Figure 5.7.3-1 (for tank lorry).

CERAPAN PENGUJIAN TANGKI UKUR MOBIL (

Nomor : ..... / TUM / TUS / TUT / ..... /

Tangki ukur untuk — Merek kendaraan
Merek dan No. Serie — Nomor polisi
Pemakai Pemilik — Alamat
Tanggal pemeriksaan — Tanda tangan
P e m e r i k s a

A. Rata - rata suhu air dalam TUM (tl) adalah rata - rata suhu air dalam lubang TUM, tengah - tengah TUM dan dasar TUM ..... = ... ^{o}C

Rata - rata suhu air dalam takaran / Bejana ukur standar (t2) adalah rata - rata suhu air pada penakaran dengan bejana standar 1000 liter pertama dan terakhir ..... = ... ^{o}C

Perbedaan suhu ($\triangle$ t) = t 1 - t2 ..... = ... ^{o}C

B. Penakaran dengan Takaran Standar

No. Isian	Pengukuran termasuk koreksi takaran dengan waktu tetesan 10 sekon		Penunjukan pada salib ukur (mm)
	T a k a r a n	Jumlah Terusan	
			.....
1.	.....	.....	.....
2.	.....	.....	.....
3.	.....	.....	.....
4.	.....	.....	.....
5.	.....	.....	.....
6.	.....	.....	.....
7.	.....	.....	.....
8.	.....	.....	.....
9.	.....	.....	.....

C. Penakaran dengan Bejana Ukur Standar

No. Isian	..... L ± ..... mL waktu tetesan 30 sekon	..... L ± ..... mL waktu tetesan 30 sekon
1.	.....	.....
2.	.....	.....
3.	.....	.....
4.	.....	.....
5.	.....	.....
6.	.....	.....
7.	.....	.....
8.	.....	.....
9.	.....	.....
10.	.....	.....

Sisa lebih / kurang : L

Ditakar dengan takaran standar 20 L : ..... kali = ... L
Ditakar dengan Bejana ukur standar 1000 L : ..... kali = ... L +
..... L+
Volume yang ditakar (V) .... L-

Koreksi perbedaan suhu : $\triangle$ t X 0,24% x V = ... x ..... = ... L+

Volume kompertemen : L
Isi nominal seharusnya : ..... L-
S E L I S I H ..... : L

D. Indeks penunjuk terletak pada penunjukan salib ukur antara ..... dan ..... mm
Letak indeks penunjuk dari bibir lubang TUM :

..... + (..... - .....) = ... mm

E. Letak indeks penunjukan dari dasar tangki : ..... mm
F. Kepekaan disekitar indeks penunjukan : ..... mm / L = ... %
G. Isi ruang kosong = ... L
H. Isi cairan yang tertinggal = ... L
I. Letak Indeks : ..... depan / belakang

Catatan : 0,24 % adalah perbedaan koefesien muai kubik air pada 28 ^{o}C
dengan koefesien muai kubik bahan (plat baja) = 0,27 % - 0,03 %

Figure.5.7.3-2 (for flow meter)

Formulir
UAM. 3

(dengan meter arus induk)

METER ARUS : Pemilik : _____

Merek : _____ tipe : _____ Nomor Seri : _____

Kap maks : _____ Badan hitung : _____

METER ARUS INDUK Merek : _____ Tipe : _____ Nomor Seri : _____

Kapasitas maks. : _____ Kas. Penunjukan S_m (lihat sertifikat)

CAIRAN UJI _____

Koef muai kubik B = _____ % per 1 ^0C (lihat tabel)

