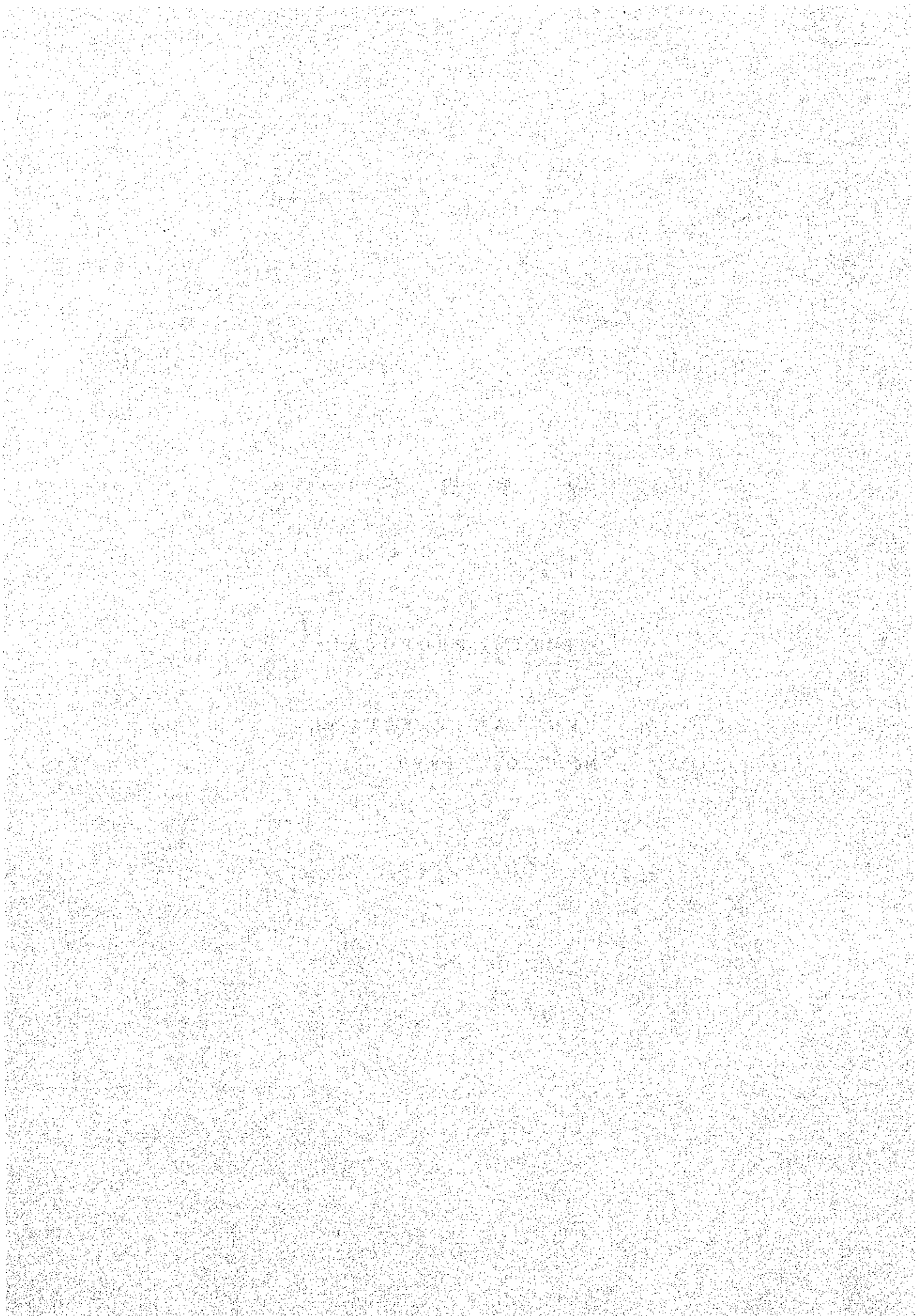


参 考 资 料

1. 新 SIRIM PROPOSAL
2. GENERAL CIRCULAR
No 1 OF 1979



参 考 资 料 1

新 SIRIM PROPOSAL

SUMMARY

DEVELOPMENT OF A NATIONAL METROLOGY
LABORATORY OF MALAYSIA
(REVISED)

CONTENTS

	<u>Page</u>
1. INTRODUCTION	51
2. ORGANIZATION	51
3. REQUIREMENTS	52
4. DETAILS OF PRECISION STANDARDS AND EQUIPMENT	53
5. CONCLUSION	33

1. INTRODUCTION

The National Metrology Laboratory of the Standards and Industrial Research Institute of Malaysia has the basic objectives of meeting the calibration, measurement and traceability requirements of the industry as well as the requirements of the metrication programme in Malaysia. The metrology facilities proposed here would form a basic infrastructure for industrial development.

With the rapid industrial growth of the country coupled with the recent production of petroleum and natural gases, the requirement for a full range of measurement and calibration facilities has increased tremendously. In addition to the metrological needs of the industry, SIRIM will require calibration and measurement facilities in the petroleum and gas industry. Additionally, SIRIM will require to develop capability in instrumentation to cater for the instrumentation needs of the industry.

The metrication programme requires the weights and measures system in Malaysia to be changed from imperial and local units to the metric units. The Weights and Measures Act enacted in 1972 and the weights and measures regulation were revised recently to cater for this change. SIRIM was appointed the custodian of weights and measures by the Minister of Trade and Industry to procure and maintain the national primary, secondary, tertiary and working standards of weights and measures such that the metrication conversion processes can be traceable to SIRIM and internationally.

This summary is to revise and up-date the original project paper formulated in 1979 under the heading 'Project paper on the development of a National Metrology Laboratory in SIRIM'.

2. ORGANIZATION

The Malaysian National Metrology Laboratory will have the organization as in the chart in Appendix A.

In brief the National Metrology Laboratory shall need to perform 4 major functions as follows:-

- i) Standards - establishment, realisation and maintenance
- ii) Calibration and measurement
- iii) Legal metrology
- iv) Instrumentation - design, fabrication and repair

These 4 functions will be serviced by 5 laboratories namely:-

- i) Electrical Metrology Laboratory
- ii) Mechanical Metrology Laboratory
- iii) Thermal Metrology Laboratory
- iv) Fluid Metrology Laboratory
- v) Reference material standards and other standards laboratory

The present Metrology Unit of SIRIM is being reorganized to function in accordance to the above organization chart.

3. REQUIREMENTS

The National Metrology Laboratory should provide instrumentation and technology for all calibration and measurements in the industry, as it will be a basic infrastructure for the development of industry.

Measurements and calibration services to the industries were initiated in Malaysia in 1972. This was initially carried out in a modest scale with the joint technical corporation programme involving ITIT and NRLM of Japan. With the Malaysian Government's programme for industrial development, the demand for the metrology increased tremendously. This is more so with the strict enforcement of the Weights and Measures Act 1972 and with the appointment of SIRIM as the custodian of weights and measures.

In 1979, SIRIM through the Economic Planning Unit of the Prime Minister's Department, applied to the Embassy of Japan for JICA Aid for the Project on the Development of a National Metrology Laboratory. This project was targeted to be completed by 1985. The revised breakdown is as follows:-

(i) Specialised Laboratory Building	=	M\$ 1.5 Million
(ii) Precision Standard and Equipment	=	M\$ 6.5 Million
(iii) Miscellaneous (fabrication, design, modification, etc.)	=	M\$ 1.0 Million
(iv) Operating Expenditure for 4 years	=	M\$ 3.0 Million
TOTAL:		<u>M\$12.0 Million</u>

The details of the Precision standards and Equipment required is given in Chapter 4.

