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ASSISTANCE TO THE MAURITIUS STANDARDS BUREAU

DP/MAR/75/006

MAURITIUS

TECHNICAL REPORT

Prepared for the Government of Mauritius by the
United Nations Industrial Development Organization,
executing agency for the
United Nations Development Programme

United Nations Industrial Development Organization

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United Nations Development Programme

ASSISTANCE TO THE MAURITIUS STANDARDS BUREAU

DP/MAR/75/008

MAURITIUS

Technical report

Prepared for the Government of Mauritius
by the United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

Based on the work of S.A. Thulin, expert in standardisation, quality control and metrology

United Nations Industrial Development Organisation
Vienna, 1977

Explanatory notes

References to dollars ($) are to United States dollars, unless otherwise stated.

During the period covered by the report, the following exchange rates were used in the conversion of country currencies to United States dollars:

Country	Currency	Exchange rate
France	franc (F)	5.00
Federal Republic of Germany	mark (DM)	2.40
Mauritius	Mauritius rupee (Mau_{Rs})	6.00
United Kingdom	pound sterling (£)	0.585

The following abbreviations of organizations are used in the report:

IEC International Electrotechnical Committee

IWS International Wool Secretariat

ISO International Organization for Standardization

MSB Maritius Standards Bureau

The following technical abbreviations are used:

Hz Hertz

kgf kilogram force

kN kilonewton

ABSTRACT

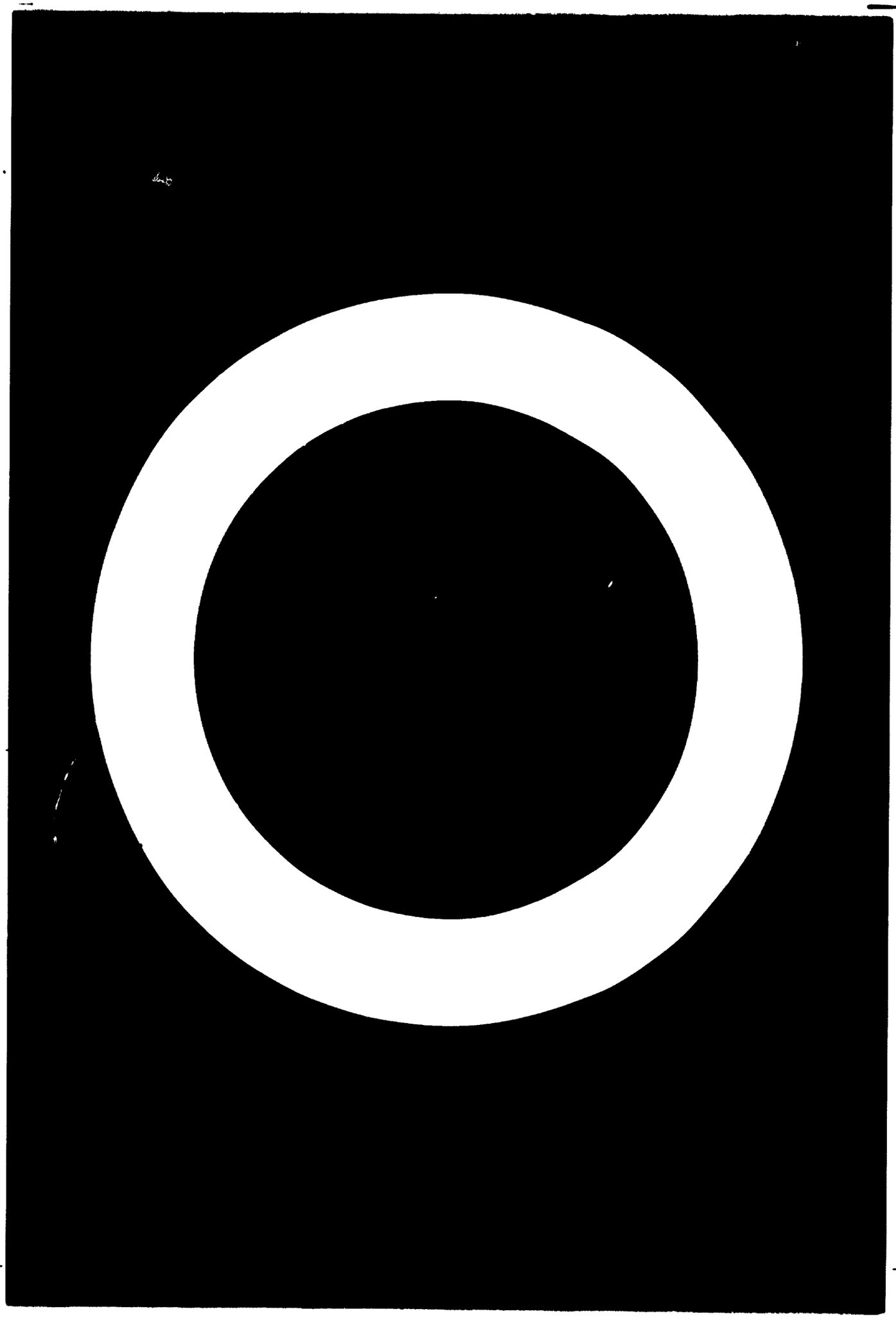
The expert was assigned for two and one-half months (1 February to 15 April 1977) as adviser to the Mauritius Standards Bureau (MSB). His mission formed part of the larger project "Assistance to the Mauritius Standards Bureau" (DP/MAR/75/008). The first report of the expert, covering the period from 7 March to 22 May 1976, set forth the requirements for completing the laboratories and contained a list of complementary equipment. Since then UNDP/UNIDO assistance has been extended according to project document DP/MAR/75/008, generally referred to as phase II of the Mauritius Standards Bureau. The present mission forms a part of the advisory services provided by UNIDO in this phase.

The major part of the equipment specified in the expert's first report had been ordered by the Government and by UNIDO, but only a minor part had arrived by the end of the expert's mission. During his mission the expert was able to follow up on the previously recommended installation and arrangement of furniture which were practically completed in the course of his stay. He also found it necessary to suggest the type of relations to be established with the University in order to avoid an ambiguous situation in routine operations.

The Standards Council, as required by the bill for the Mauritius Standards Bureau, was constituted during the expert's mission and steps for hiring the required staff were taken.

It is thus expected that some of the testing activities of the laboratories may start effectively by August 1977 when most of the equipment has arrived.

The present report contains recommendations for the organization of the various testing activities and guidelines for action to be taken.



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INTRODUCTION

This is the report of a mission forming part of the project "Assistance to the Mauritius Standards Bureau" (DP/MAR/75/008). The parent project, which was requested by the Government of Mauritius, was approved by the United Nations Development Programme (UNDP) on 8 December 1976. The United Nations Industrial Development Organization (UNIDO) is the executing agency.

The expert was sent on a short mission of two and one-half months, from 1 February to 15 April 1977, as an adviser to the Mauritius Standards Bureau (MSB). According to his job description, he was expected to assist the Government of Mauritius in developing and strengthening the activities of MSB. Specifically, he was to advise and assist:

(a) In programming and planning activities in the fields of standardization, quality control and metrology;

(b) In solving managerial, operational and other problems arising in the course of the current activities of MSB;

(c) In equipping and putting into operation the testing and metrological laboratories of MSB;

(d) In working out a programme of training for professional staff required to undertake the specialized tasks of standardization, quality control and metrology.

MSB was established in April 1975 by governmental decree (the Standards Act). It has its own testing laboratories which are mainly engaged in certification marking, but it can also execute comparative tests for manufacturers, consumers or the public administration in the fields for which it is equipped.

In addition to the product-testing activities, MSB is responsible for the physical standards of measurements and has special metrological laboratories which may expand their activities according to the needs of the industry.

The following, in brief, are the testing and metrological services being provided at present:

(a) Testing to standards, or comparative testing, of textiles, paints, rubber, leather, plastics, steel and metals, electrical cables, dry cells etc.;

(b) Metrological services, including calibration of weights, balances, length measures, end gauges, electrical instruments, pressure gauges, thermocouples, thermometers, universal testing machines (force measurements) etc.

I. ORGANIZATION OF STANDARDS WORK AND TESTING ACTIVITIES

The main lines of activity of an institution such as the Mauritius Standards Bureau (MSB) are:

(a) To establish local, or adopt internationally agreed, standards or codes of practice for materials, methods of production and testing;

(b) To adopt grading systems and minimum quality requirements based upon international and national practice or local conditions.

Standards and quality

The work of the MSB relating to standards and quality should be done on a voluntary basis by technical committees recruited among the experts on the island, representing producers and consumers, public and private institutions and services. The MSB should provide library, reproduction, typing and secretarial facilities for these committees. The final recommendations of the technical committees would then be passed on to the Standards Council for approval.

The standards or other recommendations approved by the Standards Council will constitute the basis for the acceptance of a product and will include the test methods and type of equipment to be used.

The work of a technical committee may require comparative tests or trial of test methods. Such work can be done in the MSB laboratories, at the University or in any other qualified laboratory agreeing to do such consultative work.

Testing to standards

The standards approved by the Standards Council should be accepted by all parties concerned. The testing of the product should normally be done by the producer. In case he is not equipped to do so he may request MSB or other official, the University or an industrial laboratory to do such tests for him on a more or less regular basis. The test results should in this case be subject to confidential reports by the laboratory to the producer (the test may form part of a product development programme of the producer with the aims of reaching an acceptable standard.)

In a similar way confidential tests may be required by consumers, industries, the Ministry of Commerce, other ministries etc. Such tests may be executed by MSB, the University or any other local or foreign laboratory.

The producer may be interested in using, or be persuaded to use, the local standards mark issued by MSB, in which case he must subscribe to a contract by which regular control of the production is arranged through the MSB laboratories.

The obtainment of the standards mark is generally entirely voluntary, but it may be required for such purposes as customs duty protection, development certificate facilities, export facilities etc. Test results here again are fully confidential, but if it is proved that the quality of the product no longer meets the requirements of the standard, the permission to use the standards mark will be withdrawn.

Role of MSB laboratories

The activity of MSB in the field of testing is thought to be mainly related to issuing the standards mark, which involves regular quality control and to a somewhat lesser extent confidential testing, which may involve only occasional work. It would in fact hardly be justified to equip laboratories and to maintain staff if these were not basically for routine and regular operations. Occasional testing can be executed by the University or any other laboratory (if required abroad) provided the necessary competence and equipment are present. Any type of testing that would involve specially trained staff, which would be occupied less than, say, 5% of the time for such testing, should be confined to other laboratories. However, this limit may be revised in cases in which the total value of the goods to be tested is high or in which reasons of safety prevail.