No. Urut	Uraian	Rumus	Satuan	Pengujian ke		
				1	2	3
	METER ARUS					
1.	Kecepatan air	- -	1 / min			
2.	Tekanan	P_w	Kg / cm^2			
3.	Suhu cairan	t_w	^oC			
4.	Penunjukan Akhir	W_b	1			
5.	Penunjukan awal	W_a	1			
6.	Volum yang ditunjuk	$W = W_b - W_a$	1			
	METER ARUS INDUK					
7.	Tekanan	P_m	Kg / cm^2			
8.	Suhu	t_m	^oC			
9.	Penunjukan akhir	M_b	1			
10.	Penunjukan awal	M_a	1			
11.	Volum yang ditunjuk	$M = M_b - M_a$	1			
	HITUNGAN KESALAHAN METER					
12.	Akibat beda penunjukan	$S_1 = (\frac{w}{m} - 1) \times 1000$	%			
13.	Akibat beda suhu cairan	$S_2 = \frac{w}{m}(t_w - t_m)(\alpha - B)$	%			
14.	Akibat tekanan cairan	$S_3 = \frac{w}{m}(P_w - P_m) F$	%			
15.	Akibat kesalahan Meter induk	S_m (sesuai dengan kec. alir)	%			
16.	- Kesalahan penunjukan meter	$S_w = S_1 + S_2 + S_3 + S_m$	%			
	- Kesalahan penunjukan rata-rata...	$\frac{Sw}{3}$	%			
17.	Ketidak tetapan		%			

Hasil pengujian : Sah / Batal

.....
Di uji oleh :

CATATAN :

1. Koefisian muai kubik bahan meter arus diambil rata - rata 0.004 % (α)
2. Tabel :

Koefisian	muair cair	kompresibilitas
Jenis cairan	B (%)	F (&)
Bensin	1,108	0,012
Kerosine	0,090	0,009
Solar	0,072	0,006

_____
NIP.

5.8 Existing Facility and Equipment

5.8.1 DOM

1) Outline of facility

DOM was built in 1928 and designed to meet the requirement for the National Metrology Institute. The buildings were renovated in 1970s. The sections, which have to avoid the influence from outside (vibration, temperature, humidity, etc.), are located at the basement; however, the vibration from the expressway, constructed in front of DOM, may influence the accuracy of measuring equipment such as weight, length, etc. The utility of central air-conditioning system has been out of order for a long time. Because of this, many rooms use a common air-conditioner to control the temperature and humidity. Such air-conditioners are installed even in the weighing sections, including room of kilogram prototype, and the cold air from the air-conditioner directly blows the weighing equipment, which might influence the accuracy of measurement.

2) Outline of equipment

DOM has 14 laboratories to play a central role in the field of legal metrology in Indonesia (see Table 5.8.1-1). The laboratory units and equipment are listed in Table 5.8.1-2. Most equipment and facilities in each laboratory are obsolete. DOM is facing with the necessity of improving their equipment and facilities.

Table 5.8.1-1 Laboratory Unit in DOM

No.	Laboratory Unit
1	Gas meter
2	Comparator & Level gauge
3	Force & Pressure
4	Temperature
5	Density & Viscosity
6	Package
7	Mass
8	Water meter
9	Volume
10	Length
11	Balance
12	Electricity
13	Electric meter
14	Fuel oil meter

Table 5.8.1-2 List of Laboratory Equipment in DOM (year 2005)

No.	Item	Mark/Type	Quantity
1	Hydrocarbon Meter Test Installation		1 Unit
2	ATG Test Installation		1 Unit
3	Proper meter test installation		1 Unit
4	Gas meter test installation and household gas meter installation		1 Unit
5	Big Capacity Water Meter Installation		1 Unit
6	Small Capacity Water Meter Installation		1 Unit
7	Etalogyr Electric meter tester Test Installation		1 Unit
8	Meter Standard grade 1	Mo. X 27	1 pcs
9	Meter Standard grade 2	H	1 pcs
10	Meter Standard grade 3	G.Ba Koningh	1 pcs
11	Meter Standard grade 4	V Recker	1 pcs
12	Meter for work standard		1 pcs
13	Transversal Comparator		1 pcs
14	Comparator 20 m		1 pcs
15	Micro Indicator	JM Diets	1 pcs
16	Gauge Block	CE Johnson Sweden	2 set
17	Calibration Tester	Mitutoyo	1 set
18	Manometer Tester	Ruhaak	1 unit
19	Toolmakers Tester	Mitutoyo	1 set
20	Profile Projector	Mitutoyo	1 set
21	Micrometer Set	Mitutoyo	1 set
22	Bore Gage	Mitutoyo	1 set
23	Dial Indicator	Mitutoyo	2 set
24	OTT Flanimeter	Germany Type 30113	2 set
25	Spedometer tester	Kuramoto Keiki	1 set
26	Thermostat	Karl Kolb	1 set
27	Thermometer 1420	Broun	1 pcs
28	Spherometer	MEX KOHL	1 pcs
29	Taxi meter tester	Nishibi Keiki	1 unit
30	Niveau Fruper	E. Leybolds	1 set
31	Optical Paralel	Mitutoyo	2 set
32	PH Meter		1 pcs
33	Water Distilling apparatus		1 unit
34	Gas Hydrometer		1 unit
35	LPG Specific Gravity testing machine		1 set
36	Cviskometer tools		1 unit
37	Densimeter tools		1 unit
38	Flask Tester tools		1 unit
39	Mercury Barometer	IGA SINGER	2 unit
40	Weigh Balance		1 pcs
41	Master Meter for fuel oil	Avery Hardol	1 unit
42	Master meter complete with stainer and water eliminator	SMITH	1 unit
43	Portable Master meter	Avery Hardol	1 unit
44	Force Standard Block		1 set
45	Master Water Meter	Avery Hardol	2 pcs
46	3 Phase KWH meter tester	Metrablok Landisk cyr	2 unit
47	Accessories of 3 phase W-H meter tester	TVH 4-3	1 unit