The proposed revised development programme for the National Metrology Laboratory of Malaysia shall begin in 1982 and be completed in 1985. This

means that the programme shall be for a period of 4 years. The breakdown of expenditure required is as follows:-

No.	Year	1982	1983	1984	1985	TOTAL
1	Building	1,000	500	0	0	1,500
2.	Equipment	1,000	2,000	3,000	500	6,500
3.	Miscellaneous	200	400	200	200	1,000
4.	Operating Expenditure	600	690	790	900	2,980

In Units of \$1,000

4. DETAILS OF PRECISION STANDARDS AND EQUIPMENT

The National Metrology Laboratory of Malaysia shall require precision standards and equipment to an amount of 6.5 million. The precision standards and equipment required are in the various fields of studies.

The details are provided in the following appendices:-

Section 1: Electrical Metrology - Appendix B

Section 2: Mechanical Metrology - Appendix C

Section 3: Thermal Metrology - Appendix D

Section 4: Fluid Metrology - Appendix E

Section 5: Reference material - Appendix F
standard and other
standards

The requirements in each of the appendices are presented under 3 broad headings: -

- i) Standards
- ii) Measurement and Calibration service
- iii) Equipment

Under these broad headings, requirements of SIRIM for the next 4 years are also stated.

5. CONCLUSION

This project shall be completed by 1985. The equipment proposed in details in chapter 4 shall need to coincide with the building programme as indicated in the table in chapter 3.

The manpower requirements will also need to be developed co-ordinately. SIRIM will plan for this.

3. 計量機器販売商店 12月14日

(1) 新興磅秤商

ここは店名のとおり、はかりのみの販売会社である。店頭には秤量10kgまでの上皿手動はかり、手動指示はかり、秤量200kgまでの台秤等が多数並べられている。

(2) 新財利商店

ここは前者よりも大きく、機種もばね秤り、台秤り、天秤、上皿天秤等多種類が店頭に並べられている。

ばね秤りは、SALTER製、中国製、北東衡器製(日本国福島県)等のものであり、他にキッチンスケール、台秤が多数ある。高精度のものでは秤量200gの化学用天秤がある。

これらのはかり類は何も上記検定所の検査を受けているということである。

4. VANGUARD CO. 12月14日

マレイシアにおける横河電機の代理店で、工業計器、電気計測器の販売・修理・校正を行っている。この他GR、Torio、山菱、京浜電測器の製品も扱い、大学、工場、研究所へ納入している。

社員28名で、内3名が修理・校正の技術者であり、シンガポールにも支店を有する。

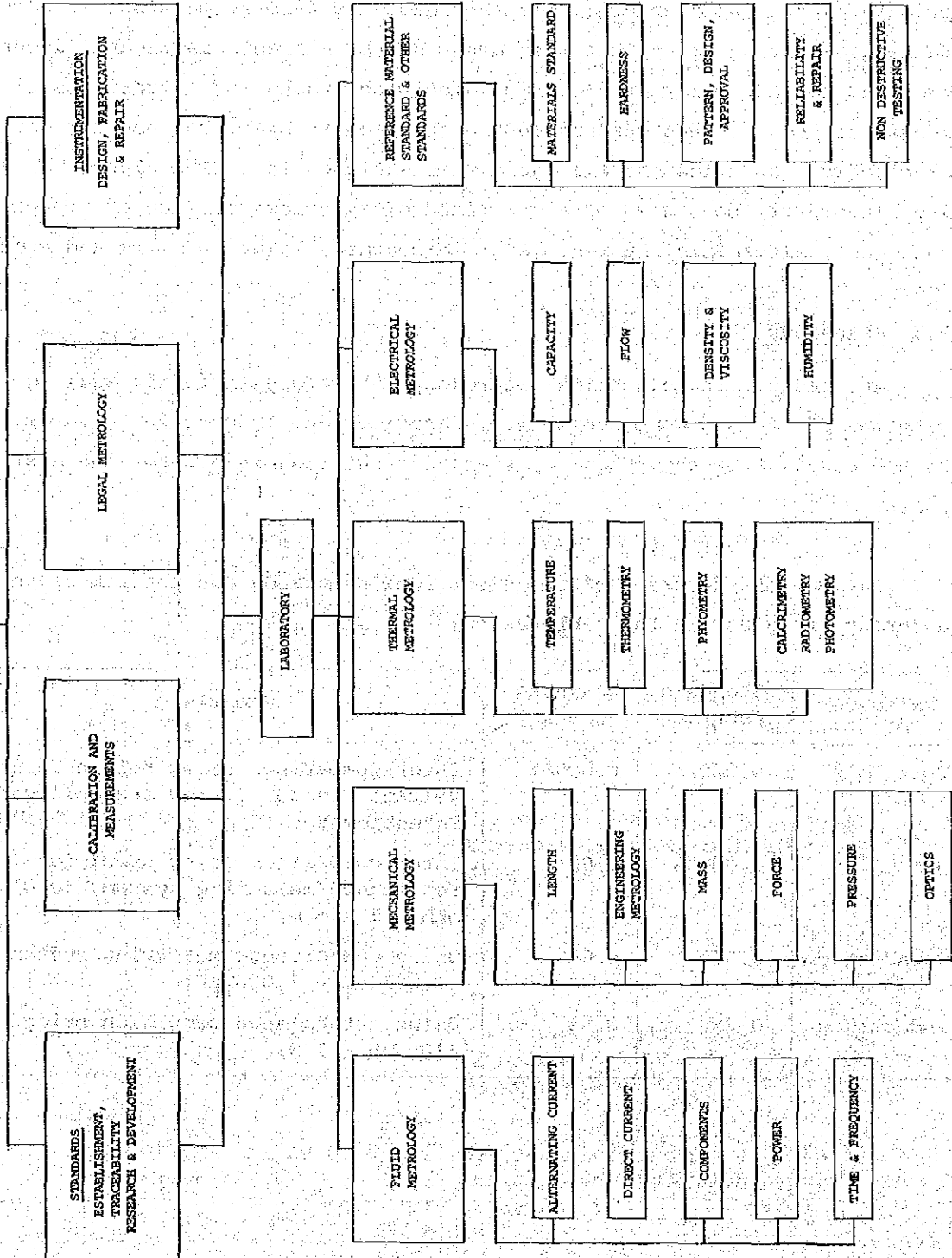
電気計測器はカタログ製品が中心で、ブリッジ、電位差計、標準電池、指示計器(V、A、W、Pf)、抵抗箱、メガー、テスター、電気温度計の他、最近ではデジタル計測器の販売も増加している。サービスショップには、DC、ACの電圧電流標準器、抵抗箱、デジタル温度計、圧力計、GRのLCRメータを備え、修理・校正を行っている。修理品としてはレコーダが多い。特にトレーサビリティはなく、YEWの付した値をそのまま使用している。部品も同時に販売しているので、修理のサービスは良好である。YEW製は長期使用の可能な点で評判が良い。また、サービスエンジニアの定着の悪い点について苦情を開かされた。

5. ジョホールバル州計量検定所 12月19日

この検定所はクアラランブルと比較すると整備されている。すなわち、敷地も官庁舎の一階で前者に比し広く、計量標準機器類も多品種があり、精度的にも良く、職員も数名が居る。

機器としては、体積標準器が1、 $\frac{1}{2}$ 、 $\frac{1}{4}$ ……ガロン、格納箱入りの組立式天秤1kgが2台、長さ標準器兼検査器として全長1mの、ヤード・メートル両系共用のもの、分銅は20kg枕型メッキ分銅25個、56ポンド分銅25個等があり、検査個数も前者に比し多い。

NATIONAL METROLOGY LABORATORY OF MALAYSIA



SECTION 1: Electrical Metrology1.1 Introduction

The electrical metrology laboratory is responsible in maintaining the national primary standard in electrical. Besides maintaining the national primary electrical standard, this laboratory is also responsible in maintaining measuring electrical instrument of the highest practicable accuracy required for all relevant electrical metrology tasks and concern itself with modern methods of measurements and calibration in practical use for electrical/electronic industries and all the government agencies. The electrical metrology laboratory consisted of a few field of measurements such as Direct Current (DC), Alternating Current (AC), Components, Power and Time and Frequency.

