



**KOREA MACHINERY-METER AND PETROCHEMICAL
TESTING & RESEARCH INSTITUTE**

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The receipt number: Liquid & Gas 2005-103

Issue Date : February 13, 2006

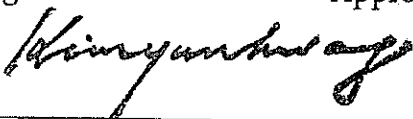
Certificate of Type Approval

① Company	Daesung Measuring Co.,LTD		② Telephone No	055-385-7894	
③ Representative	Choi Suk Hae Kim Young Tae		④ Citizen Record Number	351219-1055118 421002-1023317	
⑤ Applicant Address	289-22 Yangsan-Dong, Kyungnam Korea 626-230				
⑥ Description	Gas Meter	⑦ Model & Type	Diaphragm Gas Meter G4		
⑧ Application section	New Application	⑨ Application Date	05. 11. 4		
⑩ Test Item	⑪ Reference Value		⑫ Test Report	⑬ Result	⑭ Note
	- See Attachment -			Pass	
<p>The above test report is the accredited test result that it is in conformity with Type Approval Criterion(Korean Agency for Technology and Standards Notification 2005-681) in accordance with 9 Provision 2 Article in Enforcement Rule on Measurement</p>					

- Continuation -

Writer : Park Ho Young

Approval : Kweon Young Mum

President 

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TEST REPORT
FOR THE EVALUATION OF DIAPHRAGM GAS METERS

0 General

0.1 General information on the gas meter(s)

Model	Q_{max} [m ³ /h]	Q_{min} [dm ³ /h]	p_{max} [kPa]	V [dm ³]	Year of manufacture
G4	6.0	0.04	10	1.2	2005

Type of display : Mechanical 

Number of drums/figures : 8

Additional devices

- prepayment devices : no
- pulse generator : no
- number of output drive shafts : -

Built-in temperature conversion device : no

- one indicating device : -
- two indicating devices : -

0.2 Overall result of the pattern evaluation

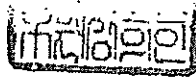
Overall result of pattern evaluation	+/-
1 Documents and meters submitted	+
2 General inspection	+
3 Initial performance test	+
4 Additonal devices	not applicable
5 Built-in temperature conversion device	not applicable
6 Endurance test	+

(*) mark + when the result meets the requirements of R6 and R31

mark - when the result does not meet the requirements of R6 and R 31.

Final result

OK



1 Documents and meters submitted

1.1 List of documents submitted (B.2.1.1)*

- Application overview
- Operation principle;
- Photographs;
- Parts lists;
- Parts cross section drawings with names;
- External appearance drawings with dimensions;
- Verification mark and sealing structure drawing;
- Display structure with adjustment function drawing;
- Essential parts;
- Meter marking;
- The list of documents submitted, are presented in the OIML certificate
- Safety declaration.

Declaration of conformity with safety regulations (R6, 11.3)

1.2 List of meters submitted (A.2.1.2)



$Q_{max}[m^3/h]$	Manufacturer's serial number
6.0	SAMPLE(01)
6.0	SAMPLE(02)
6.0	SAMPLE(03)
6.0	SAMPLE(04)
6.0	SAMPLE(05)
6.0	SAMPLE(06)

1.3 Meters and documents compatible (A.2.1.3) : Yes

2 General inspection

2.1 Inscriptions on the meters (B.2.2.1)

2.1.1 Display panel/data plate

- approval sign of the gas meter : not applicable
- maker's trade mark/ trade name : ✓
- serial number and year : ✓
- Q_{max} : 6.0 m^3/h
- Q_{min} : 0.04 m^3/h
- P_{max} : 10 kPa
- V : 1.2 dm^3
- t_m : -20/+60 °C
- P_m : not applicable

(*) References are to clauses of Recommendation R 31 unless otherwise stated.