48	Accessories of Portable 1 Phase W-H meter tester	TVG 1	1 unit
49	R S S meter	CFMF 3 E 1	1 unit
50	Precision Volt Meter		1 unit
51	Ultrasonic Thickness Tester		2 set
52	Precision Ampere Meter		1 set
53	Portable Frequency Meter	YEW	1 unit
54	Power Factor meter	YEW	1 unit
55	Digital Stopwatch	Hanhart Klceda	1 set
56	Power Meter	Gosen	1 pcs
57	1 Phase W-H Meter	AEG Puji electric	3 unit
58	3 Phase W-H Meter	AEG	2 unit
59	Direc anting electrical Recorder	YEW	1 unit
60	Multi tester	Kaise	1 unit
61	R L C Bridge	Philips	1 unit
62	Insulation tester	1010 T	1 set
63	Watt meter	Landis & Gyr TVZ 6.3	1 unit
64	Direc meter error indicator	TVK 4	1 unit
65	Telephone pulse meter	Sodeco	3 unit
66	Frequency meter	Mitsubishi electric Co	1 unit
67	Pulse meter tester	Wilten	1 unit
68	Portable DC Potentiometer	YEW/2727	1 unit
69	Portable 3 phase watt meter	YEW/2042	1 pcs
70	Portable 1 phase watt meter	YEW/2041	1 pcs
71	Transformer	KSB/A5 KPA	1 pcs
72	Mercury Column Manometer	KARL KOLB	2 pcs
73	Psychometer		1 set
74	Dial head micro meter	Mitutoyo	1 set
75	Hand + Dial micro meter		1 set
76	Oil Dead Weight tester 50 kg		2 set
77	Oil Dead Weight tester 30-330 kg		1 set
78	Pressure Generator	Keiki	1 set
79	Manometer Oil		15 pcs
80	Air Pressure Indicator 2 kg/cm2		1 pcs
81	Micrometer Indicator 0-25 mm		2 box
82	Proving Ring		1 set
83	Sphygmomanometer		1 pcs
84	Hardness Tester	Avery Dension	1 pcs
85	Thermometer Tester Tools		1 unit
86	Precision A meter Class 0.2		1 unit
87	Precision Volt meter Class 0.2		1 unit
88	Electric and Electronic Practice Tools		1 set
89	Pressure Gauge Calibration Tools		1 set
90	Level Gauge Tester Tools		1 unit
91	Tank lorry spare tools		1 set
92	Tire meter (complete with box)		5 unit
93	Theodolite Wild Type		1 set
94	Theodolite Kern Type		1 set
95	Electrical Standard meter		1 pcs
96	Oscilloscope		1 pcs