1.2 Standards

At present, the electrical metrology laboratory is fairly well equipped with the DC, AC and Components (i.e. Capacitor and Inductor) standards. As to the power, time and frequency standards this is planned for the next 4 years.

The present accuracy of the electrical standards and their measure accuracy are given in the table below:

Parameter	Standard Accuracy	Measured Accuracy	Remarks
Volt	0.0002%	0.0006%	Inter comparison using Kelvin Varley voltage divider system and sullivan Potentiometer
Ohm	0.0005%	0.001%	Inter comparison using precision resistance measuring system, (0.01 ohm - 1 K ohm)
Capacitance	0.05%	0.08%	Using Capacitance measuring system (0.001 uF - 1,000 pF)
Inductance	0.2%	0.5%	Using autobalance precision bridge (100 uH - 1 H)

Expected accuracy required of the electrical standards within the next 4 years.

Parameter	Standard Accuracy	Measured Accuracy	Remarks
Volt	0.0001%	0.0002%	A few set of standard cells and Precision Direct Current Comparator Potentiometer are required.
Ohm	0.0001%	0.0002%	Reference Standard resistor of various values required.
Capacitance	0.01%	0.04%	Precision Capacitance measurement system and reference standard capacitor are required.
Inductance	0.1%	0.2%	Precision inductance bridge and reference inductor are required.
Frequency	10^{-11}	10^{-10}	Frequency standard and the relevant equipments are required.

1.3 Services

The present status of measurements with the present calibrating measuring equipment that can be achieved and also the future status of measurements projected for the next 4 years are given in the table below:

Parameter	Range	Precision of Measurement	
		Present	5 years time
DC Volt	1 V - 1.1 KV (Source)	KV 0.003%	The range of measurement should be extended to 25 KV with accuracy of about 0.01%
	1 V - 1.5 KV (meter)	KV 0.005%	
DC Current	1 - 10 A (source)	0.08%	The range of measurement should be extended to 100 A with accuracy of about 0.01%
	1 - 300 A (meter)	0.03%	
AC Volt	1 mV - 1.1KV (source)	0.01%	The range of measurement should be extended to 5 KV with accuracy of about 0.01%
	1 mV - 1.1KV (meter)	0.05%	The range of measurement should be extended to 10 KV with accuracy of about 0.01%

Parameter	Range	Precision of Measurement	
		Present	5 years time
AC Current	100 UA -10A (source)	0.08%	The range of measurement should be extended to 100 A with accuracy of about 0.01%
AC Current	0 - 50 A (meter)	0.05%	Increase the range and accuracy to about 100 A and 0.01% respectively.
Power	1 mW to 100KW (DC)	-	The accuracy should be about 0.03%
	1 mW to 100 KW (AC) (5 Hz to 2 KHz and unity p.f)	-	The accuracy should be about 0.1%
Frequency	100 KHz, 1 MHz, 5 MHz	-	The accuracy should be about 1 in 10^{11}
	10 Hz - 18 GHz	-	The accuracy should be about 2 in 10^8

1.4 List of Equipment

To upgrade and to extend the range of measurement and calibration capabilities in the laboratory and also to set up power, time and frequency standard in the laboratory, the following equipments are required.

DC, AC and Components measurements

No.	Description of item	Quantity
1	Reference standard Cell	12 pcs.
2	Reference Standard Resistor 1 ohm Thomas Type	3 pcs.
3	Standard Resistors 0.001 ohm - 10 M Ohm	17 pcs.
4	High Resistance Standards 10^8 - 10^{12} ohm	5 pcs.
5	Hamon Transfer Standard 1 - 100 ohm	1 unit
6	Mega ohm Bridge (10^{14} ohm)	1 unit
7	Constant Temperature oil bath ($\Delta T = 0.01^\circ C$)	1 unit

No.	Description of item	Quantity
8	Precision Direct Current Comparator Potentiometer	1 set
9	Potential Transformer	1 unit
10	Precision AC/DC Current Calibrator (~ 100 A)	1 unit
11	Reference Standard Capacitors 10 pF - 0.1 uF	10 pcs.
12	Precision Capacitance - measurements system	1 set
13	Standard Inductor 10 mH - 1 H	6 pcs.
14	Precision Inductance Bridge	1 unit
15	LCR digital meter	1 unit

Equipment required for the preliminary set up of power measurements

No.	Description of item	Quantity
1	Single phase Watt Meter Calibration system	1 set
2.	Standard DC Watt Meter	3 units
3.	Standard AC Watt Meter	3 units
4.	Digital power factor meter	2 units
5.	Standard Watthours Meter (single phase, three phase)	4 units

Equipment required for the preliminary set up of Time and Frequency Standards

No.	Description of item	Quantity
1.	Cesium Beam Frequency Standard	1
2.	Quartz Oscillator	1
3.	Frequency divider clock	1
4.	Linear Phase Comparator	1
5.	Strip Chart Recorder	1
6.	Electronic Counter	1
7.	Vector Voltmeter	1
8.	Time Comparator	1
9.	Frequency Difference Meter	1
10.	VLF/LF Tracking Receiver	1
11.	HF Receiver	1

Section 2: Mechanical Metrology

2.1 Introduction

The Mechanical Metrology Section will be responsible for the maintenance of standards and providing measurement and calibration services in the following areas; Length, Engineering Metrology, Mass, Force, Pressure and Optics. The main activities of the Section include meeting the needs of the Weights & Measures Act, providing measurement and calibration services for load proving and testing devices, length, dimensional and optical measurements to both the industries and government department.

2.2 Standards

The Section is at present fairly well equipped in the area of mass standards while some basic standards and equipment are available in the other areas mentioned above. The present measurement capability of the Section is as follows:

Area	Stds. Accuracy	Measuring Accuracy	Remarks
Length	1×10^{-5} (Line Std)	± 0.05 mm	Precision linear scale comparator not available yet.
	$\pm 0.03 \sim \pm 0.08$ μ m (End Stds)	± 0.05 μ m	Measurement with Electronic Gauge Block comparator.
Engineering Metrology	-	± 1 μ m	Measurement on horizontal Universal Measuring Machine
Mass	5×10^{-7}	± 0.05 mg $\sim \pm 20$ g	Range: 1 mg \sim 1 tonne
Force	0.025%	0.05 \sim 0.1%	Comparison with Std. Proving Rings
Pressure	-	0.01%	Calibration against Dead Weight Pressure Gauge Tester
Optics	Not available		

In view of the appointment of SIRIM as the Custodian of Weights & Measures and the rapid industrial development which the country is now going through an increase in the needs for more varied and precise measurement and

calibration services is anticipated. The table below indicates the major standards and calibrating equipment that will be required within the next 5 years to meet the above needs.