2.1.2 Additional devices

- pulse generator : not applicable
- output drive shaft : not applicable

2.1.3 Conversion devices

- t_b : not applicable
- t_{sp} : not applicable
- P_b : not applicable

2.1.4 Other indications

- symbol " m^3 " : ✓
- flow direction indication : ✓

2.2 Check on location of sites of for verification and protection marks (A.2.2.2)

OK

2.3 Indicating devices(s), test element(s) (A.2.2.3)

Indicating devices(s), test element(s)	+/-
General construction	+
Test element	+
Diameter drums/dials	+
Reading of indicating device	+
Advance of figure	+
Removal of indicating device	not necessary

2.4 Reading of indicating device

Flowrate (appr. 0.1 Q_{max}) : 0.60 m³/h
 Air volume per measurement : 60 dm³
 Tolerance : 0.2 dm³
 Indicated volume (V_i) : See page 7 of 13
 Mean indicated volume
 $V_m = (\sum V_i)/30$: See page 7 of 13

$standarddeviation = \sqrt{\frac{\sum (V_m - V_i)^2}{29}}$: See page 7 of 13

Result



OK

Repeatability test (Meter no : SAMPLE(03))

Test No.	indicated volume V_i [dm ³]	$V_m - V_i$ [dm ³]	$(V_m - V_i)^2$
1	60.25	-0.143	0.021
2	60.25	-0.143	0.021
3	59.90	0.207	0.043
4	60.30	-0.193	0.037
5	60.30	-0.193	0.037
6	60.05	0.057	0.003
7	60.20	-0.093	0.009
8	60.20	-0.093	0.009
9	59.80	0.307	0.094
10	59.75	0.357	0.127
11	60.15	-0.043	0.002
12	60.30	-0.193	0.037
13	60.05	0.057	0.003
14	59.70	0.407	0.165
15	60.15	-0.043	0.002
16	60.15	-0.043	0.002
17	59.95	0.157	0.025
18	59.80	0.307	0.094
19	60.20	-0.093	0.009
20	60.10	0.007	0.000
21	60.15	-0.043	0.002
22	60.30	-0.193	0.037
23	60.10	0.007	0.000
24	60.10	0.007	0.021
25	60.25	-0.143	0.003
26	60.05	0.057	0.009
27	60.20	-0.093	0.029
28	60.35	-0.243	0.059
29	60.15	-0.043	0.002
30	60.00	0.107	0.011

Mean volume : 60.107 dm³
 Standard deviation : 0.17 dm³

3 initial performance test

Ambient conditons t = 20 ± 1 °C
 RH = 42 %
 P_{amb} = 106.5 kPa

3.1 Error curve (A.2.3.1)

Running in : 1m³ at 6 m³/h

Flowrate [m ³ /h]	Test volume [dm ³]	Errors [%] (Serial number :SAMPLE(01))						maximum difference [%]	
		1	2	3	4	5	6		
Q _{max}	820	- 0.4	- 0.4	- 0.4	- 0.4	- 0.4	- 0.4	0.1	
0.7Q _{max}	550	+ 0.2	+ 0.2	+ 0.3	+ 0.3	+ 0.3	+ 0.3	0.1	
0.4Q _{max}	400	+ 0.2	+ 0.4	+ 0.3	+ 0.3	+ 0.3	+ 0.3	0.1	
0.2Q _{max}	300	+ 0.5	+ 0.5	+ 0.6	+ 0.4	+ 0.5	+ 0.4	0.1	
0.1Q _{max}	200	+ 0.5	+ 0.6	+ 0.6	+ 0.4	+ 0.5	+ 0.4	0.2	
3Q _{min}	90	+ 0.4					+ 0.5		
Q _{min}	60	+ 0.0					- 0.2		