Within reasonable limits of the cost of investment in equipment the internal laboratory activities of MSB should be based mainly on the use of trained personnel, especially if this personnel cannot be used in other activities.

In addition the MSB laboratories should not handle all testing or quality control to approved standards since in certain fields, such as civil engineering and food technology, drugs etc., there may be other laboratories in Mauritius which have both equipment and competence to perform tests. In case of regular testing according to the standards mark scheme, it would be necessary, however, for MSB to have in each case a

subcontract with these laboratories by which the testing to standards implies the full responsibility of the subcontracted staff to ensure the proper functioning of the test equipment, the correct application of test methods and samples and the non-divulgation of the test results to other than the customer that is ordering the test.

Consultant activities

It has been mentioned in some reports of the previous project (phase I) that MSB laboratories would in addition to periodic supervision over industrial products initiate and perform applied research in order to upgrade the quality of local products. Although this may be a desirable goal, one must be realistic: the improvement of a product can in the last analysis be done only by the producer, and it may take considerable time before MSB has such expertise that it can do the required research to improve a product. (And this would not necessarily imply that effective production would be any better.)

Many ways exist for assisting industries especially when the manufacturers show good-will in co-operating to improve the production:

(a) The industry (ministry or other body) may submit to MSB samples for comparative testing or analysis on a confidential basis. These samples may each involve different compositions of raw materials and/or different processing. Depending on the results obtained by MSB (or an MSB subcontractor) and the cost of the operation, the manufacturer (or the ministry) may be able to find out the required process for raw materials which would result in a product with competitive or satisfactory quality;

(b) MSB may advise the manufacturer to obtain product or production consultancy from local or foreign competencies. (It should be borne in mind that the quality of a local product may depend many times more on practical factory routines and staff than on raw materials and machines.);

(c) It is expected that applied research concerning new products will be more in the line of the University, especially post-graduate, activities. MSB should again be fully co-operative in doing comparative tests should the University or the researcher not have the required equipment.

II. RELATIONS WITH THE UNIVERSITY OF MAURITIUS

There has no doubt been a confusing situation as regards the procurement of equipment for MSB, resulting from the fact that no complete line of equipment was available at MSB or at the University for executing standard tests on items such as textiles, paints, leather, electrical goods etc., nor was clear responsibility for testing designated.

During his first mission the expert tried to complete the MSB equipment in accordance with international or foreseen local standards. This type of wear or aging equipment is generally such that it is only of very marginal educational interest.

In other more general fields there has been some joint action or attempts of complementary ordering of equipment between the University and previous MSB experts, concerning the chemical laboratory somewhat but mainly to do with the mechanical laboratory. Thus, occasional tests or research projects run entirely by the University or under MSB subcontract should normally be executed at the University with the full responsibility given its staff. (There may of course be cases in which a suitable form of co-operation or work-sharing may have to be elaborated using MSB facilities and staff.)

Experience shows that routine standards work cannot be done with test equipment which is simultaneously used by a number of people, including students. Therefore, the activities that are to be handled fully by MSB should be done with its own (and not shared) equipment even if this may sometimes involve duplication. On the other hand, activities judged to be of a less routine character for MSB could be subcontracted fully to the University or to other laboratories.

MSB should open to students for demonstrations of test equipment and test methods on agreement between the University and the MSB staff. MSB may obtain from the University the equipment and test pieces, subject to special orders. These services would then be executed fully by the University staff and the work debited to MSB. It is understood that the MSB staff would normally not make use of University facilities, workshops etc. other than in exceptional cases and on mutual agreement. The same would be true for University staff. In brief, lines of demarcation and the technical relations between the laboratories would thus be clarified.

MSB should take every opportunity to give support to the University in improving its facilities and in particular in research and development which would normally not be handled by MSB. The latter would confine its activities to routine operations and subcontract special studies to the University and to other laboratories on a consultant basis. (For details of testing various materials, see annexes I-IX.)

III. RECOMMENDATIONS TO THE GOVERNMENT

1. Administration

MSB started operation with the formation of the Standards Council and the holding of its first meeting on 19 March 1977. It is now necessary that it be given full administrative status so that it can handle its own affairs as regards correspondence, purchases, filing, mail etc. Requests for tests by industries and other bodies should be addressed directly to MSB which should give a cost and time estimate. Every such order should contain a clear statement regarding the test method to be used, sampling, marking etc. MSB should keep confidential individual files (archives) of all such tests numbered in consecutive order.

All files concerning equipment to be procured, whether expendable or not, should be kept at MSB and no longer at the Ministry (which may still for reasons of finance keep indents, copies of invoices etc.). The actual system as regards files on equipment is most confusing. MSB should be allowed to make direct cash disbursements for small procurements and services.

An administrative officer with good experience will have to be employed to manage finance, procurement, incoming and outgoing work and reports.

2. Staff

It was not anticipated in the 1976 report that technical staff would be hired before the equipment arrived. However, this was a prerequisite in the new UNDP project. The recruitment action has now been too long delayed and the matter should be given the highest priority to avoid further delays. The planned staff for the textile laboratory should be present by July 1977 and for the paint testing by August 1977. In addition, the administrative officer should start his work at MSB immediately.

3. Installation

The installation of the paint laboratory should be completed immediately according to the plan shown in annex II.

The electrical supply lines in room 10 (and probably also in the future in room 9) should be increased to at least 32A three-phase for each room and the necessary cables drawn to the machines (see annex VIII).

MSB should have its own premises. A doorbell should be installed (and the type of door lock changed to a more covenient system) for the entrance. The passage of students to and from the third floor must be stopped.

4. Library

The procurement of standards should be followed up so that at least the full set of ISO standards will be available.

A Xerox machine should be rented for photocopying documents. (It is not worthwhile trying to repair the old photocopying machine.) The rented machine should enable photocopying from books and other thick documents. One of the clerks should be charged with the operation of the machine and with keeping the standards library in order.

5. Financing and budget

(a) A pick-up van should be procured immediately and a driver employed;

(b) A certain amount of testing of products may have to be done abroad; provision should therefore be made for a yearly budget (MauRs 30,000 as a start);

(c) The equipment procurement budget foreseen for 1977/78 should be kept at MauRs 300,000 minimum. This budget has to take into account the testing of a number of products which will come up during the work of the technical committees.

(The still available government funds on the 1976/77 budget will be absorbed by the procurement of the items mentioned in annex X).

6. Technical assistance

(a) Negotiations with the International Wool Secretariat (IWS) for obtaining the services of a textile expert to train local counterparts should be followed along the lines suggested in annex I. The assignment should start at the end of July 1977;

(b) The request for British bilateral assistance for a textile testing expert for short duration (3 months) should be kept in abeyance until the result of the IWS negotiations are known. The period of three months is too short in any case since it has not been possible to recruit a trained textile technologist as local counterpart;

(c) An expert in metallurgy and mechanical testing for MSB has been requested for a period of at least one year together with analysis equipment for steel. A final decision from the French authorities was expected in May 1977. The matter should be given necessary attention by the Ministry. The assignment should start in October 1977;

(d) An expert in paint testing is required from the UNDP/UNIDO programme for a total period of six months (four months in 1976). A job description is included as annex XII;

(e) The request for a mechanical engineer who is an expert in mechanical testing and a chemical engineer from Indian technical assistance should be kept until candidates with curriculae that are fully in line with the job descriptions are put forward;

(f) The available consultant man-months from the UNIDO/UNDP contribution for 1978 will have to be committed at the latest by October 1977 when the most urgent technical work programmes for MSB will have been defined and the results of the bilateral requests will be known.

It may already be foreseen, however, that depending on the availability of local staff and the progress of technical committee work there may be need for a consultant in chemistry, mainly physical chemistry (six man-months), and a consultant in food technology and testing (six man-months).

7. Training abroad

The training programme should be defined after the staff has been employed and when the availability of experts is known so that staff will be present to work with the experts.

8. Standardization programme

The work started by technical committees several years ago should be resumed immediately so that the quality of a number of products can be specified technically to allow grading systems and minimum quality requirements to be established. Standards should be based as much as possible on international practice, but they may often be simplified to avoid complicated or time-consuming tests. For each standard to be written the committees should select a drafter among themselves or other specialists and establish time schedules in order to enable the publication of a good number of essential standards during the first year.

Based on previously available information, the expert has drawn up a preliminary standardization programme, listed in annex XI. The main role of MSB will be twofold: to protect the consumer and to promote quality of production for both local use and for export.

The effective implementation of quality standards and standards in general depends finally largely on the industries themselves and their willingness to co-operate.

First, however, MSB and the technical committees must be fully in a position to lay down standards and to provide for quality control and test schemes - work on which the future practical implementation will depend.

Annex I

TEXTILE LABORATORIES

Status of laboratories and equipment

The textile laboratory premises and equipment as described in the previous report have been completed and special air-conditioning and furniture have been installed. Some important equipment has still not been delivered however, such as the Xenon Tester (NP 2), the incubator (NP 3) and the drying oven (NP 8) as well as chemicals and glassware. According to present information this equipment should be fully delivered in Mauritius by the end of July 1977.

Some minor modifications of the layout as regards equipment has taken place as a result of consultations with experts from the International Wool Secretariat. Thus, the Xenon Tester (item NP 2) will be installed in room 3 for wet tests on the basement.

Furthermore, the moisture determination apparatus (UN 103), supplied by the firm Baer, Switzerland, and equipped by mistake for 220 V delta three phase, is considered obsolete and will be put in store for possible other use.

The yarn determinator (UN 102) from the same supplier was never received. The supplier pretended it had been packed together with UN 103, but this was physically impossible. Owing to delays in communications (two months) it became too late to request an insurer's inspection certification as required by the supplier, who furthermore never sent the coversion parts for the moisture-testing apparatus.

It is suggested that, if required, a yarn determination from another supplier as well as other equipment possible needed be put on a future government ordering requisition by the expert to join MSB. It is suggested that an amount of MauRs 50,000 be reserved for ordering textile equipment during 1977/78.

Expert assistance, textile laboratory

It is recalled that the textile laboratories were subject to a UNIDO consultant mission by H. Bilbie from the International Wool Secretariat in 1974. Since this time the amount of wool knitwear manufacturing and other processing on the island has been considerably increased. Knitwear has become, next to sugar, the most important industry. The advisory services of the

International Wool Secretariat to Mauritius have therefore increased to the point at which it is envisaged that a permanent representative will be established in Mauritius.