Area	Stds./Equipment	Accuracy	Remarks
Length	1 m Line Scale and Comparator	1×10^{-6} or better	The comparator is urgently required for the calibration of line scales.
	Laser Interferometer	1×10^{-7} or better	A versatile system for measuring length, angles, straightness and flatness if recommended.
	Electronic gauge block comparator with digital readout	$\pm 0.02 \mu\text{m}$	
	10 m Length Bench provided with a 10 m std. tape and two movable micrometer microscopes	$\pm 0.2 \text{ mm}$	Urgently required
	Sets of dial gauges and micrometers	0.001 mm - 0.01 mm	
Engineering Metrology	3 - Coordinate Universal Measuring Machine ext. measuring range at least 200 mm	$\pm 1 \mu\text{m}$	For the precision measurement and comparison of gauges, diameters, threads and tapers.
	Roundness and Straightness Measuring Machines and Recorders		Measurement of Roundness and Straightness
	Surface Roughness Measuring Machine		Measurement of Surface Roughness
	Profile Projector - screen diameter 300 mm, magnification 10M to 100M		Inspection of machine parts, gears, threads, etc.

Area	Stds./Equipment	Accuracy	Remarks
Mass	Direct Reading Balances - 20g, 200g, 500g, 1kg and 5kg	Semi micro or better range	Precision calibration of weights up to 5 kg
	Double Pan Equal-Arm balance - 50 kg	± 100 mg	Calibration of weights and weighing
	Standard Platform Scales - 50 kg and 250 kg	± 10 g	Calibration of weights and weighing
Force	Proving Rings - 50 kH, 270 kH, 600 kH, 1200 kH and 2700 kH	0.01%	Calibration of load proving devices
	Dead weight Machine 10 kN and 50 kN	0.005% or better	Calibration of load proving devices up to 50 kN
	Proving Rings - 200 kN, 500 kN, 1000 kN, 2500 kN	0.1%	Calibrating standards for load verification machines.
	Universal Calibrating Machine 1000 kN	0.01% or better	Calibration of load proving devices
Pressure	2,500 kg/cm ² dead weight tester	0.1%	Calibration of pressure gauges
	Precision manometer - 1,500 mm Hg	0.004%	Precision measurements of pressure to 2 atm.
Optics	Precision goniometer	$\pm 0.0001/$ ± 0.5 seconds of arc	Measurement of refractive index in the visible spectral region and angles.
	Autocollimator	± 0.5 seconds of arc	Measurement of angles
	Interferometer	$\pm 1/50$ fringe	Measurement of flatness

2.3 Services

As can be observed above no attempt is made to acquire the Hrpton-86 Primary Standard for length yet and the focus shall be on the 1 m Primary Standard Scale to an accuracy of 1×10^{-6} with a conventional comparator fitted up with two visual microscopes. An electronic gauge block comparator with a digital readout is acquired for the calibration of end standards. With the further acquisition of a laser interferometer system it is anticipated that the needs for length measurements for the next five years can be fully met.

The acquisition of the 3 coordinate Universal Measuring Machine and Profile Projectors provide the necessary immediate facilities needed for dimensional (engineering) metrology. Further equipment like the Surface Roughness Tester, Roundness and Straightness Measuring Machines are anticipated to be of greater need towards the later part of the 5 year project.

Based on the present requests and enquiries from industries it is felt that a series of proving rings of accuracy 0.01% together with the related calibrating machines are required for the calibration of rings and other load proving devices. A set of lower accuracy rings has also been planned for purchase to supplement the existing rings we have to be mainly used for the calibration of load verification testing machines. For the calibration of smaller precision rings up to 5 tonne (50 kN) two deadweight machines will be needed. Requests for the calibration of pressure gauges mainly from the construction industries have prompted us to plan for the purchase of some deadweight pressure gauge testers. A precision manometer will also be required for the precision measurements and comparison of pressure up to 2 atm pressure.

The demand for optical measurements at the present is rather low. Nevertheless some basic optical equipment such as a precision goniometer, autocollimator and interferometer will be acquired for the anticipated requirement for the measurements of refractive indices, angles and flatness.

SECTION 3: Thermal Metrology

3.1 Temperature and Thermometry

3.1.1 Introduction

The temperature laboratory basically started off with a set of mercury-in-glass thermometers suitable for calibration between 0°C to about 250°C. At present the laboratory has acquired a platinum resistance sensor, a platinum versus platinum - 10% rhodium thermocouple and a set of mercury or mercury-amalgam in glass thermometers for all its temperature calibrations. Presently temperature calibrations range from -50°C to about 1100°C. Facilities for calibration above 1100°C are not available due to lack in instrumentation.

3.1.2 Standards and Services

The present and projected temperature laboratory facilities are as given below:

(a) PRESENT CAPABILITY

Capability	Limit of Accuracy	Equipment	Remarks
Mercury in glass thermometry	$\pm 0.01^\circ\text{C}$	One set of mercury in glass standard thermometers ranging from -50°C to 600°C	-
Platinum Resistance Pyrometry	$\pm 0.1 \text{ mk}$	One 25 ohms platinum resistance sensor	Calibration performed using 100 ohms std. resistor and DVM
Thermocouple Pyrometry	$\pm 0.15\%$	One Pt. Vs. Pt 10 Rh Thermocouple	Calibration performed using DVM as readout device
Fixed-Point Temp. Stds.	$\pm 0.1 \text{ mk}$	3 sets of Triple Pt. cell of water.	-

(b) PROJECTED CAPABILITY

Capability	Limit of Accuracy	Equipment	Remarks
Mercury in glass thermometry	$\pm 0.01^{\circ}\text{C}$	Two sets of mercury in glass thermometers ranging from 0 to 600°C . Two sets of mercury in glass thermometers ranging from 0 to -100°C .	Field std. temp. thermometers. For low temp. comparison.
Platinum Resistance Pyrometry	$\pm 0.1 \text{ mk}$	2 x 25 ohms nom. platinum resistance sensor. 2 x 100 ohms nom. platinum resistance sensor. High Precision Thermometer Bridge Assembly (Muellor Bridge) D.C. Null Detector Strip chart Recorder Portable Platinum Resistance Thermometer	For low temp. calibration.
Thermocouple Pyrometry	$\pm 0.25\%$	High Precision Six-Dial Potentiometer D.C. Null Detector DC Constant Voltage supplies Thermocouple wires (noble metal type)	
Optical Pyrometry	$\pm 0.5 \text{ k}$ $\pm 1 \text{ k} - 10 \text{ k}$	High Precision Micro-Optical Pyrometry bench with tungsten filament lamp. Portable Optical Pyrometer	
Temperature Comparators	-	Water bath ($0-100^{\circ}\text{C}$) Oil bath ($100-200^{\circ}\text{C}$) Salt-bath ($250-400^{\circ}\text{C}$) Thermocouple furnace Fluidised Sand Bath Temperature Controllers	

Capability	Limit of Accuracy	Equipment	Remarks
Fixed Pt. Calibration	-	Metal Fixed Pts. Oxygen Pt.	
System Support Equipment	-	Calculators and peripherals. Cabinets and enclosures Oscilloscopes and accessories Precision Power supplies Data Loggers Vacuum Pumping System Vacuum Measuring System Cryogenic Facilities Workshop Machines and tools.	
Miscellaneous	-	Thermocouple wires Type, J, K, E, T, S, R, B. Quartz Thermometer Thermocouple insulators and sheaths. Cryogenic Facilities	

3.2 CALORIMETRY, RADIOMETRY AND PHOTOMETRY

3.2.1 Introduction

At present there are no facilities for any of the activities mentioned above. However statutory regulations on photometry and radiometry have made it necessary for this laboratory to be set up such that reliable results can be available to the interested scientific and public authorities.