97	Electronic Watt meter		1 pcs
98	Installation for Flow Meter Calibration BI Directional		1 pcs
99	Standard Volume		1 pcs
100	Piston Gauge for LPG meter		1 pcs
101	Hydraulic force comparator		1 pcs
102	Repeatability Test		1 pcs
103	Pressure Standard		1 pcs
104	Climatic Chamber		1 pcs
105	End Gauge		1 pcs
106	Portable Electric Sub Standard Meter		1 pcs
107	Mass of 1 kg Class E 2		3 set
108	Mass of 1 kg class F 1		2 set
109	Set of Standard masses class E2 With BMN Cerf.		1 set
110	Set of standard masses class E2 with manufacture Certf.		1 set
111	Standard Volume Installation		1 pcs
112	Ultrasonic Washing Machine		1 pcs
113	Distillation moisture meter		1 pcs
114	Dual trace Oscilloscope		1 pcs
115	Decade Resistance Box		1 pcs
116	Digital Thermometer		1 pcs
117	Digital Multi-meter		1 pcs
118	Spart part & Training Sundries		1 set
119	Taximeter Calibration		1 pcs
120	Moisture Determination Balance		1 pcs
121	Rockwell Hardness Tester		1 pcs
122	Ultrasonic Thickness Meter		4 pcs
123	Stabilizer Trafo 3 Phase		2 pcs
124	Optical Plummet ZNL		1 unit
125	Universal Thermocouple Calibrator	ALTEX	1 unit
126	Measuring tank (capasity : 20 liter)		1 pcs
127	Automatic Dehumidifier		3 unit
128	Thermo hygrograph		3 unit
129	Digital Hygrometer		2 unit
130	Digital Barometer		2 unit
131	Comparator Electronic		1 set
132	Gauge Block class 0/A		1 set
133	Gauge Block class 1/B		1 set
134	Flat Optical (diameter 45 mm)		1 set
135	Flat Optical (diameter 60 mm)		1 set
136	Flat Optical (diameter 100 mm)		1 set
137	Plan Parallel Flat Optical		1 set
138	Fix Angle type Micrometer Standard		1 unit
139	Adjustment Angle Type Micrometer Standard		2 unit
140	Vertical type Micrometer Standard		1 unit
141	Granite Table		1 unit
142	Automatic Deku Modifier		1 unit
143	Thermo Hygrograph		1 unit
144	Mercury Thermometer		3 unit
145	Beaker (Capacity 10 liter)		1 pcs

146	Beaker (Capacity 20 liter)		1 pcs
147	Dry Block Calibrator		1 unit
148	Taxi Meter Tester Standard		1 unit
149	Hydro Test Chamber		1 unit
150	Decade Resistance Box	Yokogawa	1 unit
151	Precision Pressure Calibrator 1	Joprasyfen 1	1 unit
152	Precision Pressure Calibrator 2	Joprasyfen 3	1 unit
153	Multifunction Portable Calibrator	Scondwa B-20	1 unit
154	Portable Temperature Calibrator	Scondwa BL-0	1 unit
155	Mass Comparator	Meter Toledo	1 unit
156	Climatic Measurement Station	Klimet A 30	1 unit
157	Mass Comparator 30 kg/5 mg	Mettler Toledo	1 unit
158	Mass Comparator 52 kg/10 mg	Mettler Toledo	1 unit
159	Auto Collimator	Leica	1 unit
160	Ohm Meter Calibrator Verification	STDRES 1000	1 unit
161	Sound Level Calibrator	42 AA, 14 AA, RA 0014	1 unit
162	Lux Meter Calibrator	STDLIGHT	1 unit
163	Glass Filter	SRM 2034	1 unit
164	Measuring Tank Standard 5 L	Lokal	1 unit
165	Measuring Tank Standard 10 L	Meter Toledo	1 unit
166	Flask 2 L	Pyrex	1 unit
167	Gas Master Meter	Scandura	1 unit
168	Torch Tester	Tohnichi	1 unit
169	Roll Tester	Lokal	1 unit
170	Balance C for Verification	Lokal	1 unit
171	Pressure Measure Standard	Ametek	1 unit
172	Volume Determination	Mettler Toledo	1 unit
173	Picnometer	Mettler Toledo	1 unit
174	Mass Comparator AX 1005	Mettler Toledo	1 unit
175	Mass Comparator AX 64004	Mettler Toledo	1 unit
176	Digital Manometer	Yokogawa	1 unit
177	Mass Flow Meter Tester	Mettler Toledo	1 set
178	RTD Calibrator	Fluke 712	1 unit
179	PT censor class A		1 unit
180	TC Calibrator	Cat HS 5133	1 unit
181	S type TC censor		1 unit
182	Climatic Chamber WTB Blinder	KBF-115	1 unit
183	Meter Prover Tester		2 set
184	Digital Multi-meter	Cat TE-5075	1 unit
185	100 kVA meter Phoenix	PHK-VM-100	1 unit
186	AC Voltage/Current Standard	2041 A	1 unit
187	DC Voltage/Current Standard	VS-2701 C	1 unit
188	Thermo Hygrograph	THDX	5 unit
189	Thermometer	Fluke 51 S	5 unit
190	Hygrometer	CE-TH 103	5 unit
191	Strapping Tools	Lokal	2 set
192	Universal Testing Machine UEETM	AM-FM	1 unit
193	Digital Real Time Oscilloscope Easy Sonic		1 unit
194	pre-packaged goods Lab Tools		1 set

