Bangladesh Garments Accessories and Packaging Manufacturers & Exporters Association (BGAPMEA)

Final Report

on

"Study for setting up of a Testing Laboratory"

under Bangladesh INSPIRED Project Component 2b

SME Competitiveness Grant Scheme Project of BGAPMEA

March, 2015

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In collaboration with BGAPMEA

Funded by

The European Union

Ministry of Industries

Govt. of the Peoples Republic of Bangladesh

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INTRODUCTION

1.1 Background

Garment accessories & packaging, although constitute insignificant percentage of cost of the products, occupies most important position in production economics. Packaging and Garments accessories are among the high growth industries in Bangladesh and are the most crucial determinants of quality of products. A high degree of potential exists for almost all user segments which are expanding appreciably. Bangladesh is becoming a preferred hub for accessories and packaging production. Accessories and packaging are inseparable ingredients of the products and as such they add distinguishable features to the related products. Product branding is critically dependent on the accessories and packaging. These add aesthetic value to the garments products which justifies claiming: **accessories and packaging qualify the products**.

In the export process, the contribution of packaging & accessories is very crucial. So, the uninterrupted supply of accessories and packaging must be ensured for successful production and timely shipment of any exportable product. In many cases, the accessories & packaging units are located within the mainstream industrial units; for instance packaging & accessories of medicine is an integral part of pharmaceutical industry, many garment factories have their manufacturing facilities of poly, sticker etc. In Bangladesh, there are large numbers of small, medium and cottage-based independent packaging and accessories industrial units scattered all over the country.

„Bangladesh is aiming at exporting RMG for US$ 30 billion by the year 2015 and US$ 50 billion by the year 2021. Export oriented garments accessories and packaging sector earned USD 4.75 billion during last fiscal year and is likely to be exported USD 12.0 billion by the end of 2018 and USD 18.0 billion by the end of 2025. If the packaging and accessories could be exported directly together with deemed exports the figure may even assume much higher figure and may stand as a parallel industry sector with RMG in terms of earning."

In order to cater to the demands of the garments sector, capacity of the GAP sector should be scaled up through increasing operational capacity and efficacy of the existing industrial units and also developing new enterprises.

Since Accessories and Packaging sector is inseparably related with export market, importance of up gradation of quality of the products of this sector to the international level is attracting serious attention from all quarters. The international buyers are increasingly pressing for improving quality of products for environmental and social compliance. They are imposing conditions for compliance and quality testing. And quality assurance can be achieved through conducting broad spectrum of testing of different aspects of the products. So, testing services have become a basic necessity for survival of the products in the world market.

In this backdrop, establishment of a Testing Laboratory under Bangladesh Garment Accessories & Packaging Manufacturers & Exporters Association (BGAPMEA) is essential to provide internationally acceptable testing facilities for various types of products manufactured by the industrial units under BGAPMEA.

This study has been conducted to determine the imperatives of establishing a Testing Laboratory embedding technically, economically and financially viable/ feasible propositions. This testing laboratory will critically analyze both raw materials and products and exhibit the qualitative features and their adherence to accepted standards. such testing will cover wide range of issues such as, quality of raw materials, design of the products, models, type, size, shapes, colors adaptation to standards, durability, resistance to climatic conditions, ease and reliability of packaging during shipping, handling, design of levels, quality impression, etc.