Flowrate [m ³ /h]	Test volume [dm ³]	Errors [%] (Serial number : SAMPLE(02))						maximum difference [%]	
		1	2	3	4	5	6		
Q _{max}	820	- 0.7	- 0.7	- 0.7	- 0.6	- 0.7	- 0.6	0.1	
0.7Q _{max}	550	- 0.1	- 0.3	- 0.1	- 0.2	- 0.1	- 0.1	0.2	
0.4Q _{max}	400	- 0.3	- 0.3	- 0.3	- 0.3	- 0.2	- 0.3	0.1	
0.2Q _{max}	300	- 0.2	- 0.2	- 0.2	- 0.2	- 0.1	- 0.1	0.2	
0.1Q _{max}	200	- 0.3	- 0.3	- 0.3	- 0.2	- 0.2	- 0.2	0.1	
3Q _{min}	90	- 0.5					- 0.4		
Q _{min}	60	- 2.0					- 2.3		

Flowrate [m ³ /h]	Test volume [dm ³]	Errors [%] (Serial number : SAMPLE(04))						maximum difference [%]
		1	2	3	4	5	6	
Q _{max}	820	- 0.3	- 0.5	- 0.5	- 0.4	- 0.4	- 0.5.	0.2
0.7Q _{max}	550	+ 0.2	+ 0.0	+ 0.1	- 0.1	+ 0.1	+ 0.0	0.2
0.4Q _{max}	400	+ 0.2	+ 0.1	+ 0.1	+ 0.1	+ 0.1	+ 0.0	0.2
0.2Q _{max}	300	+ 0.3	+ 0.3	+ 0.2	+ 0.2	+ 0.2	+ 0.1	0.2
0.1Q _{max}	200	+ 0.3	+ 0.3	+ 0.2	+ 0.2	+ 0.1	+ 0.1	0.2
3Q _{min}	90	+ 0.1					- 1.0	
Q _{min}	60	- 0.9					- 1.2	

Flow rate [m ³ /h]	Mean error of each meter [%]			MPE [%]	Result (+/-)
	001	002	004		
Q _{max}	- 0.5	- 0.7	- 0.4	± 1.5	+
0.7Q _{max}	+ 0.3	- 0.2	+ 0.0	± 1.5	+
0.4Q _{max}	+ 0.3	- 0.3	+ 0.1	± 1.5	+
0.2Q _{max}	+ 0.5	- 0.2	+ 0.2	± 1.5	+
0.1Q _{max}	+ 0.5	- 0.3	+ 0.2	± 1.5	+
3Q _{min}	+ 0.5	- 0.5	+ 0.0	± 3.0	+
Q _{min}	- 0.1	- 2.1	- 1.1	± 3.0	+

(*) MPE: maximum permissible Error

General result for error curve

OK

3.2 Average total pressure absorption at at 6 m³/h : 185 Pa

(B.2.3.2)



Tolerance : 200 Pa

3.3 Average total pressure absorption at 0.016 m³/h : 30 Pa

(B.2.3.3)

Result pressure absorption

OK

3.4 Constant temperature test (B.2.4)

Declared temperature range of the meters: -20/ +40 °C

The constant temperature test is performed with 1 meters at +20, +55 and at -15°C.

For each meter the measured errors are stated at mentioned temperature.

(Serial number : SAMPLE(03))

Metering temperature : - 15 °C

Flowrate [m ³ /h]	Test volume [dm ³]	Measured errors [%]	
		Error1 (decreasing flow)	Error 2 (Increasing flow)
Q _{max}	600	- 0.1	- 0.2
0.7Q _{max}	400	- 0.4	- 0.6
0.2Q _{max}	300	- 0.8	- 0.8

Metering temperature: + 20 °C

Flowrate [m ³ /h]	Test volume [dm ³]	Measured errors [%]	
		Error1 (decreasing flow)	Error 2 (Increasing flow)
Q _{max}	600	- 0.5	- 0.4
0.7Q _{max}	400	- 0.4	- 0.5
0.2Q _{max}	300	- 0.4	- 0.6



Metering temperature: + 55 °C

Flowrate [m ³ /h]	Test volume [dm ³]	Measured errors [%]	
		Error1 (decreasing flow)	Error 2 (Increasing flow)
Q _{max}	600	- 0.2	+ 0.2
0.7Q _{max}	400	+ 0.4	+ 0.5
0.2Q _{max}	300	+ 0.3	+ 0.4