195	Gas Meter Tester		1 set
196	Big Capacity Water Meter Tester	UWE	1 set
197	k Portable Tester	ECON	1 unit
198	Glass Thermometer	BRAND	1 unit
199	Pressure Gauge	LOKAL	10 unit
200	Standard Tape Meter	LOKAL	2 unit
201	Laser Distillate	LEICA	2 unit
202	Ultrasonic Thickness Meter	TT-100	2 unit
203	Scanning Head	LOKAL	5 unit
204	Acid Rack	LOKAL	1 unit
205	Mass Comparator Printer	METTLER	1 unit
206	Wheatstone Bridge	YOKOGAWA	1 unit
207	Wood Master Moisture Meter	LUTRON	1 unit
208	Climatic Chamber Module	LUTRON	1 unit
209	Card Endurance Test	AUTRONICS	1 set
210	Moisture Meter Installation	EASY/KRAUTKRAMER	1 set
211	Gas Meter Verification Facility	INOVATIVE	1 unit
212	Transversal Measure	FLUKE	1 unit
213	Suseptometer	SARTORIUS	1 unit
214	Piston Phone	LUTRON	2 pcs
215	Oil Bath	Techne	1 unit
216	Truck Scale Roughness Tester	TAYLOR HOBSON	1 unit
217	Load meter		1 pcs
218	Fast Scale		4 pcs
219	Balance A for Verification		5 pcs
220	Balance B for verification		3 pcs
221	Balance C for verification		5 pcs
222	Balance D for verification		6 pcs
223	Parama Balance A		1 pcs
224	Parama Balance B		4 pcs
225	Parama Balance C		2 pcs
226	Parama Balance D		2 pcs
227	Parama Balance E		9 pcs
228	Substitution Balance		5 pcs
229	Substitution Parama Balance		1 pcs
230	Balance A for verification		1 pcs
231	Balance B for verification		1 pcs
232	Weight washer		1 unit
233	Semi micro electronic Parama Balance	Sartorius	1 unit
234	Electronic Parama Balance (Capacity 5.1gram)		1 set
235	Electronic Parama Balance (Capacity 5.1 gram)		1 set
236	Hydrostatic Balance		1 set
237	Electronic Balance	Sartorius Q A.60	1 unit
238	Analytic Balance	Metler Toledo	2 unit
239	Balance 6 kg / 10 mg	Mettler Toledo	1 unit
240	Balance 15 kg / 0.2 mg	Sartorius	1 unit
241	Balance 2100 g / 0.01 g	Sartorius	1 unit
242	Balance 16 kg / 0.1 g	Sartorius	1 unit
243	Balance 60 kg / 1 g	Sartorius	1 unit