1.2 Objectives and Scope

The objectives of the study are to:

01. Provide internationally acceptable testing facilities for various types of products manufactured by the industrial units under BGAPMEA;
02. Contribute to improvement of quality of products of the Industrial units under GAP Sector of Bangladesh through providing timely and reliable testing facilities;
03. Strengthening the institutional capacity of BGAPMEA by establishing a testing laboratory so that it can extend necessary support to its member units in respect of internationally acceptable testing facility;

The scope of the study includes, among others:

01. Making an overview of the countrywide scenario of the existence of testing facilities, including their services, service cost, sustainability of services against needs, time requirement for providing the services;
02. Classifying the existing units under GAP Sector according to the type of products, number and types of tests required by the units under different classes, and so on;
03. Assessment of the requirement of testing facilities (both total and type-wise) by the units under GAP Sector;
04. Assessment of the requirement of physical facilities (such as land, building, laboratory, furniture and fixture etc.), machineries and equipment for each testing laboratory, energy, fuel and other logistic supports required by the proposed laboratory project;
05. Assessment of requirement of different categories of manpower (i.e. technical, administrative and other support personnel) to run the project;
06. Preparation of cost estimate of all inputs, such as land, building, furniture and fixture, machineries and equipment, raw materials, manpower etc. Also making realistic assessment of fixed cost, variable cost etc.; and
07. Making financial cost-benefit analysis of the Project.

1.3 Methodologies and Instruments

1.3.1 Study Approach

Testing Laboratory undertakes quality testing on internationally accepted parameters and help standardization of the quality of products. All the units under BGAPMEA are categorized into 19 on the basis of the types of products. Each product requires a set of quality testing. This study aims at assessing the needs of quality testing of each type of products through direct field survey covering acceptable sample units under each category. Based on the needs assessment, the subsequent analysis has been carried out to identify the need for testing equipment's and machineries, land and building, technical manpower, supply of raw materials, electricity etc. for setting up of a testing laboratory for GAP sector. Thus this study is based on pragmatic field survey from reliable statistics and information.

1.3.2 Sources of Data

The study has been conducted on the basis of both primary and secondary data. The primary data have been collected through a specially designed field survey conducted over the sample units under Garment Accessories and Packaging (GAP) sector. The secondary sources include among others, Bangladesh Garment Accessories & Packaging Manufacturers & Exporters Association (BGAPMEA), Bangladesh Garments Manufacturers & Exporters' Association (BGMEA), Accessories and Packaging Materials Testing Units, Chamber of Commerce & Industries etc.

1.3.3 Component-wise Methodology

The principal activities/tasks and corresponding methodology of conducting various tasks are presented below:

Sl. No.	Tasks/Activities	Methodology	Study Instruments/Tools
01	Making an overview of the countrywide scenario of the existence of testing facilities, including their services, service cost, sustainability of services against needs, time requirement for providing the services;	Exploring secondary sources and consulting data received from these sources	Pre-designed Checklist to collect short profile of the existing testing facilities in the country
02	Classifying the existing units under GAP Sector according to the type of products	Exploring both primary and secondary sources and consultation and classification of the GAP Units by types of product.	Pre-designed Checklist to collect short profile of GAP Units and then classification according to products
03	Classifying the existing units under GAP Sector according to number and types of tests required by the units under different classes	Making further classification of GAP Units on the basis of set of testing facilities	Pre-designed checklist

		required.	
04	Assessment of the requirement of testing facilities (both total and type-wise) by the units under GAP Sector	Exploring sample primary sources regarding requirement of testing facilities.	Pre-designed Questionnaires for use at the sample GAP and Testing Units
05	Assessment of the requirement of physical facilities (such as land, building, laboratory, furniture and fixture etc.), machineries and equipment, energy, fuel and other logistic supports required by the proposed testing laboratory Project.	Review and analysis of data outcome derived from serial 02, 03 and above, particularly through brainstorming, forming and norming process among consultants.	Standard practice, keeping in view the present and prospective needs
06	Assessment of requirement of different categories of manpower (i.e. technical, administrative and other support personnel) to run the proposed laboratory.	Continuous discussion among the consultants	Standard practice, keeping in view the present and prospective needs
07	Preparation of cost estimate of all inputs, such as land, building, furniture and fixture, machineries and equipment, raw materials, manpower etc. Also making realistic assessment of fixed cost, variable cost etc	Continuous discussion among the consultants	Standard practice, keeping in view the existing and prospective needs
08	Continuous discussion among the consultants	Continuous discussion among the consultants	Standard practice, keeping in view the existing and prospective needs