During a visit of Mr. Botes, travelling representative of IWS, in early March, the following suggestions were formulated on the iniative of IWS, subject to confirmation and approval by the parties concerned:

(a) That IWS delegate a textile expert to Mauritius for a preliminary period of two years;

(b) That the IWS resident expert agree to train MSB staff in textile testing during such time as deemed necessary and to guide all the textile-testing work using the MSB facilities and equipment;

(c) That IWS take full charge of the cost of the expert, bearing in mind that the expert will undertake consultant advising in Mauritian industries and supervise the international Woolmark operations of IWS;

(d) That the Woolmark testing operations be free of charge to Mauritian industries according to the IWS practice in other countries (IWS is financed by the major wool producers in the world);

(e) That the MSB testing services be made available to Mauritian industries for a charge for textile tests outside the normal Woolmark operations covering other yarn and textiles;

(f) That after a period of operation of two years the mode of operation be revised by both parties in view of the results obtained and the development of the local industry;

(g) That the Government be requested to grant such facilities to the IWS expert as those normally granted to expatriate development experts in similar cases.

Note: The above suggested points are noted down from the preliminary discussions held with the IWS representative, Mr. Botes, in the presence of the Principal Assistant Secretary, R. Maugendre. They commit neither IWS nor the Ministry of Commerce and Industry.

It was hoped that a final agreement on the above programme would be reached during the common visit to Mauritius planned for 26 April 1977, of Mr. T. Brown of IWS headquarters and Mr. Botes.

The UNIDO expert considers that the above arrangements would be the best by far for the textile operations of MSB and would allow it to build up a competency at the same time that it would leave full freedom for future operations possibly involving artificial fibres, cotton etc. which are not covered by IWS operation. The equipment for such testing is practically identical on all points.

A request for a short-term expert in textile testing had been addressed to the British technical assistance. The duration requested (three months) would in any case have been much too short. It is suggested that after the final agreement has been reached with IWS (expected by end April 1977) the British assistance be approached for a required adjustment of the request to some other speciality. (The above notes may be verbally communicated to the British High Commissioner to inform him about the possibility of future changes.)

Staff, textile laboratory

The MSB post for a textile technologist was announced in 1975. There was only one qualified applicant who preferred however to join a local industry. The post has been announced once more but the result of applications, which are handled by the Public Service Commission, is not yet known. The jobs for textile technicians (two posts) were announced very late and the result is not yet known.

It is of the utmost importance that the staff problems are solved before the arrival of the expatriate expert planned for the end of July 1977.

If a textile technologist cannot be found, a chemical engineer or a physicist can be recruited, provided the planned long-term training and guidance by IWS is accomplished.

Annex II

TESTING OF PAINTS

Status of laboratories and equipment

The installation of a special paints preparation hut on the University premises, as suggested in the first report, has not been done since the permission was not granted by the University. It has therefore been decided to install a small spray preparation cabinet in the paints drying room. However, this cabinet must be fully separated from the drying tests and must be well ventilated without disturbing the painting of the sample panels.

The paints drying room 6 has been equipped with double doors, as suggested in the first report, but no other ventilation or preparation facilities are yet installed.

The technical committee work on paints should be resumed and a meeting is scheduled with the paints manufacturers to finalize the details of the paints preparation and drying facilities.

Additional equipment has been ordered by the Government in accordance with the first report of the expert, but so far only item Nr 16, a gloss-meter, has arrived.

The paint preparation and sample panels should be immediately procured. An amount of MauRs 40,000 should be foreseen for additional equipment during 1977/78.

Expert, paints laboratory

It is suggested to request an expert for paints testing for a period of four to six months from the UNIDO contribution to the project. It would be a desirable advantage if this expert also had experience in the connected field of corrosion protection. The start of the assignment would be suitable by August 1977.

Staff, paints laboratory

The testing of paints can be directed by a chemical engineer or a physicist. One, preferably two, technicians are required. The jobs for the latter are being announced. The staff must be available at the latest by August 1977.

Paints technical committee, installation and equipment

The previous members of the paints technical committee were consulted at a meeting held at MSB on 3[illegible] March on their willingness to continue to serve on the committee, and in particular as regards the finalizing of the paints sample preparation and drying laboratory.

It appeared that spraying was used only in special cases and that paint preparation should be done using brushes and rollers. Sample panels would most probably be found locally. As regards corrosion-free black steel plates the question of their availability should be investigated further by checking the local market.

The standards drafted so far should be fully revised and simplified (information about test methods and limits can be gathered from various local organizations in Kenya, Singapore etc.).

Priority should be given to: emulsion paints for interior use, emulsion paints for exterior use and primers.

Special consideration should be given to fungal tests and comparative studies conducted if necessary by exposure in areas where such problems are predominant (Curepipe, Vacoas).

The premises for testing were visited and the final layout was determined for the paints preparation in liquid-testing and drying room [illegible] (see figure I).

The following equipment should be procured from abroad:

(a) Photocells (UNILO) for capacity tests (to be used with suitable multimeter, sensitivity 100 µA full scale);

(b) Spray gun with small compressor and nozzles;

(c) Equipment for fungal tests (sterile box, culture material, separate incubator). Microscopes are available. (Consult University and Sugar Research Institute as regards equipment.)

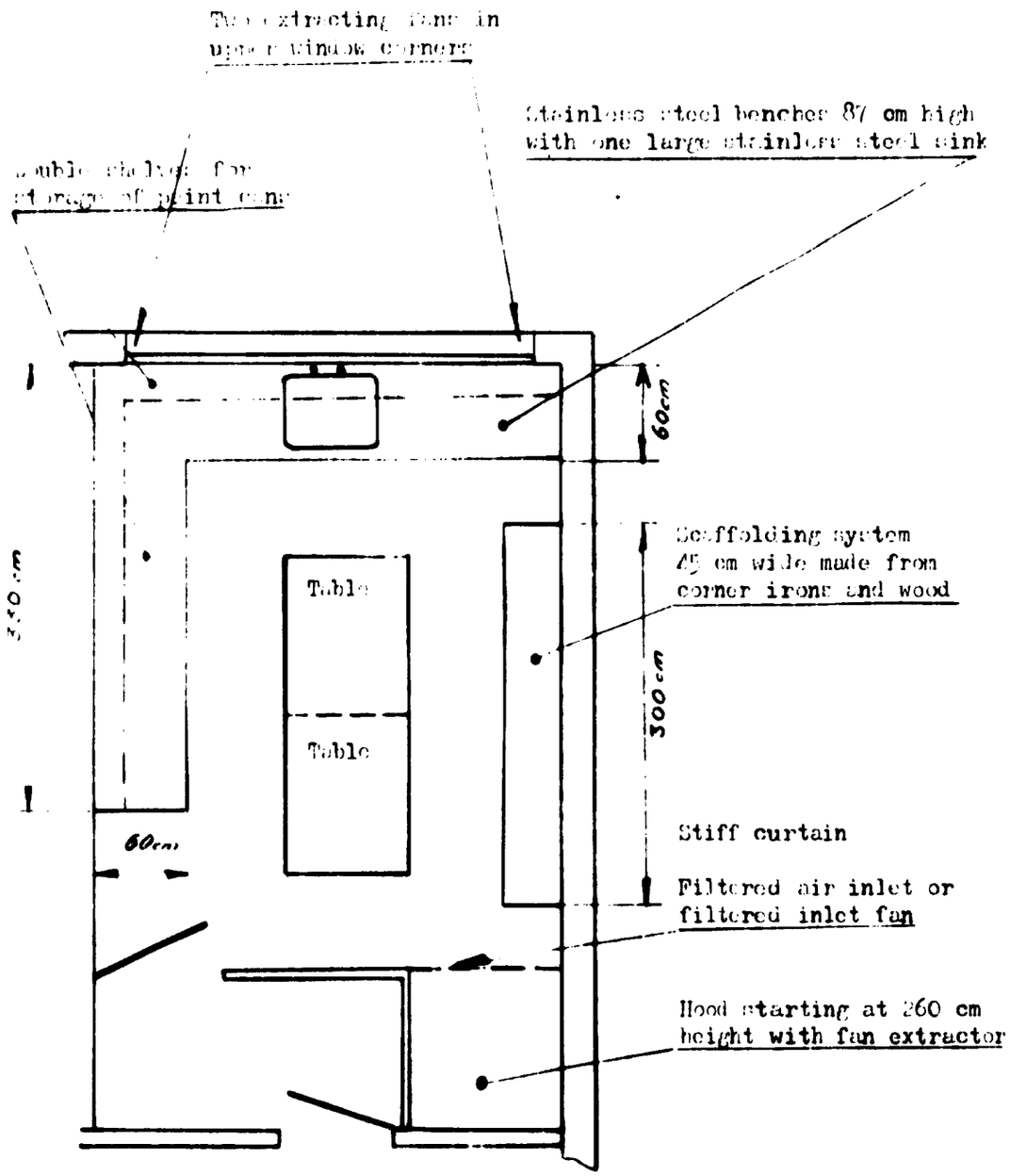

Figure I. Room 6: Paint application and drying laboratory (modified layout)

Annex III

TESTING OF PLASTICS

The extensive survey made in the first report showed that there were no real problems in Mauritius associated with the production of plastic materials.

The production of plastic pipes may if required be controlled advantageously at the factory where equipment is available.

Heat deformation, acetone immersion, tensile, impact and some other tests may be executed at MSB (laboratories 5,10 and chemical laboratory 26). Plastics used for manufacturing electrical cables and wires are subject to the electrical tests (see annex VII) usually executed in room 29.

It was found that the hardness tester received is not suitable for plastics. Other types will be requistioned for use with rubber and plastics.

Cutting dies have been ordered for tensile tests to ISO on plastics using the Instron machine to be installed in the textile testing room.

Annex IV

TESTING OF LEATHER

The equipment recommended in the previous report has been ordered by the Government but has not yet been received. This equipment will be installed in room 5 together with the available mechanical and thermal plastics-testing equipment. (Tensile tests will be done in the conditioned textile room 27).

The items marked within brackets (NP) in the first report have not been ordered nor some additional items listed in the report of Mr. Grimwade, pending the determination of needs.

Future action to be taken

A technical committee for leather should be formed, and the findings of Mr. Grimwade and his consultant should be made available to them. The future needs as regards both standards and quality control of leather will then have to be identified and, if required, additional equipment should be ordered. A budget reserve for equipment of about MauRs 10,000 should be foreseen in the 1977/78 capital budget.

Expert leather testing

No foreign expert is foreseen at the present time. A short-term consultant may be required in special cases.

Staff, leather

It is expected that the technicians and the engineer of the chemical laboratory can execute the required routine tests in addition to those on plastics and paints.

