and valves.</li> <li>Buildup of deposits in measuring chamber – flush meter.</li> </ul>
High Differential	<ul style="list-style-type: none"> <li>Buildup of deposits in measuring chamber.</li> <li>Worn bearings or gears.</li> <li>Heavy oil.</li> <li>Impellers rubbing side plate or timing gears out of time.</li> </ul>	<ul style="list-style-type: none"> <li>Flush meter.</li> <li>Repair meter.</li> <li>Replace with proper oil.</li> <li>Check for binding or rubbing. Remove obstructions. Check for meter level.</li> </ul>
Vibration noise	<ul style="list-style-type: none"> <li>Piping misalignment or strain.</li> <li>Impellers rubbing casing.</li> <li>Contaminations in measuring chamber.</li> </ul>	<ul style="list-style-type: none"> <li>Remove piping strain.</li> <li>Level meter.</li> <li>Buildup of deposits-flush meter.</li> <li>Worn bearings or gears.</li> </ul>

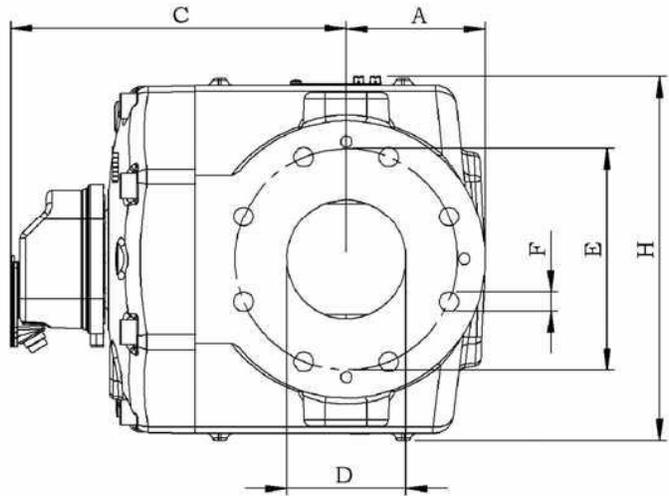
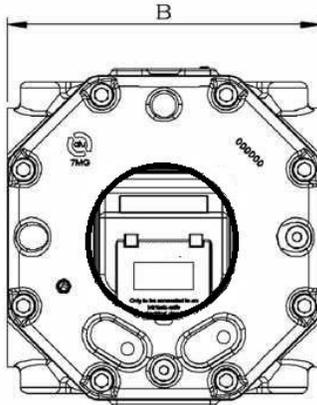
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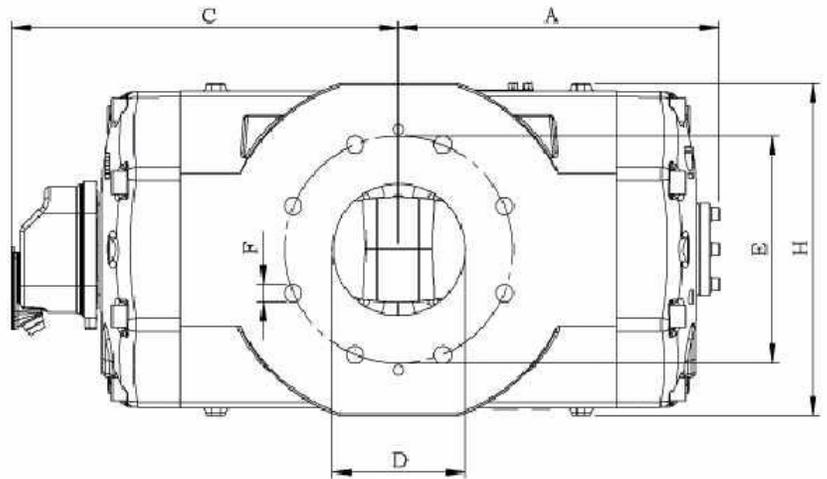
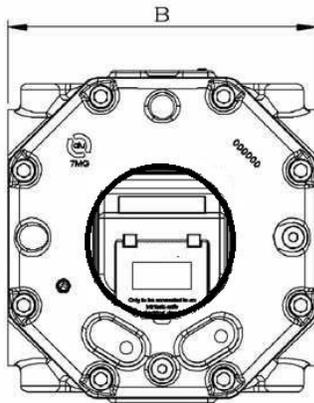
## Rotary Gas Meter Installation and Operation Manual