3.2.2 Standards and Services

The following table depicts briefly the needs of this laboratory for satisfactory calibration and standardisation.

PROJECTED CAPABILITY

Capability	Limits of Accuracy	Equipment	Remarks
Luminous Intensity	$\pm 0.01\%$ for d.c. operation	Photometer bench photo electric photometer Reference Std. Tungsten Lamp. Stabilised Power supplies.	
Luminous Flux	$\pm 0.1\%$	Integrating sphere Photo electric Photometer Stabilised Power supplies.	
Colour Temp.	-	Photometer bench Lummer - Brodhun Visual Photometer Temperature conversion filters Reference Std. Lamps.	
Applied Photometry	-	-	Calibration of photometric, photo electric equipment in terms of luminous intensity, flux, luminance, illuminance etc.

Section 4: Fluid Metrology

4.1 Prover and Fluid Flow Metrology

4.1.1 Introduction

This section shall be responsible for the accurate determination of prover volumes in accordance with established practice of calibrating prover tanks.

Furthermore such provers shall be installed to prove fluid flow meters of various sizes for petroleum as well as water calibration services.

4.1.2 Standards

The present and project prover and fluid flow capabilities are as listed below:

(a) PRESENT CAPABILITY

Capability	Limits of Accuracy	Equipment	Remarks
Prover calibration Facility	$\pm 0.02\%$	1, 2, 5, 10, 20 seraphin cans. 50 l std. tank.	Seraphin cans gravimetrically calibrated and adjusted on a 200 mg double arm balance.
Gas Meter Proving Facility	$\pm 0.5\%$	Wet-type gas meter Dry-type (diaphragm)	Calibrated in house using 50 l tank.
Master Meter Prover (Petroleum)	$\pm 0.02\%$	Smith's 4" P.D. meter ATG compensated.	Uncommissioned due to lack of supporting infrastructure.
Master Meter Prover (water)	$\pm 0.05\%$	Oval 1" and 2 1/2"	- do -

(b) PROJECTED CAPABILITY

Capability	Limits of Accuracy	Equipment	Remarks
Prover Calibration Facility	<u>+ 0.02%</u>	50, 100, 200 l stainless steel std. tank	Portable calibration tanks. Also useful for small water meter verification.
Meter prover Facility	<u>+ 0.05%</u>	Prover tank 3,000, 5,000 liters. Centrifugal pump. Air eliminator/strainer Temp. sensors and indicators and data acquisition loggers. Storage vessel. Miscellaneous flow control valves etc.	For calibration of petroleum meters
Gas Meter Prover	<u>+ 0.03%</u>	Bell Prover	
Water Meter Prover	<u>+ 0.1%</u>	Prover tank 5,000 liters. Pumps and other accessories.	
Waste Water Calibration Facility	<u>+ 1%</u>	Weirs and flumes	For open channel flow calibrations.

4.1.3 Services

The present prover calibration make exclusive use of the one 50 litre stainless steel standard tank for all prover calibrations which for large provers is tedious to be used. Although the seraphin cans can be utilised for most of the small prover calibrations in the laboratory it is recommended that secondary standard tanks be acquired for liquid calibration of tanks in field use.

The meter proving facility projected shall be basically used to prove master meters in the laboratory to obtain the maximum calibration accuracy which can be attained under laboratory proving conditions. Similar facilities shall also be installed for public water service meters. A master water calibration facility is also envisage in relation to pollution control act.

4.2 DENSITY AND VISCOSITY METROLOGY

4.2.1 Introduction

The laboratory has a set of standard hydrometers ranging from 0.6 - 2.000 gm/ml. A set of Cannon-Fenske viscometers are also available in the laboratory for the determination of dynamic and kinematic viscosity.

4.2.2 Standards

The following items listed are available for density and viscosity calibrations.

(a) PRESENT CAPABILITIES

Capability	Limits of Accuracy	Equipment	Remarks
2.1.1. Standard Hydrometer	± 0.0005 g/ml	Hydrometers from 0.600 to 2.000 g/ml	-
2.1.2 Standard Viscosity Fluid	$\pm 0.1\%$	Cannon-Fenske Viscometers	Provided with standard viscosity fluids.

(b) PROJECTED CAPABILITIES

Capability	Limits of Accuracy	Equipment	Remarks
2.1.3 Standard Hydrometer	± 0.0005 g/ml	API Hydrometers Thermo hydrometers constant temp. bath (0 - 100°C). Density bottles thermometers	
2.1.4 Viscosity calibration.	$\pm 0.1\%$	Const. temp. bath thermometers calibration fluid.	

4.2.3 Services

The present dynamic and kinematic viscosity standard fluids range from 0.004 to 1.778 Pa.s. and 0.000005 to 0.002 m²/s consecutively. This capability is quite adequate for the present and future needs of viscosity

calibrations. However it is envisaged that the petroleum industry will be in need of standard viscometer calibrations for crude oil and other petroleum products. Also API hydrometers and thermo hydrometers shall be needed for density calibrations.

4.3 HUMIDITY AND MOISTURE MEASUREMENT

4.3.1 Introduction

In humidity and moisture measurement, the basic problem is the identification and quantification of the water (as vapour or liquid) associated with a second gaseous, liquid or solid substances. At present the facilities for humidity and moisture measurement are not available except for normal relative humidity measurements of atmosphere using the wet and dry hygrometer.

4.3.2 Standards and Services

The following facilities are projected to be required for humidity and moisture measurements as listed below:

(a) PROJECTED CAPABILITIES

Capability	Limits of accuracy	Equipment	Remarks
3.1.1 Hygrometry	+ 0.30	Dew-pt hydrometer Pneumatic bridge Aspirate Psychrometer Coulometric Hydrometer Humidity generators Gravimetric and olumetric humidity measurement.	

The instruments used for humidity moisture measurement purchased shall depend on the principle of the humidity and moisture measurements adopted. The following are broad classification of measurement of humidity and moisture measurements.

- (a) Classification of humidity measurements
 - (i) Removal of water vapour from a moist gas
 - (ii) Addition of water vapour to saturate gas
 - (iii) Absorption of water vapour by a sensor
 - (iv) Measuring physical property of a moist gas
 - (v) Vapour-liquid or vapour-solid equilibrium
 - (vi) Chemical reactions or procedures

- (b) Classification of moisture measurements
 - (i) Removal of moisture from a material
 - (ii) Measuring physical property of material
 - (iii) Nuclear methods
 - (iv) Chemical reactions or procedures
 - (v) Equilibrium vapour pressures
 - (vi) Thermometric methods

- (c) Absolute Method of moisture measurement
 - (i) Gravimetric method
 - (ii) Conlometric method
 - (iii) Titration
 - (iv) Distillation

4.4 VOLUME CALIBRATION

4.4.1 Introduction

The present capability of the section is confined mainly to capacity measurements by gravimetric and volumetric methods, using distil water as the calibrating medium. Volumetric comparisons are carried out using a set of standard glass wares in the form of pipettes and burettes, measuring cylinders and flasks. Gravimetric volume measurements are also done frequently using the density of water and employing a precision double arm balance or automatic single pan precision balance.

4.4.2 Standards

The tables below depicts the present and future capabilities of the section.