Annex V

TESTING OF RUBBER

The problem of retreading (non-vulcanized) compounds

Since the previous report by the consultant on equipment it has been confirmed that the main problem in Mauritius regarding rubber is the quality control of retreading compounds and the resulting finished tyres.

Visits were paid by the expert to a few retreaders and to one factory producing retreading compounds. It was found that the retreaders were well equipped whereas the factory did not have regular control of the retreading compounds. The complaints from customers for the compounds were mainly the lack of continuity in the quality and the difficulty of the factory in delivering the required quantities. There was, however, no complaint as regards the price which was lower than that of other suppliers. The factory admitted great difficulties with the labour. A breakdown of the only extruding machine had also once created difficulties in maintaining deliveries.

No consistent defects of the products have been reported by the retreaders, but there have been numerous temporary irregularities which may be owed largely to labour difficulties involving the in-weighing of raw materials of the proper operation of the extruder. As there are no consistent product or production defects, it is difficult to apply a quality control scheme by sampling unless production operations are first improved, or a consistent production quality control is made which for sampling reasons must take place in the factory itself. (It is not desirable to stock the retreading compound before delivery to the retreader.) It would not be possible at present to classify the quality of the product, but only to confirm the irregularities. This would not improve the production but could settle individual disputes by the fact that correct sampling could be made.

A priori, there does not seem to be any difficulty with the raw materials used except that occasional water appears in the chemicals used, producing bubbles in the compound but not affecting the vulcanized product much.

In the field of rubber testing of non-vulcanized compounds MSB could assist:

(a) By settling technical disputes between the suppliers and the customers, provided proper sampling operations are possible;

(b) By testing new compositions of compounds resulting from the use of modified mixing formulaes or modified raw materials.

The first activity in many cases can be done by frequent tests on finished vulcanized samples, and these can usually be limited to visual inspection, measurement of hardness and, if necessary, of tensile strength which MSB will be equipped to do. Occasional tests on the vulcanizing prooperties may also be done in specialized laboratories abroad, but it is practically impossible to provide such services on a regular basis since the samples to be sent would be representative of only a very small part of the production. It would be a great load on MSB and an expensive operation if samples had to be taken at the factory every day and tested at MSB, though such a scheme is at least theoretically possible. It would involve training and work for two rubber technicians to ensure full continuity and procurement of the following additional equipment: mould for samples and a hydraulic press.

An international rubber hardness meter is also needed. If the regularity of the production is improved so that sampling can be reduced to once a week, it may be possible to find a solution for the vulcanisation of tests samples at some rubber-producing factory that is willing to co-operate. This would reduce the costs considerably and fewer specialized technicians would also be required at MSB. It is not an ideal scheme since it may not be easy to ensure the consistency of the vulcanization as to pressure, temperature and timing etc. It is an attractive compromise solution, however.

Technical testing requirement for retreading rubber

There are usually no standard specifications for the compounds but only for the tread rubber obtained.

As there is at present no international standard for retreaded car and vehicle tyres it is suggested that the technical committee study the British Standard BS AU 144 a in particular with the view of adopting a corresponding standard for Mauritius. The characteristics involved in the testing are according to this standard.

Characteristic	Equipment
1. Ultimate tensile strength	Tensile tester
2. Elongation at break	
3. Tensile strength at 300% elongation	
4. Hardness (IHRD)	Hardness tester
5. Specific gravity	Chemical laboratory
6. Ash	Chemical laboratory
7. Acetone extraction	Chemical laboratory

The mechanical tests 1, 2 and 4 above are to be made before and after 7 days of ageing at 70°C.

MSB equipment for rubber testing

If a regular rubber-testing scheme is envisaged, it is suggested that an additional tensile-testing machine be procured to avoid too much interference in the regular testing work of the textiles laboratory. This machine may also be used for testing rubber or plastic sheaths of electrical cables.

With the test equipment present or on order it is possible to cope with a limited amount of both mechanical and chemical tests on finished tyres and rubber products, according to the scheme mentioned above.

Vulcanization can, if possible, take place outside the laboratory in view of the high cost of a press (see above).

The curing and other characteristics of rubber compounds are usually controlled by a rheometer of the Monsanto type. Though it is now practically a standard instrument, it is elaborate and quite expensive, costing about $US 20,000.

The regular follow-up of the curing properties would be an advantage and could be done by a less expensive instrument such as the Wallace curometer.

Hardness tests

A dead-weight hardness tester according to ISO R48 should be procured. The Wallace tester H-1 is suitable for thicknesses over 4 mm only, preferably 8 mm. For thicknesses smaller than this, a special micro-hardness tester has to be used for which the standard test pieces should be 2 ± 0.5 mm thick. An investigation should be made to determine which hardness tester to procure depending on the moulds to be used.

A hardness tester according to the Shore scale is available in the laboratory. The Shore Scale A is identical to IHRD numbers, according to ISO, but only for highly elastic rubbers.

Tensile tests

Tensile tests are made using dumbbell-formed samples in accordance with ISO R37. Two types may be used: 115 mm long and 6 mm wide, but usually 75 mm long and 4 mm wide. The thickness should in this case not be more than 2.5 mm and preferably 2 mm.

The requirements for the tensile machine to be used are:

Capacity 50 to 100 kgf

Stroke minimum 600 mm

Speed 500 mm/min (constant)

Preferably not pendulum type due to inertia

Mould for testing

The mould to be ordered should take into account the desired thicknesses for:

Hardness tests:

8 mm for normal IHRD

2 mm for micro IHRD

Tensile tests:

2 mm (preferably), maximum 2.5 mm

Addendum

At a meeting on 29 March 1977, representatives of rubber industries expressed their willingness to participate in a technical committee for rubber products starting with tread rubber.

It appeared that a small press was available at one manufacturer (Firestone) which could be used for vulcanizing samples for tensile testing. A larger press (3 x 3 cm) was available at another manufacturer (Bata) which could be used occasionally for vulcanizing samples, but it would not be suitable for frequent tests since pressure, temperature etc. would have to be specially adjusted.

It was mentioned that compression tests may be required in some cases. It is likely that the already available plastometer may be used in such cases. Abrasion tests may be made using the available Taber abraser.

The testing of the vulcanizing properties and, in particular, tests to see if a compound is pre-vulcanized were also found to be of interest. Consequently, it is suggested that the following steps be taken in the future to procure equipment for the rubber-testing laboratory (room 5):

Item

NPR - 1 Dead-load hardness tester for rubber according to ISO R48 type Wallace H-1 for 220 V, 50 Hz operation (cost app. £300).

NPR - 2 Hydraulic press 2-platen type with electric heating of platen suitable for vulcanizing: one rubber sample 152 x 152 mm for tensile tests (2-mm thick samples) and hardness tests (8-mm thick samples), platen dimensions 200 x 200 (minimum).
(Manufacturers : Drake, USA, or Carver, USA or supplied by Testing Machines Inc., 400 Bayview Avenue, Amityville, New York 11701, USA.)

(Note: Presses costing more than $US 3,000 f.o.b. should not be considered.)

NPR - 3 Mould for vulcanizing one rubber sample 152 x 152 mm, 2 mm thick
Supplier: Wallace, UK.

NPR - 4 Mould for vulcanizing one rubber sample 152 x 152 mm, 8 mm thick
Supplier: Wallace, UK.

NPR - 5 Curometer for measuring cure characteristics of rubber, complete with electrical recorder and connection for 230 - 250 V, 50 Hz one phase
Type Wallace-Shawbury
Curometer type MK VI
Paper speed 1 inch/2.5 min and 1 inch/10 min with 15 extra rolls of chart paper and spare thermometers (cost app. £2,400 c.i.f. Mauritius).

Note: Item NPR - 1 to NPR - 4 have the highest priority and form part of equipment required for regular quality control. Item NPR - 5 is a substitute for a more expensive instrument such as the Monsanto rheometer and is mainly intended for consultant work for rubber industries. It is expected that it will allow in particular measurement of the extent to which a compound is already pre-vulcanized and the practical curing time.

Annex VI

TESTING OF PAPER, PACKAGING AND WOOD

No further requirements to those mentioned in the previous report have so far been formulated.

No suitable low-cost testing machine for testing packaging has been found so far (item NP 27).

It is expected that the Tinius Olsen Super "L" testing machine can be used in many cases down to loads of about 200 kgf (2,000 newton).

Testing problems pertaining to packaging and wood should be further examined when standards have been formulated for particle board and plywood. (See also annex VIII on mechanical testing).

Annex VII

ELECTRICAL TESTING

The work of the electrical technical committee will have to be resumed and sub-committees formed to be concerned with:

(a) Electrical installations in buildings. The Institute of Electrical Engineries (IEE) regulations should be further studied and compared to IEC general regulations and VDE regulations before adoption with or without amendments for use in Mauritius;

(b) The type of electrical sockets and plugs to be installed in new buildings must be decided by the committee. (It is proposed that the British Standards Institute (BSI) three-contact flat-pin 13A connectors be used until adoption and availability of the world-wide IEC plugs);

(c) The type of installation cables and wires to be admitted in Mauritius must be decided, taking into account the high humidity. (The current flat-type BSI cables with ground may not be suitable from the point of view of fire protection);

(d) Electrical dry cells for current consumption. A suggestion for standard is attached to this report.

The standards relevant to the electrical installation listed above should be elaborated to be ready for application at the latest by 1 July 1978.

The equipment for testing batteries is being ordered from the UNIDO contribution as follows:

UNIDO requisition number	Description	Delivery date
-	Load resistors and switches	Present
77/1	Fluke model 8800A digital voltmeter	April 1977
77/3	Six universal timers SUEVIA model 100	April 1977
The local Government should procure:		
NPE 1	Five test racks made from formica-covered topboard	
NPE 2	Fifteen 4-contact relays type VC0500 coils 240 V, 50 Hz	

The layout and connections are shown in the following section on "Dry battery testing".

For testing cables and electrical goods in general the following equipment listed in the previous report should be ordered from the government contribution.

Item	Description	Estimated cost
NPM-59	Combined Kelvin-Wheatstone Bridge General Radio model 1666 DC	$US 1,690 (f.o.b.)
NPM-60	Four-terminal wire holder, one metre length between potential contacts (knife-edges) (To be made locally using a laboratory table, suitable large pole-screws current supply and two well-defined edges for potential contacts)	
NPM-95	Insulation resistance tester General Radio megohmeter type 1864-9700 for 240 V, 50 Hz	$US 995 (f.o.b.)
NPM-96	Insulation breakdown tester -5000V Model TPR 26 05 (Elektrotechnische Laboratorium Karl Baumann, 7015 Kornital-Stuttgart, Federal Republic of Germany)	DM 3,628.80 ($US 1,450) Sea freight

In addition to the above-listed items the DC and AC power supplies listed in the previous report as NPM-66 to NPM-69 should be ordered. The quotations received so far (Philips), however, do not fully conform to the specifications and further investigations have to be made. A main difficulty is that the power supply is 240 V and not 220 V, which is important in particular for high-power AC supplies.