1.3.4 Data Instruments used in the Study

The following Instruments have been used to conduct the study:

01. Questionnaire used for collecting data from the sample GAP Units
02. Checklist to collect short profile of all Testing Units in the country
03. Checklist of aspects for discussion with Key Informants (KIs) from Association Offices

Copies of Questionnaires and Checklist are given in the Annexure

1.3.5 Sample Size and Sampling Design

The sampling techniques applied for selection of sample units for the study are summed up below:

- All the units under GAP Sector were first divided into 19 (Nineteen) identifiable categories based on product specifications;
- Sample size of the GAP has been determined on the basis of number of units under each category;
- In case of small number of units, 100% units have been taken as sample units;
- In the case of categories with large number of units of each category of products (Accessories and Packaging products), 10% units have been taken as representative units;
- In some cases, applying rational sense of sampling, less than 10% have taken as representative sample units.

The sample size of the units selected through the application of population proportionate to size (PPS) technique, are presented below in tabular form:

Table 1 Sample size of units

Sl. No.	Entity/Unit	Total No. of Units/Entities	No. of Sample Units/Nos.	Remarks
01	GAP Units	1,232	55	
02	Testing Units	NA	05	
03	Different Associations	NA	All Associations	

A. Selected Sample Units from different categories of Industries

Since the GAP Sector includes 19 categories of industrial units, the study has selected sample units from each category following PPS method. The selected units belonging to different categories of industries are shown in table 2.

Table 2 Selected units from different categories of industries

Sl. No.	Name of Accessories and Packaging	No. of Units	No. of Sample Units for Study (Average 10%)
01	Button (Button & Elastic Button)	24	03
02	Chemical	01	01
03	Corrugated Carton	632	08
04	Elastic & Drawstring	103	05

05	Embroidery	02	02
06	Gum Tape & Twill Tape	02	02
07	Hanger	06	02
08	Interlining	07	02
09	Multi Items	166	04
10	Packaging	23	03
11	Padding	03	02
12	Poly Bag	133	05
13	PP Band	01	01
14	Labels	37	04
15	Quilting & Padding	01	01
16	Resin	01	01
17	Sewing Thread	67	03
18	Screen Print	03	02
19	Zipper	20	04
	Total:	**1,232**	**55 Nos.**

B. Distribution of Sample Unit by Administrative Divisions:

While selecting the sample units, special attention was given to geographical location. The geographical dispersion of the sample units are given below:

Table 3 Distribution of sample unit´s

Administrative Divisions	Total No. of Unit under GAP sector	Sample Size (No.)
Dhaka	996	40
Chittagong	222	14
Khulna	11	01
Rajshahi	2	0
Sylhet	0	0
Barisal	1	0
Rangpur	0	0
Total	**1,232**	**55**

C. Flexible Packaging Industries in Bangladesh

In Bangladesh, about 20 large and 100 small flexible packaging industries are in operation. Flexible packaging industries have the capacity to produce a wide range of flexible packaging items with most modern and innovative technology. Available typical manufacturing facilities in the flexible packaging industries are:

- Seven Color Roto Gravure Printing
- Four Color Flexographic Printing
- Laminating
- Slitting
- Pouch Manufacturing

Feature on printing : Surface and reverse roto gravure printing capabilities.
Futures on lamination : Adhesive or extrusion with dry and wet laminating films.
Feature on pouches : Three side seal, two side seal, one side seal, and Zipper capabilities.

Packaging Applications:

Flexible packaging industries are able to provide products in different gauges, width, length and film structures to meet customer specification and specific demand. The pouches and films are custom designed with regard to customer specification and applications. Flexible packages are used in:

- Food Products
- Detergent
- Insecticide & Pesticide
- Spices
- Tea & Milk
- Ice Cream
- Cosmetics & Toiletries
- Cigarette
- Pharmaceutical

Flexible packaging industries do different types of tests mostly in their own laboratory. For some tests, these industries usually use the testing facilities of Bangladesh Council of Scientific and Industrial Research(BCSIR), Dhaka.