Result

OK

4 Additional devices : Not applicable

5 Built-in temperature conversion device : Not applicable

6 Endurance test (7.2.3, 7.2.4)

6.1 Meters completely sealed : Not applicable; the test is performed at the premises of the MPI.

6.2 Test medium : natural gas

6.3 Ambient conditions at test site

Ambient temperature : 20 ±1 °C

Environmental classification : B

6.4 Data endurance test

Flow rate : 6 m³/h

Duration : 2 000 hours

Meter number	meter reading [m ³]		measured volume [m ³]
	at beginning	at end	
SAMPLE(01)	0	12000	12000
SAMPLE(02)	0	12000	12000
SAMPLE(04)	0	12000	12000

Date and time of termination endurance test : 2006. 2. 3 10:00



6.5 Final error curve

Date and time of determination of the error curve : : 2006. 2. 3 18:13

Serial number : SAMPLE(01)							
Flow rate [m ³ /h]	Test volume [dm ³]	mean error before endurance [%]	error after endurance test [%]	MPE [%]	Shift [%]	Maximum permissible shift [%]	Result ±
Q _{max}	820	- 0.4	- 0.5	±3	- 0.1	±1	+
0.7Q _{max}	550	+ 0.3	+ 0.3	±3	+ 0.0	±1	+
0.4Q _{max}	400	+ 0.3	+ 0.3	±3	- 0.0	±1	+
0.2Q _{max}	300	+ 0.5	+ 0.3	±3	- 0.2	±1	+
0.1Q _{max}	200	+ 0.5	+ 0.3	±3	- 0.2	±1	+
3 Q _{min}	90	+ 0.5	+ 0.2	- 6 + 3	- 0.3	-	+
Q _{min}	60	- 0.1	- 0.3	- 6 + 3	- 0.2	-	+

Serial number : SAMPLE(02)							
Flow rate [m ³ /h]	Test volume [dm ³]	mean error before endurance [%]	error after endurance test [%]	MPE [%]	Shift [%]	Maximum permissible shift [%]	Result ±
Q _{max}	820	- 0.7	- 0.5	±3	+ 0.2	±1	+
0.7Q _{max}	550	- 0.2	+ 0.1	±3	+ 0.2	±1	+
0.4Q _{max}	400	- 0.3	+ 0.2	±3	+ 0.4	±1	+
0.2Q _{max}	300	- 0.2	+ 0.2	±3	+ 0.4	±1	+
0.1Q _{max}	200	- 0.3	+ 0.1	±3	+ 0.4	±1	+
3 Q _{min}	90	- 0.5	- 0.1	- 6 + 3	+ 0.4	-	+
Q _{min}	60	- 2.1	- 1.7	- 6 + 3	+ 0.4	-	+

Serial number: SAMPLE(04)							
Flow rate [m ³ /h]	Test volume [dm ³]	mean error before endurance [%]	error after endurance test [%]	MPE [%]	Shift [%]	Maximum permissible shift [%]	Result ±
Q _{max}	820	- 0.4	- 0.4	±3	+ 0.0	±1	+
0.7Q _{max}	550	+ 0.0	- 0.1	±3	- 0.1	±1	+
0.4Q _{max}	400	+ 0.1	- 0.0	±3	- 0.2	±1	+
0.2Q _{max}	300	+ 0.2	+ 0.0	±3	- 0.2	±1	+
0.1Q _{max}	200	+ 0.2	+ 0.0	±3	- 0.2	±1	+
3 Q _{min}	90	+ 0.0	- 0.1	- 6 + 3	- 0.1	-	+
Q _{min}	60	- 1.1	- 1.0	- 6 + 3	+ 0.0	-	+

General result for error curve shift

OK

6,6 Pressure absorption at Q_{min} : 25 Pa
 Change : - 5 Pa

6,7 Average total pressure absorption at Q_{max} : 196 Pa
 Change : 11 Pa