NPF-3 Two more testing cabinets for testing will also have to be ordered. Specifications to be furnished by the consultant (Haereus, Federal Republic of Germany)

When ordering from General Radio Co. the following electrical metrology items should also be included (not ordered by UNIDO):

NPM-77	Decade capacitor, General Radio model 1412-BC	(600)
NPM-78	Order of this item has been postponed since there may be only very limited measurements of inductance	
NPM-79	Decade resister 0.01% accuracy, 1 ohm to 11 megohm, General Radio model 1433H	(800)
NPM-80	Impedance bridge 0.1% basic accuracy, General Radio model 1656-9701, and test jig, General Radio model 1650 P1	($US 1,700)

All General Radio equipment should be shipped by air freight.

Other items pertaining to electrical testing have in large part been ordered from the UNDP contribution for 1976/77. (See summary in annex XA).

The metrology and testing items included in annex X of the first report which have not been acquisitioned or ordered so far will have to be ordered either from the government or UNDP contribution for 1978, depending on the urgency of procurement. (See annex X for summary.)

Dry battery testing

MSB will test on a regular basis common types of dry batteries whether locally manufactured or imported. Tests will normally be made according to IEC standard 86 but will at the start be limited to portable lighting, transistor radio sets and similar applications.

The total life of the battery depends on the current consumed and the time cycles as well as on storage time and storage temperature. The test methods will be selected from the IEC standard. However, the minimum life requirements for approval marking or quality grading will have to take into account the general improvement of output from dry cells which has taken place in recent years as well as the cost of the commercialized cells.

A grading system of such cells in three (or more) classes would be advisable, thereby taking into account the fact that intrinsically more expensive batteries may have a much longer life. Work for consumer protection

may involve a certain amount of comparative tests.

It is suggested that the MSB laboratory be equipped for regular testing of the following types of cells and applications.

Battery US size	Diameter (mm)	Length (mm)	Test application	Test load resistance (ohm)	Test cycle	Minimum
AA	14	50	Transistor use	150	4 h/day	65 h (25 days) for end voltage 0.9 V
C	25.4	50	Transistor use	75	4 h/day	80 h (20 days) for end voltage 0.9 V
D	33	61	Transistor use	40	4 h/day	150 h (40 days) for end voltage 0.9 V
			Portable lighting	5	30 min/ day	690 min (25 days) for end voltage 0.75 V

The most common type of battery has the following chemical system: manganese dioxide (depolarizer) - sal ammoniac (electrolyte) - zinc (negative electrode). (The positive electrode is pure carbon.) The IEC designations for sal ammoniac batteries of this type with the dimensions above are R6, R14 and R20. However, a number of new constructions have other chemical systems including alkali electrolytes, and the US size designations AA, C, D are more frequently used internationally.

Some comparative tests have so far been done at the University using manual switching of the load and daily control of the voltage. It is proposed to make 5 automatic test cycling installations at MSB each for 12 batteries, using the listed loads and time cycles. Parts for this installation have already been ordered and the layout and connections are shown in figures II and III.

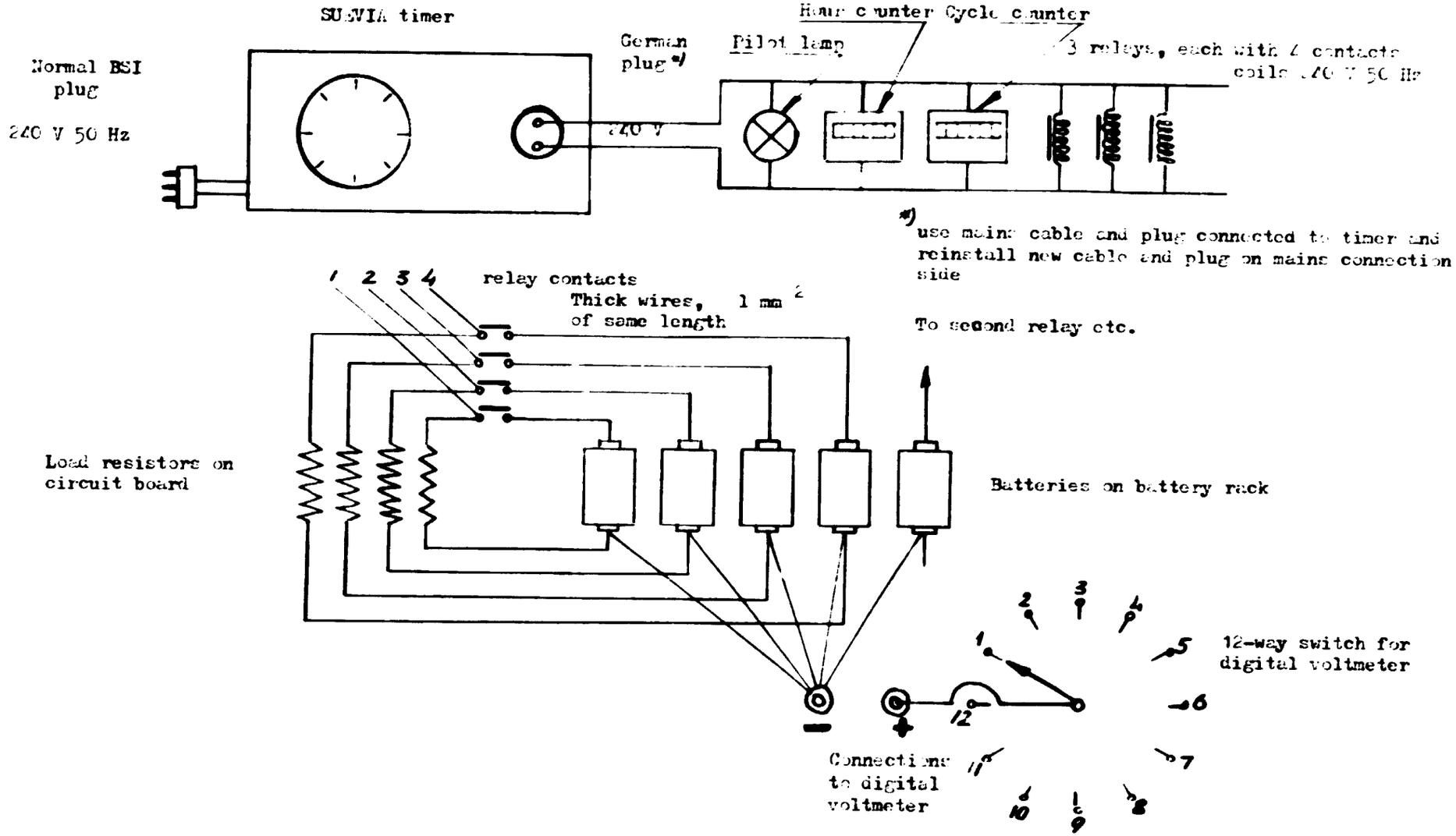

Figure II. Dry battery test rack connections

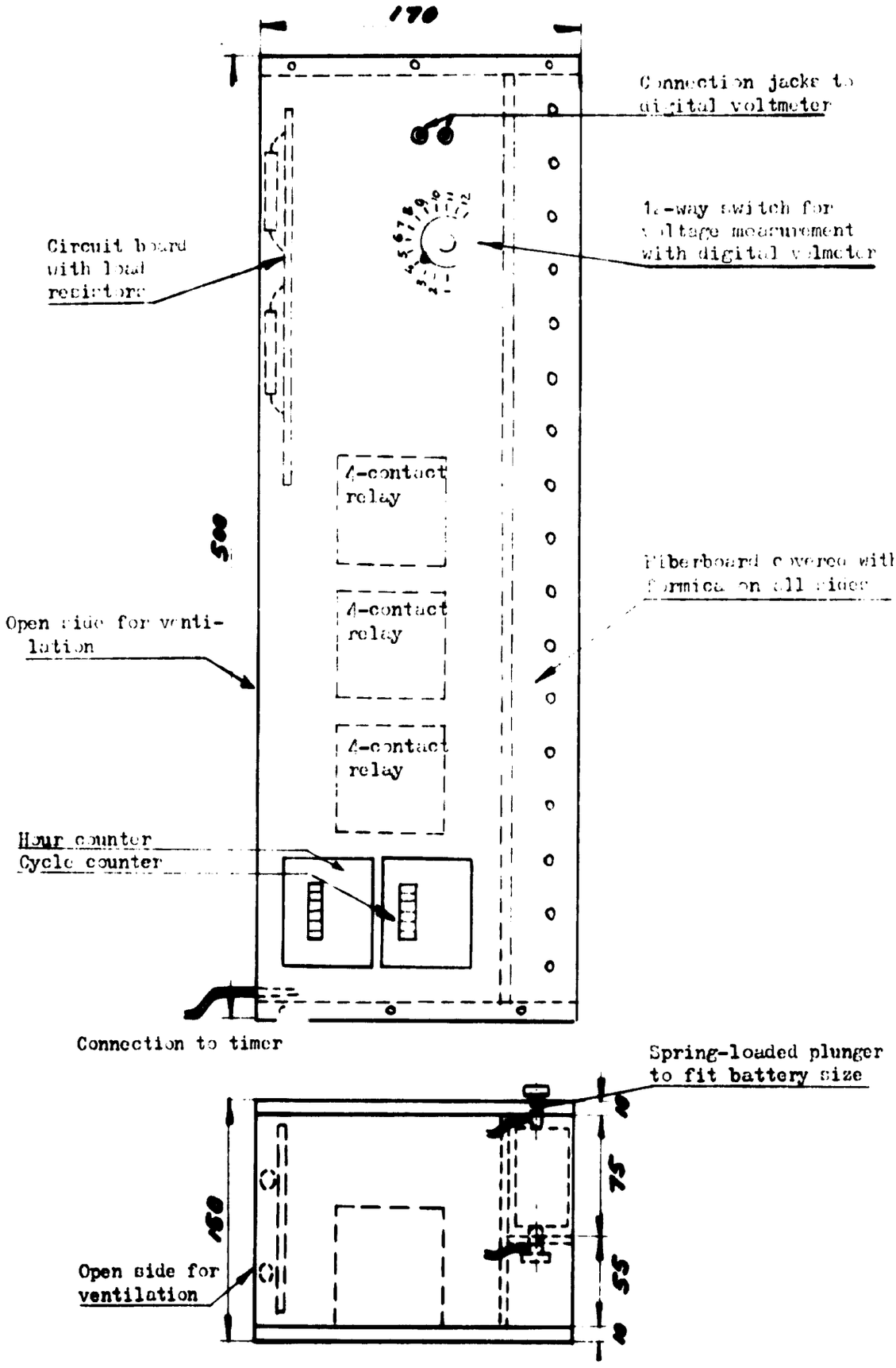

Figure III. Dry battery test racks

Tests after storage, type tests and accelerated tests

The IEC standard specified that tests should also be done on batteries which have been stored for six months at a temperature of 20°C. The storage temperature in Mauritius is generally closer to 27°C than to 20°C. The shelf life may in this case be decreased considerably for the usual types of batteries. As the limits set by IEC are rather low it is suggested that these limits be maintained as minimum type-test acceptance conditions with the mean storage temperature prevailing in Mauritius.