### TECHNICAL DATA

#### NDM 15C thru 5M



#### NDM 7M thru 38m



SIZE	A (in)	B (in)	C (in)	D (in)	E (in)	Bolt Qty	F (in)	H (in)	WEIGHT (lb)
15C	2.13	4.76	6.73	1.5" NPT	N/A	N/A	N/A	4.96	12
3M	3.35	6.75	7.48	2	4.75	4	5/8-11UNC	6.89	22
5M	4.06	6.75	8.74	3	6.0	4	5/8-11UNC	7.25	29
7M	4.02	9.5	9.49	3	6.0	4	5/8-11UNC	10.18	60
11M	5.16	9.5	16.5	4	7.5	8	5/8-11UNC	10.13	66
16M	9.65	9.5	12.01	4	7.5	8	5/8-11UNC	10.40	103
23M	9.65	9.5	12.01	6	9.5	8	3/4-10UNC	10.40	99
38M	12.4	9.5	14.37	6	9.5	8	3/4-10UNC	10.27	123

# NDM



## Rotary Gas Meter Installation and Operation Manual

SPECIFICATION	UNITS	15C	3M	5M	7M	11M	16M	23M	38M
Base Qmax	ACFH	1500	3000	5000	7000	11000	16000	23000	38000
Max. Operating Pressure	PSIG	85	290						
Temp Range	F	-22F to 140F							
Turndown Ratio		80:1	160:1						
Over Range Capability		25%							
Start Rate	CF	2.12	1.7655	2.4717	3.531	5.2965	21	22.75	24.5
Stop Rate	CF	1.41	1.05	1.7655	3.15	4.2	17.5	21	21
Differential 100% Flow	W.C.	0.80	0.81	0.89	1.10	1.58	1.82	1.82	2.04
Min CTR Reading	CF	1	1	1	10	10	100	100	100
Nom Pipe size	IN	1.5"NPT	2	3	3	4	4	6	6
Flange to Flange Dim	IN	4.76	6.73	6.73	9.5	9.5	9.5	9.5	9.5
Bolt Size	IN-UNC	N/A	5/8-11	5/8-11	5/8-11	5/8-11	5/8-11	3/4-10	3/4-10
ANSI Bolt Qty/ Flange		N/A	4	4	4	8	8	8	8
Bolt Torque	FT-LB	N/A	30	30	30	30	30	40	40
Meter Oil Capacity(ml)									
Vertical	ml	10	120	120	310	310	310*2	310*2	310*2
Horizontal	ml	8	25	25	70	70	70	70	70
Pulse Rate	CF	10	10	10	10	100	100	100	100
Net Weight	LB	12	22	29	60	66	103	99	123

# NDM



## Rotary Gas Meter Installation and Operation Manual

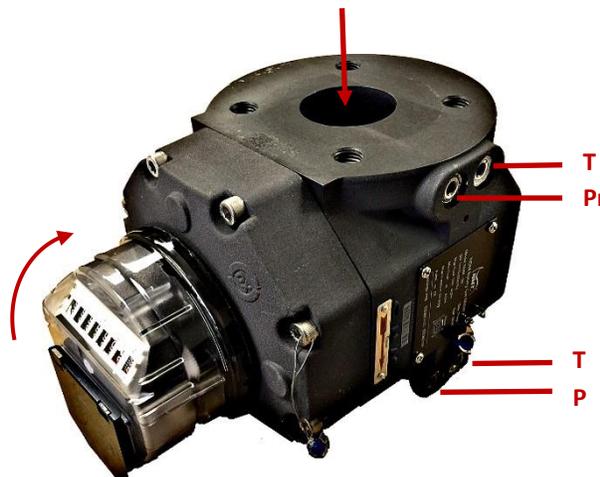
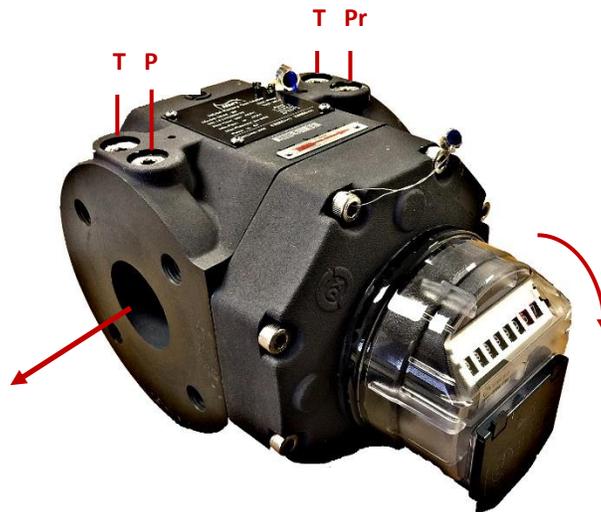
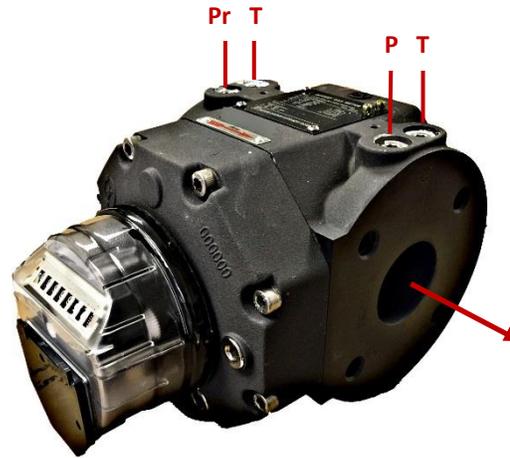
### APPENDIX