244	Balance 150 kg / 2 g	Sartorius	1 unit
245	Balance 30 kg / 0.1 g	MBK 35 LA	1 unit
246	Analytic Balance	OHAUS	1 unit
247	Weight grade 2		2 pcs
248	Weight grade 3		28 pcs
249	Set of Standards Grade 3		2 pcs
250	Set of a.t Standards grade 3		2 box
251	Set of Standards grade 4		1 set
252	Set of Weights for work standard		1 box
253	Weight 10 kg (pernekel)		2 pcs
254	Weight 5 kg (pernekel)		2 pcs
255	Weight 2 kg (pernekel)		4 pcs
256	iron Weight 25 kg		280 pcs
257	Weight class E I		1set
258	Weight class F2		1 set
259	Weight class M1		2 set
260	Weight class M2		2 set
261	Weight class F1		1 pcs
262	Weight class F2		1 set
263	Weight class M1		1 set
264	Weight class F2		1 set
265	Weight class E1	Mettler Toledo	1 unit
266	Weight class E2	Mettler Toledo	1 unit
267	Iron Weight 25 kg	Lokal	1 unit
268	Mass Standard class E1	Mettler Toledo	1 unit
269	Mass Standard class E2	Mettler Toledo	1 unit
270	Mass Standard grade 2	Mettler Toledo	2 unit
271	Iron Weight Standard class M2	Local	1 set
272	Weight Corrosion Tester	HT-8052C	1 set
273	Balance D 50 gram for verification	Local	10 unit

5.8.2 Regional Verification Office

Fifty-four RVOs exist in Indonesia, and all have the equipment related to mass such as weight and balance. These offices must provide the verification services of weight and balance, water meter, taxi meter, volume of tank, etc. Most of their equipment has been installed and used for over twenty years, which exceeds recommended lifetime of the equipment. After the autonomy law, each Provincial Government which RVO locates is responsible for equipping RVO to have capability of meeting community needs. However, most Provincial Governments cannot allocate enough budget to RVOs which makes it difficult for RVOs to maintain the quality of service. To avoid this situation, LMS Center of Medan started to provide the standard 10L tank to the jurisdictional RVOs to replace the old standard tank. LMS Center of Medan plans to expand the scope of its support as follows.

The building size of RVOs varies according to scale of services, which is based on the community needs. The maintenance condition of the buildings is fairly good. Air conditioners are installed only in the laboratories, in which weight standard (E2 or F1 class), balance standard, and length standard are preserved. Air conditioners are general units that blow cold air, therefore the temperature and humidity are difficult to control.

5.8.3 MTC

MTC is the only metrology training center of in Indonesia. MTC became independent from DOM in 1992 and moved to away from DOM to its present location with a total land area of approximately 10,000m^2. The buildings that house the administration, classrooms, a multipurpose hall, and auditorium were constructed in 2002 and 2003.

Most MTC-owned equipment is old-fashioned and unsuitable for the training. Therefore, MTC sends trainees to DOM for practice in using certain equipment such as electric balance. MTC made the necessary facility/equipment list to improve the level of training and submitted it to the Ministry (see Table 5.8.3-1). According to MTC staff, the budget of Rp9 billion (about US$1 million) would cover the cost of purchasing necessary equipment.

Table 5.8.3-1 List of Necessary Equipment of MTC

No.	Name of Equipment
1	Mass measuring instrument and balance
2	Vertical cylindrical tank measuring instrument (TUTSIT)
3	Water meter
4	Basic physical measuring instruments
5	Measuring instruments with PC
6	PC and internet
7	Watt hour meter
8	Taxi meter with PC
9	Horizontal tank measuring instrument (TUM)
10	Gas meter with PC
11	Telephone pulse meter
12	Equipment for calibration and verification
13	Fuel dispenser
14	Measuring instruments for length and volume
15	Testing equipment for metal corrosion
16	Electronic measuring instrument
17	Height testing equipment
18	Measuring instruments for temperature and pressure
19	Testing equipment for pre-packaged goods
20	Simulation equipment for verification and re-verification
21	Equipment for machine processing

The crucial matter for MTC is a building condition. The study team found several cracks on the walls and pillars of all buildings. New MTC is located on the hillside and the ground has not been leveled sufficiently for construction. The foundation work of the building seemed to be the same method of general houses on the flat land according to the drawings. As a result, the walls and pillars have to support the heavy weight of building on the soft land, which led to the distortion of the whole buildings. This distortion may affect the utilities such as water supply, drainage and electricity of the buildings. The study team recognized that the eroded ceiling fell down in a room at the classroom building, because of the water leakage from the water pipe overhead. Although the study team did not check the building structure in detail, some of the

buildings appeared inappropriate for use for the training center of metrology. Therefore, when using them, it is recommended that the building conditions have to be carefully checked by experts.

The staff of MTC explained that they would purchase the neighboring land to extend the area of MTC (approx. 7,000m^2). MTC has already submitted the budget request to MOT for approval.