It is thus suggested that type tests according to IEC standards be executed for the battery types above including tests after six months in ambient temperature and leakage tests according to IEC. Batteries which thus fulfil IEC regulations and minimum life can be given the MSB quality grade MSB-ML (minimum life). Two other grades may be defined MSB-LL (long life) and MSB-EL (extra long life). These grades will have to be further defined, such as LL = 1.5 times ML, EL = 2 times ML etc. The latter will generally apply for batteries with other compositions, such as alkali electrolytes etc. It is necessary to classify the batteries in this way in view of the higher production costs of leak-proof long-life batteries. All batteries should be marked with production date or importation day.

Type (including leak-proof) testing is very time consuming and some form of accelerated tests must be made for regular control of locally produced or imported batteries, be it for absolute classification in the grades listed or for comparative purposes (including price considerations). It is suggested that the following cycles may be used which do not need modifications of the installations planned.

Size AA (14 mm) batteries tested with 75 ohm load for 4 h/day
Size C (25 mm) batteries tested with 40 ohm load for 4 h/day
Size D (33 mm) batteries tested with 5 ohm load for 1 h/day

This accelerated test scheme seems realistic in that it corresponds to a number of actual applications and still allows the batteries to recover from one day to another. The testing time may in this case be reduced to 12 (or 10) days, by which time the cell voltages are measured with load. The minimum acceptance voltage per cell can then probably be set to 1 V (or 0.9 V), depending on results obtained from correlation with the IEC type tests. Such

correlation can be made by having type tests and accelerated tests run simultaneously on two groups of 12 batteries of the same type. For the 5-ohm tests in particular it is in all cases important to check that voltage drops in the wiring and in the contacts are negligible.

Tentative MSB standard for dry round cells

1. Scope and purpose

The present standard concerns dry round 1.5 V cells currently used in Mauritius with the following approximate dimensions.

External diameter (mm)	Length between contact surfaces (mm)	Maximum total length[a/] (mm)
14 ± 0.5	50 ± 0.5	50.5
$25 \begin{smallmatrix} +0.7 \\ -0.3 \end{smallmatrix}$	$49 \begin{smallmatrix} +0.1 \\ -0.5 \end{smallmatrix}$	50
$33 \begin{smallmatrix} +1.2 \\ -0.8 \end{smallmatrix}$	60 ± 0.5	61.5

a/ Including insulating borders, if any.

The indicated limits of dimensions are in conformity with the recommendation 86-2 of the IEC.

The main uses of the cells are portable lighting and portable transistorized appliances, radios and recorders.

The purpose of the standard is to provide means for the classification of quality of these products in particular with respect to duration of use and storage.

2. Dimensions

No cell conforming to the present standard shall have dimensions falling outside the tolerances listed in paragraph 1.

3. Duration of cells (type and regular quality control test)

Fresh cells should have the following minimum lifetime.

Cell type		Accelerated test		Minimum duration for end voltage 0.9 V		
Diameter (mm)	Contact length (mm)	Load (ohm)	Cycle	Grade ML	Grade LL	Grade EL
14	50	75	4 h/day			
25	49	40	4 h/day			
33	60	5	1 h/day			

The quantity of tested cells should be at least three of each type.

Note: The two first types of cells are to be used mainly for portable transistorized appliances, whereas the main application of the last type is portable lighting. The test loads and test cycles have been chosen to reduce testing time and still allow the cells to recover.

The minimum useful cell voltage with the loads indicated has been set to 0.9 V. Correlation tests have shown that the values indicated for grade ML generally correspond to the minimum requirements set forth by IEC using longer test periods. The accuracy of the values of load resistance, voltage and time measurements should be $\pm$ 1% or better.

4. Influence of storage (type test)

Cells that have been stored for six months at a mean temperature of 25°C and 80% rh according to the present standard, shall not show a lower on-load voltage than 0.9 V when tested to 80% of the durations indicated in paragraph 3. Furthermore, the influence of the storage should show no apparent external alteration of the cells as leakage of electrolyte or oxidation of contacts.

5. Leakage-proof (type test)

The mention "leakage-proof" on the cells will not be accepted unless repeated type tests on 100 fully discharged cells of the same type has shown that no leakage has occurred on more than one cell when stored for a duration of six months at normal atmospheric conditions in Mauritius (mean temperature 25°C and 80% rh.)

6. Marking

Cells conforming to the present standard should be clearly marked with the date of manufacture or importation. The manufacturer and importer may apply for the MSB quality mark in accordance with the tests and other specifications of the present standard.

The quality marks of MSB are: ML for minimum quality, LL for medium quality and EL for high quality.

The qualities LL and EL will imply type tests for leakage proofness according to paragraph 5.

Annex VIII

THE MECHANICAL TESTING LABORATORY

As was mentioned in the previous report, testing of concrete blocks, bricks and building elements in general is done on a routine basis by the laboratory of the Ministry of Works and when necessary by the civil engineering laboratory of the Universsity. MSB generally tests steel, metals, wood, plastics etc. in its own laboratories.

Calibration activities

Proving rings have been ordered from UNIDO for the calibration of testing machines up to 60 tons (600 kN). Proving rings for higher capacities are usually extremely heavy and uncomfortable to use for field calibration of hydraulic presses. It will be investigated if suitable reliable equipment using strain-gauge load cells can be procured to carry out such calibrations up to 300 tons (or 3 meganewton). This item NPM 41 is to be listed for procurement on the 1978 UNIDO contribution (see annex X). The mechanical laboratory will be in charge of such calibrations as well as calibrations of pressure gauges, length end gauges and similar items for which equipment has been procured.

At present it is urgent that the Tinius Olsen 100 t testing machine is calibrated using the 600 kN Wazau dynamometer which has been ordered from the UNIDO contribution and is due to arrive within two months.

A manual for the calibration of dynamometers and of a testing machines has been written by Dr. Thulin for Institute of Standards and Industrial Research of Iran, (ISIRI) and is available at MSB. Extreme care in pressure loading must be taken in order not to overload the dynamometers with powerful machines such as the Tinius Olsen.

Testing of steel and metals

The Tinius Olsen 100 t testing machine, which was previously installed at the University, has been transferred to the mechanical laboratory of MSB (room 10) and is found to operate to full satisfaction in spite of transport difficulties.

A certain amount of testing of reinforement steel is immediately foreseen.

To ascertain values found it is necessary, however, to calibrate the machine as mentioned. Results obtained on the Avery-Denison 5-ton machine, which has been repaired, are sometimes different by 50% from the values found on the Tinius Olsen machine. At least one of the machines must have considerable indication error. Further checking of the operation of the 5-ton machine has to be made.

Layout of laboratory room 10

The layout of the laboratory shown in the sketch for room 10 in the first report has been followed, with the exception that the two hardness-testing machines for Vickers and Rockwell tests have been installed temporarily at the locations of metallic cupboards 10 - 11 and 10 - 12. These machines will have to be transferred to room 12. Space must in fact be made available for a small workshop to be installed in the corner of the room where the plastometer (item 10 - 8) is installed. The latter can preferably be transferred to room 9 which can be used partly for storage or cumbersome items and partly for voluminous items such as the plastometer, the climatizing (humidity) cabinet to be ordered and the hydraulic press for rubber.

Workshop

Some hand tools have already been procured to render MSB practically independent of the workshop of the University. The following additional items should be procured:

(a) Bench drill (or foot-standing) for drilling up to 10 mm diameter;

(b) Double-ended grinding machine (preferably on stand), grinding wheel diameter up to 8 in.;

(c) Lathe for making metric and Whitworth screw-threads, centre height 150 to 170 mm;

(d) Guillotine sheet-metal cutter for cutting up to 2 mm iron plate, table 1 m wide;

(e) Rod cutter for up to 10 mm soft iron;

(f) Hack saw for sawing iron pieces up to 80 mm;

(g) Drills, grinding wheels, saw blades, cutting tools for lathe as required, thread tapers, metric for small sizes, Whitworth for tubes etc.

It is expected that most of these items can be purchased through local suppliers.

The mechanical technicians to be employed must have been trained in using workshop machines and, in particular, in lathe work.

Hardness testing

The two hardness-testing machines have arrived and hardness tests can be done. Flat parallel surfaces can generally be obtained using the diamond wheel cut-off machine which also has been delivered. This machine will have to be placed on a special iron table to be manufactured and installed in room 10.

Metallography and analysis

The plastic press for embedding small metallographic samples is the only item which has been ordered so far, polishing equipment is with the University. It is suggested that plastic powder be procured for this machine from the UNIDO contribution (as well as milling cutters for the Izod-Charpy tests).

It is not yet fully clear to what extent metallography will be needed and if the limited facilities available at the University may be used. Manufacturers emphasize that some analysis facilities for steel should be available. An attempt to implement phase II of the mechanical testing laboratory as described in the first report (including metals analysis and metallography) has been made in the form of a bilateral request to the French Government for an expert and analysis equipment (see following section "Request for bilateral assistance for metallurgy and metallurgical testing").

In case of agreement the following steps will have to be taken:

(a) Procurement of a metallographic microscope (medium-sized) from Reichert or similar;

(b) Procurement of micro-hardness equipment (Zwick or similar).

These items may be procured on the government contribution (or UNIDO contribution for 1978) and installed in room 12 together with the other hardness testers and the engineering metrology equipment.

As a second step diamond and alumina powder polishers and a rough grinder should be procured and installed in room 9 or other suitable location.

A suitable location for the analysis equipment will then also have to be found in room 9.

Request for bilateral assistance for metallurgy and metallurgical testing

MSB has a laboratory which has been equipped with some instrumentation for mechanical testing of metals (impact, hardness and tensile strength). This equipment was furnished by UNDP/UNIDO in the first phase of the project for MSB.