(a) PRESENT CAPABILITIES

Capability	Limits of Accuracy	Equipment	Remarks
4.1.1 Volume Calibration (glass wares)		Standard burette assembly - 100 and 200 ml. Flask 1 - 20 l	Gravimetric method of calibration approx. $\pm 0.02\%$
4.1.2 Volume Calibration (brass measures)	$\pm 0.05\%$	1, 2, 5, 10 20 l brass measures.	Volume adjusted and calibrated gravimetrically.

(b) PROJECTED CAPABILITIES

Capability	Limits of Accuracy	Equipment	Remarks
4.1.3 Volume Calibration (glass wares)	-2×10^{-4}	Standard burettes standard pipettes standard flask micro pipettes butyrometer	
4.1.4 Volume Calibration (brass and stainless steel vessels.)		100, 200, 300, 500 ml. 1, 2, 5, 10, 20 l	

4.4.3 Services

Presently the volume laboratory (below 50 l) is actively involved in calibration and verification of glass wares and capacity measures in accordance with the Weights and Measures Act. The rapid development of this section is required in terms of equipments of similar ones presently used to cope up with laboratory as well as field calibrations and verifications.

Section 5: Reference Materials Standard and Other Standards

5.1 Introduction

This section is relatively a new field which will be developed in the next four years. Essentially, it will cover the following:-

- (i) Materials Standard, hardness and other related standards
- (ii) Pattern, design and approval of new weighing and measuring equipment used for trade purposes under the Weights and Measures Rules and Regulations
- (iii) Reliability and repair of precision equipment and instruments
- (iv) Non-destructive testing

5.2 Standards

- (a) Since this is a new section there are no standards or precision equipment available in the laboratory except for a Rockwell Hardness Tester and the associated standard test blocks.
- (b) Under the pattern, design and approval of weighing and measuring instruments, there are no particular requirements for equipment as well as standards because the standards and equipment available in other laboratories can be made use of.
- (c) The reliability and repair of precision equipment is essentially used as a supporting service and will in general require equipment used for maintenance and workshop purposes.

The following equipment will be required in the next four years: -

Area	Stds./Equipment	Use
Hardness	Standard Vickers Hardness Standard Tester and associated standard test blocks	For determining the hardness of material
	Standard Brienell Hardness Standard Tester and associated standard test blocks	For determining the hardness of material
	Standard Micro Hardness Tester and associated standard test blocks	For determining the hardness of material
Instrumentation	A complete laboratory for repair, fabrication, reliability testing etc. of instruments especially electronic type.	

5.3 Services

The services to be rendered are mainly connected with instrumentation. As electronic instruments are now predominantly used in all types of measurements, the repair maintenance, reliability aspects becomes of importance. It is proposed here that SIRIM establishes an instrumentation laboratory with the necessary expertise to be built up to serve the industry.

参考資料 2

2. [GENERAL CIRCULAR NO.1 OF 1979]

(Sulit BPE 40/100/9 Vol. III.)

KERAJAAN SERI PADUKA BAGINDA
MALAYSIA

GENERAL CIRCULAR NO.1 OF 1979

TERMS AND CONDITIONS FOR FOREIGN EXPERTS SERVING IN MALAYSIA

I. Introduction

The purpose of this Circular is to revise the existing terms and conditions provided to foreign experts in Malaysia. This revision is necessary in the light of experience gained in the past years and to effect general improvements in the administration of technical assistance programmes as a whole. This Circular will thus supersede General Circular No.1 of 1969.

2. The provisions of this Circular will come into effect as from 1st January, 1979 and will be applicable to experts recruited and assigned to Malaysia after this date. Experts assigned to State Governments, Public Authorities and other Agencies such as Malaysian Industrial Development Authority, Federal Agricultural Marketing Authority, Malaysian Industrial Development Finance Limited, University of Malaya etc. will be governed by the provisions of this Circular. The payment of allowances and other remuneration to experts so assigned will be the responsibility of the respective agencies.

II. Definition and Categories of Technical Assistance Experts or Projects

3. In general, the term 'expert' in this Circular refers to suitably qualified and experienced personnel provided under the Colombo Plan and other bilateral programmes to carry out specific assignments requested by the Malaysian Government. The terms of this Circular will not be applicable to those experts for which separate agreements between the Malaysian Government and other Countries/Agencies concerned have already been entered into e.g. the United Nations Development Programme and other United Nations Specialised Agencies, the Ford Foundation, the International Executive Service Corps. etc.

4. Three board categories of technical assistance experts/projects are distinguished and covered by this Circular. These are:

- (a) provision of a long-term expert defined as an expert whose period of assignment in Malaysia is not less than six months;
- (b) provision of a short-term expert defined as an expert whose period of assignment is less than six months;
- (c) provision of consulting services and surveys involving a single or a team of experts with final responsibility resting on the chosen consulting firm or appropriate body.

III. Allowances and Other Privileges of Experts

A. LONG-TERM EXPERTS

5. The allowances and other privileges provided to long-term experts serving in Malaysia are as follows:

(1) Installation Grant

A lump sum installation grant will be paid to meet the initial settling-in cost of the expert for the first 14 days of his arrival in Malaysia. Thereafter the expert will be paid housing and subsistence allowances as specified in (2) below with payment for the month following the first 14 days being calculated on a pro rate basis.

The rates of installation grant are as follows:-

Single (or unaccompanied by wife)	\$ 780
Married and accompanied by wife	\$1,100
Married and accompanied by wife and one or two children not exceeding 18 years of age	\$1,500
Married and accompanied by wife and more than two children not exceeding 18 years of age	\$1,900

The installation grant is a once-for-all payment appropriate to the expert's circumstances at the time of arrival and no other claims can be made following the arrival of his family or when an expert returns from overseas leave on extension of his assignment.

(2) Housing and Subsistence Allowances

The Malaysian Government will not be responsible for providing the expert with accommodation. However, at the request of the expert, the Agency to which the expert is assigned will assist him in finding suitable private accommodation for rental. In lieu of housing the expert will be paid the appropriate rates of housing allowances as set out below.

An expert assigned to Sabah or Sarawak may be given accommodation provided there are available unoccupied Government quarters. In such a case no housing allowance will be paid to the expert nor will he be charged the normal government rental on the quarters. The expert will, however, be responsible for payment of water, electricity and other charges incurred while in occupation of such premises.

Subject to the above paragraphs the rates of housing and subsistence allowances payable to an expert depending on his family status are set out as follows:-

	Allowances for		Total per
	Housing	Subsistence	month
Single (or unaccompanied by wife)	\$500	\$300	\$ 800
Married and accompanied by wife	550	500	1,050
Married and accompanied by wife and one or two children not exceeding 18 years of age	650	650	1,300
Married and accompanied by wife and more than two children not exceeding 18 years of age	650	750	1,400

NOTE:

- (i) At the request of the donor Government/Agency, the housing and subsistence allowances may be combined and considered as a single allowance.
- (ii) The housing allowance is viewed as a subsidy and payment will be effected through the donor Government/Agency.

- (iii) For the purpose of payment of subsistence allowance, an expert who is married without children and is not accompanied by his wife will be deemed as if he is single.
- (iv) Where both husband and wife are assigned as experts they will be paid housing and subsistence allowances as for an expert accompanied by wife plus an additional sum of \$300 per month.
- (v) Changes in the family circumstances of an expert should be reported immediately to the Head of Department concerned to permit adjustments to be made in respect of the expert's entitlement to allowances under this category. In cases of doubt the Department will refer the matter to the Economic Planning Unit (E.P.U.) for a decision which will be final.