#### A) FLOW ORIENTATION

T = Temp Tap/Probe

Pr/P = Pressure Tap/Probe

*Arrow=Flow Direction*



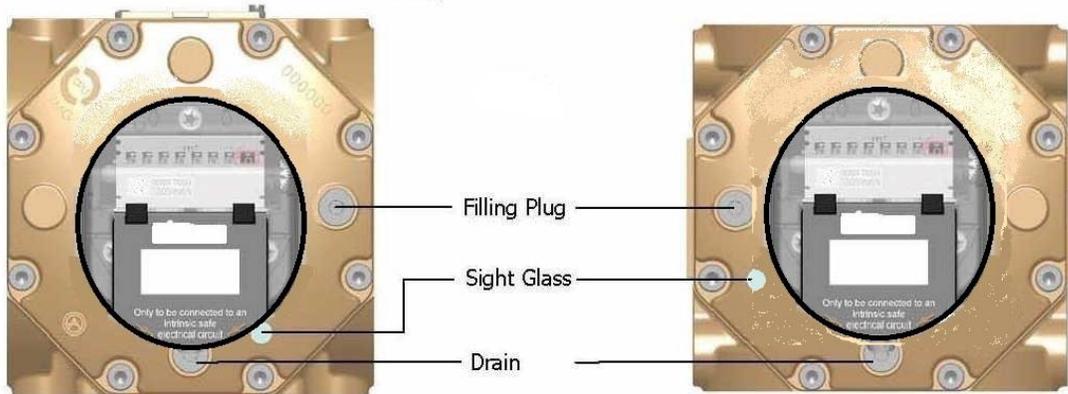
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## Rotary Gas Meter Installation and Operation Manual

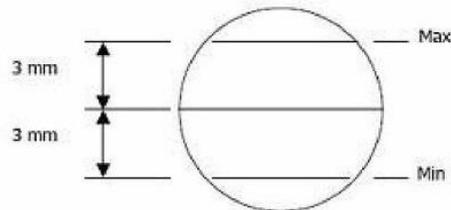
### APPENDIX

#### B) Oil Fill Locations



Horizontal position - Flow

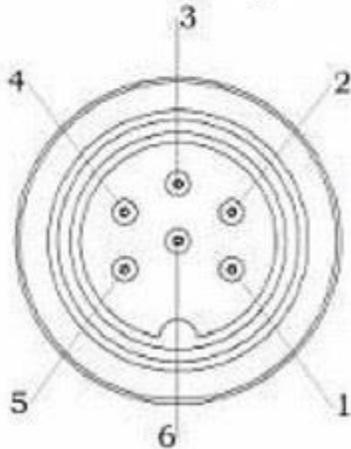
Vertical position- Flow



Meter Oil Capacity(ml)	15C	3M	5M	7M	11M	16M	23M	38M
Vertical	10	120	120	310	310	310*2	310*2	310*2
Horizontal	8	25	25	70	70	70	70	70

### APPENDIX

#### C) Pulse Output



#### Pulse Output Connector

- 1-4 RED/BLACK** *Pulse 1*
- 2-5 ORANGE/WHITE** *Pulse 2*
- 3-6 GREEN/BLUE** *Anti-Tamper*