There are at present three manufacturers of reinforcement steel in Mauritius, some important foundries, one industry making razor blades and several other metal industries which are being created. There is a continuous need to analyse and test:

(a) Imported metallic raw materials used by the industries;

(b) Finished products on a quality-marking control scheme.

The ministry concerned and the industries should be advised as to improvements to be made, and in some cases metallurgical development work should be undertaken.

The present MSB staff in mechanical engineering consists of one mechanical engineer; two technicians are being recruited.

The available equipment consists of:

One universal testing machine (Tinius Olsen) with ranges of 0 - 100 tons, 0 - 25 tons and 0 - 2.5 tons

One Universal machine (Avery), 0 - 5 tons

One Izod-Charpy hammer

One Vickers hardness tester

One Rockwell hardness tester

One cut-off machine

One mounting press for small samples

An engineering metrology laboratory facility and a chemical laboratory are also available in the MSB building.

The required additional equipment consists of:

Analysis equipment, mainly for steel (mainly carbon sulphur, phosphorus and manganese content);

Surface and sample preparation equipment

Metallographic microscope

A limited amount of equipment funds will be available from the government budget for the laboratory.

It is requested that at least the analysis equipment be supplied through bilateral assistance funds, the cost of which is estimated to be about 150,000 French francs.

The bilateral expert should assist the laboratory for at least one year and preferably two years. His main duties will be to train his Mauritian counterpart in metals analysis, mechanical testing of metals and metallography. During the first part of his stay, one year, he will also have the technical responsibility for the testing operations until this responsibility can be taken over by his Mautitian counterpart. The expert will also advise MSB on standards to be adopted and the ministries on matters concerning steel and metals and technical questions pertaining to the metals industry. He will also act as a link in the routine testing of reinforcement steel between the engineering laboratory of the Ministry of Works and MSB.

Annex IX

THE CHEMICAL LABORATORIES

The chemical laboratories, rooms 26 and 28, at the start will mainly test textiles and paints. Equipment has been ordered for these activities.

The standards to be elaborated in other fields will show what other chemical tests will be required.

A small microbiological facility will probably have to be added to accomplish fungal tests on paints, but possibly also other tests involving food products, depending on the developments in the use of other microbiological laboratory facilities in Mauritius. A suitable microscope is already present (Reichert Zetopan); a sterile glove box and an additional incubator along with culture materials may be the only additional equipment needed.

A gas chromatograph along with all accessories and carrier-gas bottles should be foreseen under the 1977/78 budget for the laboratory.

An expert in analytical chemistry should be foreseen to train local counterparts, starting in January 1978.

A new balance table has been installed for:

160 g analytical balance weighing to 0.1 milligram
20 g microbalance weighing to 1 microgram

As, in addition, a separate balance will have to be used permanently for the textile laboratory, it is necessary to purchase one more Mettler balance, capacity 160 (or 240 g) weighing to 0.1 milligram. If the Sartorius microbalance cannot be correctly repaired, it will also be necessary to procure a microbalance from Mettler, identical to the one installed for the mass metrology laboratory, room 1.

Annex X

PROCUREMENT OF EQUIPMENT

A. Government procurement as of 1 April 1977

All the items listed for government procurement in the last report, annexes I – IX, have been ordered by the Government with the exeption of:

Item	Description	Reason for delay in delivery
NP 5	Yarn-tensioning device	Textile expert to advise
NP 10	Spray gun and brushes	To be procured locally
NP 11	Panels for testing paints	To be procured locally
NP 18	Climatic cabinet	Quotations awaited
NP 23	Specimen holder	To be made locally
NP 26	Kubelka apparatus	Not available commercially
NP 27	Press for testing packaging and plastics, 100 to 3,000 kgf	Suitable quotations not yet received

The Government has in addition to the items listed in the previous report ordered the following equipment:

NP 28	Paint-film applicator
NP 29	Pilliscope for textiles
NP 30	Steaming cylinder and steam generator for textiles
NP 31	Various expendable items for textile testing to IWS list
NP 32	Weight-per-volume cup for paint testing

B. Government procurement to be made according to the present report

B 1. Equipment for testing rubber, items NPR-1 to NPR-4; see specifications in annex V.

B 2. Equipment for electrical testing, items NPE-1, NPE-2, NPE-3 and the following items from annex X of the previous report:
NPM - 59, 60, 66 to 69, 77 to 80, 95 and 96 (Full specifications on models and suppliers are given in annex VII of this report.)

P 3. Equipment for fungal tests including sterile glove box, incubator and sterile materials; consult microbiolists and SABS standards for paints.

P 4. Workshop equipment including lathe and steel saw from abroad; other items from local market, see specifications in annex VIII.

P 5. Climatic test chamber, enabling high humidity, temperature - 20°C to + 80°C, 98% rh between 20°C and 50°C with recorder, air cooling, internal dimensions, 500x500x500 mm min., two 30-mm entries for wires.

C. UNIDO procurement of equipment for phase II, 1976 and 1977 budgets

As soon as the budget for the project equipment was known, systematic requisitioning started, following the list in annex X of the previous report but taking into account priorities to avoid overdrawing the rather strict budget limits. A number of accessories and equipment complementary to those already existing were first requistioned (requisitions 76/1 to 76/5), following the indications in annex XII of the previous report.

The equipment listed in annex X which has so far not been requisitioned is given below together with the explanation:

Item no.	Description	Reason for delay	Expected to be ordered
NPM - 34	Cathetometer	Postponed	
NPM - 41	Load-cell calibrator	Quotations awaited	1978
NPM - 45	Potentiometer	Combined with NPM-57	
NPM - 49to53	Hygrographs etc.	Government has ordered (NP-7)	
NPM - 56	Weston cell enclosure		1978
NPM - 58	Volt box		1978
NPM - 59	Resistance bridge	To be ordered by Government	
NPM - 60	Wire holder	To be made locally	
NPM - 61	Standard resistors		1978
NPM - 62	Shunt box		1978
NPM - 63	Shunts, high current		1978
NPM - 64	Precision voltage supply		1978
NPM - 65to69	Power supplies	To be ordered by Government	
NPM - 75	Low-frequency generator		1978
NPM - 76	Oscilloscope		1978
NPM - 77	Decade capacitor	To be ordered by Government	
NPM - 78	Decade inductor	Postponed	

NPM - 79	Decade resistor	To be ordered by Government	
NPM - 80	RLC-bridge	To be ordered by Government	
NPM - 90	Carbon pile resistor		1978
NPM - 91	Elavi-script recorders		1978
NPM - 93	Potentiometric recorder		1978
NPM - 94	Electronic parts		1978
NPM - 95	Megohm bridge	To be ordered by Government	
NPM - 96	Breakdown tester	To be ordered by Government	
NPM - 81	Precision digital multimeter		1978

Note: The cost of the items listed above for ordering in 1978 is estimated to $US 24,000. Other items for metrology and testing, which may prove suitable for ordering in 1978, are a metallurgical microscope, profile projector, tool-room microscope, gas chromatograph etc. The priorities will have to be established according to the need for standard work and the availability of experts and other facilities.

D. Summary list of the requisitions for equipment sent to UNIDO for phase II

	Requisition number	Purchase order	Main items	Supplier	Cost in dollars
	76/1	15-6-00530	Hydrometers, sieves	Griffin & George	700
	76/2	15-6-00521	6 kg mercury for polarography	Merck	227
	76/3	15-6-00524	Accessories for polarograph	Fisher	362
	76/4	15-6-00531	Muffle furnace, air pump	Griffin & George	701
	76/5	15-6-00525	Titrimeter	Fisher	1,926
NPM-5 to 7	76/6	15-6-00527	Analytical balances	Mettler	9,642
NPM-4,8,10	76/7	16-6-00544 00544A	25-kg balance, meter Metric pipettes	Re-verifications	3,420
NPM-11	76/8		15-metre measuring tapes	BMI	1,500
NPM-12 to 17	76/9		End gauges	Hommelwerke	3,000
NPM-18, 20 to 33	76/10		Engineering metrology equipment	Carl Mahr	10,000
NPM-35	76/11		Cathetometer, 200 mm	Spindler & Hoyer	2,400
NPM-36,37	76/12		Pressure testers	Budenberg	4,016

NPM-38	76/13		Barometer	Fuess	2,800
NPM-42,43	76/14	15-7-00176	Thermometers	Fisher	378
NPM-44	76/15		Platinum thermocouples	Johnson-Matthey	750
NPM-46	76/16	15-7-00175	Iron-constantan thermocouples	Degussa	222
NPM-57	76/17		Potentiometer facility	Leeds & Northrup	4,000
NPM-47 83 to 87	76/18	15-7-00610	Electrical meters	Hartmann & Braun	4,700
NPM-2	76/19		Mass standards to 100 g	Stanton, UK	(400)
NPM-1	76/20		Mass standards to 20 kg		(5,000)
NPM-9	76/21	15-7-00177	Volume standards, stainless	Wragg	1,577
NPM-19	76/22		Surface plates	Esselte	4,000
NPM-81	76/23		Digital multimeter	Fluke (postponed to 78)	
NPM-54,55	76/24		Thermostats	Haake	2,800
NPM-70,88,89	76/25		Transformers, resistors	Ruhstrat	4,800
NPM-92	76/26		Galvanometer	Sefram	1,000
	77/1	15-7-00168	Digital multimeter 8800A	Fluke	1,098
NPM-40	77/2	15-7-00169	Three dynamometers 5 kN, 50 kN and 600 kN	Wazau	6,580
	77/3		Six timers, model 100	Suevia	(200)
	77/4		Limit switch for testing machine, 100 t Super L	Tinius Olsen	(50)

New requisitions to be made by UNIDO; final specifications to be furnished by Dr Thulin:

Requisition	Item	Supplier	Cost in US dollars
77/5	Two selenium photocells with V lambda filter (for capacity tests on paints)	Spindler & Hoyer, Federal Republic of Germany	(100)
77/6	Hour counters and cycle counters for 230 V, 50 Hz	Irion & Vosseler, Federal Republic of Germany	(700)

77/7	Eye-pieces with divided graticule for Reichert stereomicroscope type, MAK KS, part designation 6.3xw.m.	Reichertwerke, Austria	(100)
77/8	Cutters to be used on milling machine for cutting notches to standardized Charpy and Izod tests		(50)
77/9	Methylmetacrylate powder for plastic press	Metallurgical Services, UK	(50)
	Total for requisition commitments for phase II, 1976 and 1977 equipment budget, UNDP:		79,069

Note: Costs within brackets have still to be confirmed.