(3) Mileage and Other Allowances While on Duty

Mileage allowances will be paid at the normal rates for journeys performed on official duties in accordance with the existing regulations governing transport and travelling claims in the State/Public Authority to which the expert is assigned. No claim is permitted for travelling between house and office. An expert who does not own or use a personal car for official duties will be reimbursed for the cost of actual transportation used and in conformity with existing rules applicable to Government officers. An expert on duty tour away from his Headquarters is eligible for a Day Allowance/Subsistence Allowance in the same way as Government Group A officers. The payment is governed by the relevant regulations currently in force and at the rates applicable in Peninsular Malaysia, Sabah and Sarawak and of the Authority to which he is assigned.

For purpose of calculating an expert's claim for mileage and other allowances while on duty, an expert's salary will be deemed to be within the range of either \$1,006 - \$1,804 or \$1,805 - \$2,865 depending on the salary of his Malaysian counterpart in the State/Agency to which the expert is assigned.

(4) Conveyance Advance

An expert is eligible to apply for a loan for the purchase of a motor car. The terms for the granting of his loan are as follows:-

- (i) the loan is granted only once in the whole tenure of the expert including all extensions of his assignment;
- (ii) the amount of loan applied for should not exceed the value of the vehicle to be purchased subject to a maximum amount of \$7,000. The terms of the loan will be in accordance with existing regulations enforced in each of the States of Malaysia or as amended from time to time. If a second hand car is purchased a valuation certificate on the car must be attached with the application;
- (iii) the loan is to be repaid in monthly instalments and to be settled in full before the expert departs from Malaysia. At the time of making the application for the loan the expert is requested to submit his proposal for the repayment of the loan;
- (iv) during the period of the loan the expert is requested to ensure that the car is adequately covered by insurance and he is not permitted to sell or transfer his motor car without the prior permission of the Government;
- (v) provision of sureties for the loan is not required but the Head of Department to which the expert is assigned should ensure that the Registration Card of the car is stamped with the words "Ownership Claimed by the Government" until the full loan has been repaid.

Application for motor car loan should be made in the usual forms and clearly identified with the words "EXPERT" for submission to and approval by the Secretary General to the Ministry/Head of Department/State/Public Authority concerned which will also ensure that the various conditions set out above have been and will be satisfactorily met.

(5) Local Leave

Local leave at the rate of 25 days a year will be granted to an expert. However, an expert assigned to an educational institution will not be eligible for leave other than the normal school or college terminal holidays or with the prior permission of the authorities concerned. Such leave may be accumulated throughout the expert's tour of duty in Malaysia and may also

be taken outside Malaysia. All local leave shall be taken within the period of the expert's assignment in Malaysia and an expert will not be permitted to accumulate his leave immediately prior to the completion of his assignment thereby in effect bringing forward his date of departure from Malaysia.

The Head of Department to which the expert is assigned or the officer designated by him is the approving authority for such leave and application for leave must be made in the usual form.

(6) Medical Attention

During his assignment in Malaysia, an expert and his family will be eligible for free medical and dental attention at Government hospitals. A letter of identity for this purpose will be issued to an expert seeking medical attention or dental attention.

No reimbursement will be made by the Government if the expert or his family elects to be treated by private practitioners. If admitted at a Government hospital the expert will be required to pay ward charges as laid down in Government regulations applicable to his Malaysian counterpart in the State/Department/Public Authority where the expert is assigned.

For purpose of determining class of ward, an expert's salary will be deemed to be within the range of either \$1,060 - \$1,804 or \$1,805 - \$2,865 depending on the salary of his Malaysian counterpart in the State/Department/Public Authority to which the expert is assigned. If an expert requests to be admitted to a higher class of ward than that to which he is eligible, he will be billed accordingly as is laid down in government regulations. Head of Departments must ensure that the appropriate hospital bills incurred by an expert are promptly settled.

(7) Exemption from Income Tax

An expert is exempted from Malaysian income tax on his official emoluments in respect of the period of assignment in Malaysia. An expert filling a cadre-post will be required to pay taxes on the local portion of the salary paid to him.

(8) Exemption from Customs Duty/Excise Duty and Sales Tax

- (a) Subject to the conditions enumerated in sub-paragraph (d), an expert will be exempted from the payment of customs duty/excise duty and sales tax in respect of bona fide personal effects and essential basic household equipment brought into or purchased in Malaysia for his own use or the use of his dependents provided that such personal effects and equipment are brought into Malaysia or purchased locally within the period of six months from the date of his arrival in Malaysia. For the purpose of facilitating customs clearance of the said personal effects and equipment a list thereof must be presented to the Head of Department to which the expert is assigned;
- (b) In addition and also subject to the conditions in sub-paragraph (d), an expert is exempted from the payment of ad valorem registration fee and customs duty/excise duty and sales tax in respect of one motor car only brought into Malaysia or purchased locally in Malaysia, provided that --
- (i) such imported motor car has been used by the expert concerned in his country of origin or the country of last posting, or
 - (ii) the motor car is purchased locally within the period of six months from the date of his arrival in Malaysia.
- (c) Any expert desiring to make purchases of duty free locally manufactured/assembled items must in the first instances apply for the approval of the customs through the Head of Department. Such purchases are only permitted if orders are placed with the manufactures and delivery made from bonded warehouses. These purchases are allowed only in the first six months of the expert's stay in the country;
- (d) The exemptions in sub-paragraphs (a), (b) and (c) are given subject to the following conditions:-
- (i) the aforesaid exemptions are given only once irrespective of whether the expert's assignment in Malaysia is extended beyond the original period of his assignment;
 - (ii) each expert is confined to only one unit or set or a reasonable number of any bona fide personal effects to be imported or purchased locally;

- (iii) the personal effects and household equipment for which the aforesaid exemptions are given, if imported, should be from the country of origin or the country of last posting or acquired from any other country while on transit to Malaysia;
- (iv) the personal effects and household equipment or motor car in respect of which the aforesaid exemptions are given will be cleared by and delivered from the Customs upon presentation thereto of a Certificate of Exemption prepared and duly signed by the Head of Department to which the expert is assigned;
- (v) the Head of Department to which the expert is assigned shall maintain a complete record of all the personal effects, household equipment and motor car so cleared and shall make such records available upon request for inspection by the Customs or other appropriate Government authority;
- (vi) any personal effects or household equipment or motor car in respect of which the aforesaid exemptions are given, if disposed of in Malaysia during or at the end of the period of an expert's assignment in Malaysia shall be subject to the normal customs duty or other charges at the rate in force on the date the exemption was given and on the value at the time of disposal.

B. SHORT-TERM EXPERT

6. A short-term expert will be paid an all-inclusive per diem allowance of \$70 per day. He is not entitled to the allowances and privileges stated in paragraph 5, items (1), (2) and (4). He is however eligible to the facilities provided under paragraph 5, items (3), (5), (6), (7) and (8).

7. The despatch of an expert or mission by the donor Country/Agency to evaluate any project or request will not be considered as falling within the scope of this Circular and therefore no payment of allowances or other privileges will be made to such expert besides the normal reception and other arrangements for his programme of visits, discussions, etc.

C. CONSULTING SERVICES AND SURVEYS

8. Consulting services normally involve the provision of a team of experts from the donor Government, other bodies and firms for the purpose of carrying out feasibility, management and specific projects. The fee for such services will be paid by the donor Government/Agency and that individual experts provided under this arrangement will not therefore be eligible to any other allowances from the Government.

9. The Government will, however, provide the Consultants with local facilities including reasonable transport, office accommodation which are necessary in carrying out the assignment. All reports and materials obtained in the course of their assignment remain the property of the Government which has absolute discretion as to their use or disposal.

IV. Equipment Associated with Provision of Experts and Services

10. All equipment brought into Malaysia associated with the assignment of the expert and consulting services will be exempted from customs and other duties. The Head of the Department/Authority concerned will ensure that such equipment is speedily cleared at the port of discharge. A Certificate for Exemption from customs duty under this category, to facilitate customs clearance, is to be issued by the Head of Department/Public Authority concerned and copies of such Certificates are to be extended to the Treasury, Customs and E.P.U. A condition of this exemption is that the equipment is not to be resold in Malaysia but may be re-exported or left behind as a gift to the Government/Public Authority.

V. General

11. An expert is not immune from the laws and regulations prevailing in Malaysia including communication regarding classified matters/documents. In the exercise of his duties he is required to give due regard to these laws. In the event of any legal action arising from the performance of his official duties he will be entitled to legal assistance in the same manner as a Government officer.

12. The Government of Malaysia will have the right after due consultation with the donor Government/Agency to request the recall of any expert whose work or conduct is unsatisfactory.

13. The terms of this Circular are subject to review from time to time in accordance with policy and regulations and they may be modified, amended or terminated by the Government.

TAN SRI DATO' ABDULLAH BIN AYUB,
Chief Secretary to the Government,
Malaysia

ECONOMIC PLANNING UNIT,
PRIME MINISTER'S DEPARTMENT
KUALA LUMPUR,

31st July, 1979

Distribution:

Secretary-General to Ministries
Hon'ble State Secretaries
Permanent Secretary to the Chief Minister, Sabah.
Hon'ble State Secretary, Sarawak.
Heads of Federal Department.
General Manager/Chairman/Director Public Authorities.
High Commissions/Foreign Missions.

JAPATAN GETAK KEBAJAAN, KUALA LUMPUR

68083-27-7-79.

KRAJAAN SERI PADUKA BAGINDA
MALAYSIA

AMENDMENT TO GENERAL CIRCULAR NO.1 OF 1979

TERMS AND CONDITIONS FOR FOREIGN EXPERTS SERVING IN MALAYSIA

The following amendments are to be incorporated in General Circular No.1 of 1979 of 31st July, 1979 and effective from 1st January, 1979:

- (1) Delete "ad valorem registration fee and" in paragraph 3 (8) (b).
- (ii) Paragraph 3 (8) (d) (vi) now reads as follows--

"the goods of which the aforesaid exemptions are given cannot be sold or otherwise disposed of within a period of 3 months from the date of import of 6 months from the date of (local) purchase, provided that in the case of a motor vehicle if sold or otherwise disposed of shall be subject to the normal duties as the rate in force on the date the exemption was given and on the value at the time of disposal".

- (iii) Last sentence of paragraph 6 now reads as follows--

"He is, however, eligible to the facilities provided under paragraph 5, items (3), (5), (6), (7), (8) (a) and (8) (b) (1) subject to item (8) (d)".

TAN SRI DATO' ABDULLAH BIN AYUB,
Chief Secretary to the Government,
Malaysia

ECONOMIC PLANNING UNIT,
PRIME MINISTER'S DEPARTMENT,
KUALA LUMPUR
1st November, 1979

Distribution!

Secretary-General to Ministries.

Hon'ble State Secretaries.

Permanent Secretary to the Chief Minister, Sabah.

Hon'ble State Secretary, Sarawak.

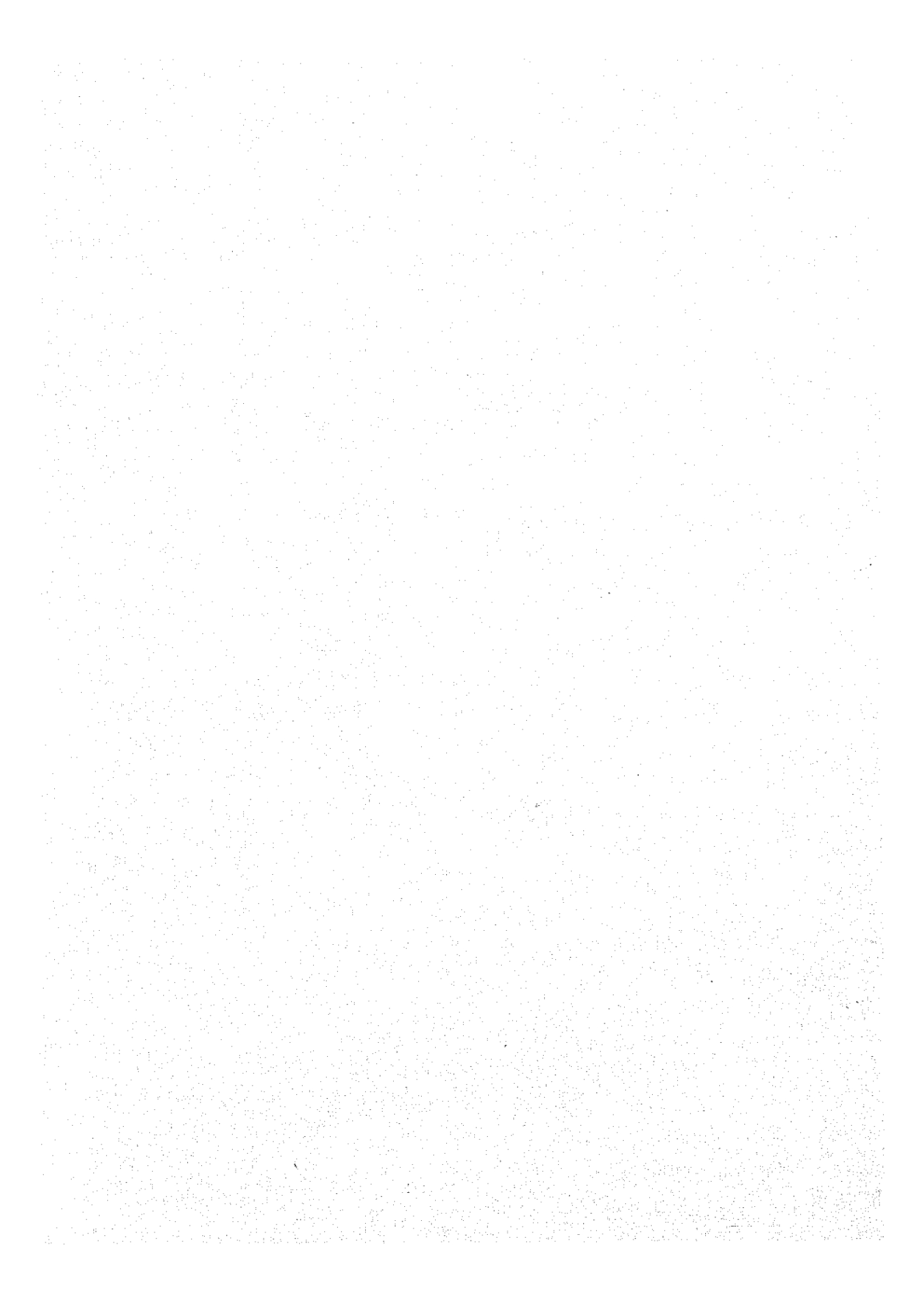
Head of Federal Departments.

General Manager/Chairman/Director Public Authorities.

High Commission/Foreign Missions.

JABATAN PERCETAKAN NEGARA, KUALA LUMPUR

68702-27-11-79



JICA