Quotations for all equipment up to requisition 77/4 included have been cleared by the expert with the exception of requisition 76/20, primary mass standards in stainless steel, for which no supplier has been found so far. The National Bureau of Standards, Washington, is being consulted on this point.

Annex XI

URGENT STANDARDIZATION PROGRAMME

(Suggested by Dr Thulin based on information available in April 1977)

A. Products intended mainly for local consumption

Product	Technical committee	Draft standard target date
1. Food		
1.1 Dairy products	TC 8	
Milk		July 1977
Pasteurized milk		July 1977
Yoghurt		Dec. 1977
Eggs		Dec. 1977
Ice cream		Dec. 1977
Butter		
1.2 Edible oils and fats	TC to be formed	
Coconut oil		Urgent
Sunflower oil		
Soya bean oil		
Groundnut oil		
Shortening		Urgent
1.3 Cereals, bread etc.	TC to be formed	
Flour		Urgent
Bread		
Yeast		
Biscuits		
Rice		
Macaroni		
Maize		
Vegetable grains and pulses		
Jellys		
1.4 Salt	TC to be formed	Urgent

Product	Technical committee	Draft standard target date
1.5 Sugar products		
Sugar for local consumption	TC	
Sugar confectionery	(MSIRI to advise)	
Molasses		
Alcohol		
Rhum		
Vinegar		
1.6 Canned products	TC to be formed	
Vegetables		Urgent
Juices		Urgent
Fruit		
Fish		Urgent
Pickles		
1.7 Drinks	TC to be formed	
Beer		
Soft drinks		
1.8 Spices	TC to be formed	
1.9 Poultry	TC to be formed	
Fresh chicken		Urgent
Frozen chicken		Urgent
1.10 Meat	TC to be formed	Consult Ministry of Agriculture
Ham		
Bacon		
Sausages		
Quality grading of fresh meat		
1.11 Fresh vegetables	TC to be formed	Consult Ministry of Agriculture
Quality grading		

Product	Technical committee	Draft standard target date
2. Household non-food consumables		
2.1 Soap, detergents, cosmetics	TC to be formed	
Soap		Urgent
Detergents		Urgent
Toothpaste		
Hand cream		
Perfumes		
Hair spray		
2.2 Consumables not used for human application	TC to be formed	
Waxes		
Floor polish		
Matches		
Razor blades		
(see also paper products)		
Aluminium utensils		
3. Products used in agriculture		
3.1 Fertilizers	TC to be formed	Consult Ministry of Agriculture
3.2 Animal feed	TC to be formed	Consult Ministry of Agriculture
4. Various industrial products		
4.1 Paints	TC 7	
Emulsion paints, exterior use		Dec. 1977
Emulsion paints, interior use		
Primers		Dec. 1977
4.2 Rubber	TC 9	
Retreaded tyres		Dec. 1977
Rubber gloves, industrial use		

Product	Technical committee	Draft standard target date
4.3 Plastics		
Plastic(PVC) pipes, pressure	TC 6	Dec. 1977
PVC sewage pipes	TC 6	Dec. 1977
Urethane foam		
Plastic tiles	TC 6	
4.4 Leather	TC to be formed	
4.5 Paper and packaging	TC to be formed	
Paper sizes		Dec. 1977
Paper bags		
Sanitary towels		
Toilet paper		
4.6 Petroleum and chemical products		When required
5. Construction materials	TC 6	
5.1 Cement		
Ready-made fresh concrete		
Hollow bricks		Urgent
Aggregates		
Coral sand		
Basalt sand		
Terazzo tiles		
Asphalt and bituminous compounds		
5.2 Steel and metals		
Reinforement steel	TC 6	Dec. 1977
Structural steel		
Galvanized iron sheets		
Metal openings		
Nails		
Brassware, taps and fittings		Urgent
Structural aluminium		
Aluminium utensils (see 2.2)		
Razor blades (see 2.2)		
Metal office furniture	TC to be formed	

Product	Technical committee	Draft standard target date
5.3 Wood		
Sawn timber	TC 6	
Particle board		Urgent
Plywood		
Wood furniture	TC 5	
Office furniture, wood	TC 5	
6. Electrical materials	TC 4	
6.1 Batteries	TC to be formed	
Dry cells		Dec. 1977
Car betteries		
6.2 Electrical mains connecting equipment	TC 4	
Electrical installations in buildings, including admitted types of plugs, sockets and switches		Dec. 1977
Electrical PVC cables and wires		
Safety rules for imported or locally manufactured electrical household appliances		

B. Products mainly for export or used by export industries

Textiles	TC to be formed	Textile expert to advise
Knitted fabrics		
Garments, quality and sizes		
Woven textiles		
Socks		
Blankets		
Towels		
Aloe-jute bags		
Sewing thread		
Yarn wool		

Other items

Canned products, see 1.6

Other export zone products may be standardised at the request of the manufacturer or by the Ministry (use of label "MADE in MAURITIUS").

Note: As the metrication act is soon to be passed, metrication will have to be included in all the standards mentioned above. No special metrication committee is required since this work will have to be done by each technical committee.

Annex XII

JOB DESCRIPTION FOR EXPERT IN TESTING PAINTS

Project:	DP/MAR/75/008 Assistance to Mauritius Standards Bureau
Post title:	Expert in testing paints
Duration:	6 months
Date required:	1 September 1977
Duty Station:	Mauritius Standards Bureau, Reduit, Mauritius (Ile Maurice)
Purpose:	To assist in the organization and operation of the paints testing laboratories of the Mauritius Standards Bureau (MSB)
Duties:	The expert will be attached to the Mauritius Standards Bureau of the Ministry of Commerce and Industry and specifically will be expected: (a) To organize and operate the paint testing laboratories of the MSB; (b) To train local counterparts in testing of paints; (c) To assist in drafting local standards for paints; (d) To assist MSB with advice in other physical and chemical testing activities in which the expert may have useful experience. Such fields cover typically fungal tests, corrosion protection, testing of plastics, rubber etc.
Qualifications:	University degree in chemical engineering, chemistry or physics with extensive experience in testing of paints. Experience in standardization of paints and physical and chemical testing of polymers in general is an advantage.
Language:	English (official language) and/or French.
Background information:	MSB was established in April 1975 by the Standards Act. The Bureau is responsible for drafting local standards based on foreign and international standards and will operate a certification marking scheme. MSB will carry out most of the testing in its own laboratories.

Paints, mainly emulsion paints and primers, are locally manufactured or imported and must be resistant to the high humidity and fungal conditions prevailing in Mauritius. The MSB testing laboratories for paints consist of one room for sample preparation and drying and one room for tests on dried samples. There is also a carbon-arc apparatus for artificial weathering tests and a corrosion test facility. The paint laboratory is installed but not yet operating.

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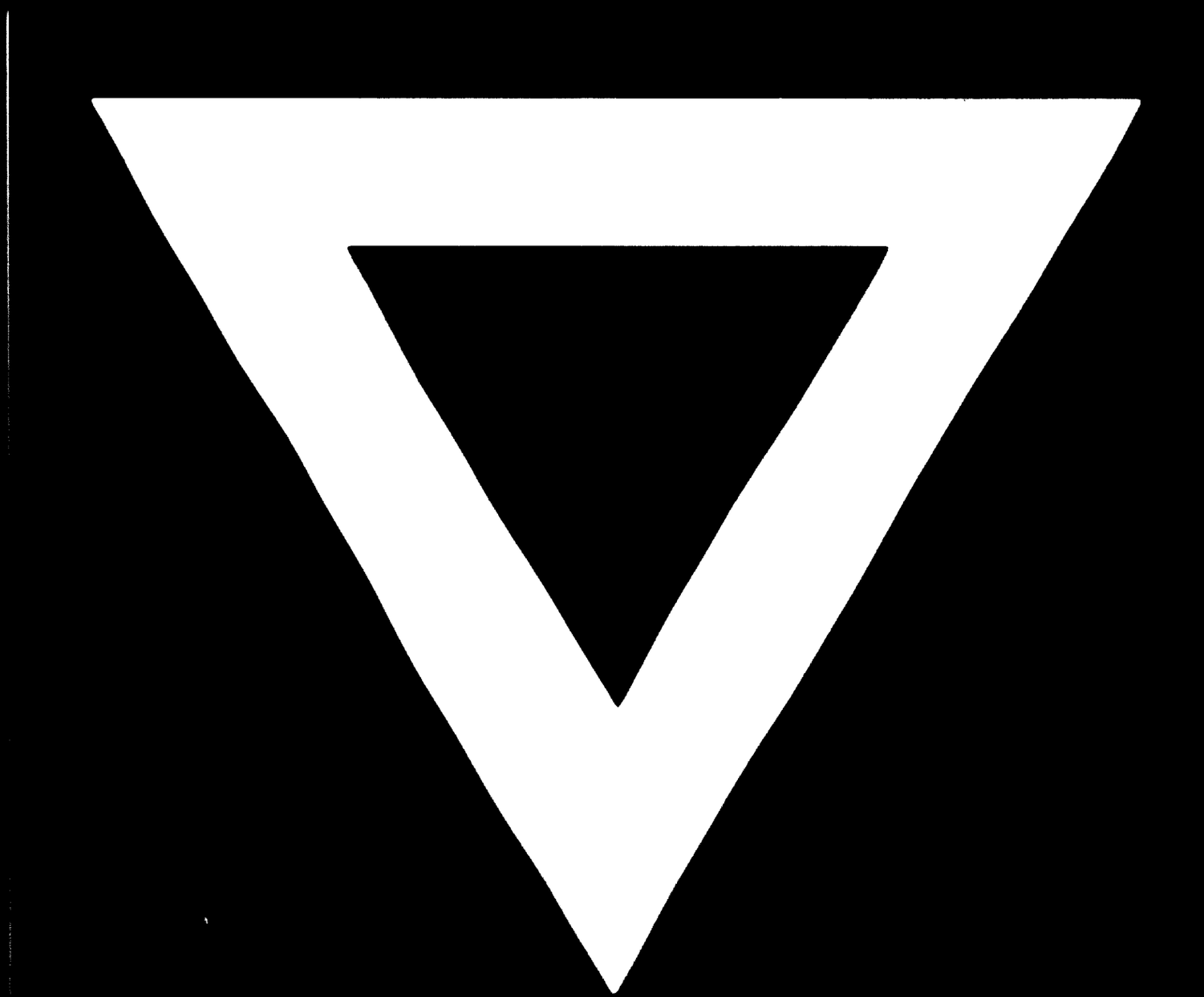

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