Table 4 Raw material flexible packaging

Paper & Board	**Film**
Fungicide treated paper;	PET [12 - 30 micron];
W/F offset paper in reel and	OPP [20 - 35 micron];
sheet [60 - 120 gsm];	BOPP [20 - 30 micron];
Coated paper (all sort) [40 - 170 gsm];	Pearlised film [20 - 60 micron];
Duplex board (all sort) [210 - 450 gsm];	Nylon film;

Card board [180 - 350 gsm];	PVC shrink film [40 - 50 micron];
Self-copy paper;	Metalised film [12 - 25 micron];
Self-adhesive label paper;	PP zipper;
Facial / Toilet tissue paper;	**Foil**
Table napkin paper;	Aluminium foil [06 - 40 micron];
Newsprint paper [38 - 48 gsm];	Blister Foil [20 micron];
PE coated board [230 gsm];	**Resins**
Directory paper;	LDPE (Extrusion / Film grade);
Coated Board for paper cup;	LLDPE (Extrusion / Film grade);
Chemicals	EVA (Extrusion / Film grade) ;
Ethyl Acetate;	HDPE (Film grade);
Ethyl Alcohol;	Master batch;
Toluene;	Pearlising powder;
Polyurethane;	Hologram Hot Stamping foil;
Isopropanol;	Hologram Lamination film;
MEK;	Hologram Security sticker;
Zyline;	Hot-melt adhesive;
Water based UV varnish;	Parafin wax ;
Dry Laminating adhesive;	
Hardner;	
Callendering Oil;	
Offset varnish;	
Gravure varnish;	
Gravure and Flexo inks;	
Gold lacquer;	
Al-foil primer;	

1.4 Limitations

" BGAPMEA authority has extended best cooperation to the study team in collecting relevant data and information from both primary and secondary sources but data collection was done during the month of Ramadan which was not convenient time to the Field Investigators as well as to the factory staffs. In spite of the limitation, the investigators collected data with sincere efforts and tried to maintain accuracy and reliability of data. However, subsequently the project team including the TTZ, Germany (Partner-1) and European University of Bangladesh (Partner-2) visited the several factories to get further data collection for preparing the study report. On the basis of data base, this feasibility study report has been prepared."

Chapter -2

REVIEW AND ANALYSIS OF THE TESTING FACILITIES FOR GAP SECTOR, TESTING NEEDS AND COST INVOLVEMENT

2.1 Existing Testing Facilities for the GAP Sector

Requirement tests is a relatively modern concept introduced mainly at the initiative and pressure of the international buyers. A good number of international testing companies (such as SGS, Bureau Veritas) took this advantage and have set up their offices in Bangladesh. But none of these testing companies has set up their full-fledged laboratory; they carry out simple tests locally but for any difficult type of test they used to send the sample to their parent organizations abroad for testing.

As it has been stated earlier, GAP sector includes 19 categories of industrial units, which produce more than 100 types of products. Each of these products require several types of tests. Some of these tests are known according to the nature of test (e.g. A3o test, Nickel Content test etc.), while others are known by products test (e.g. Zipper Test i.e. the test of strength, durability etc. of zipper).

They survey also highlighted on the existing institutions from where the testing services are availed by the industrial units under GAP sector. A list of the existing testing institutions is given below in Table – 5.

Table 5 Testing Institutes in Bangladesh

SL. No.	Name of the institutes utilized for testing	Frequency of Use
1	SGS	30
2	Bureau veritas	15
3	Intertect Testing Service	6
4	Walmart	1
5	Tema	1
6	B.U.B.T association	1
7	GSS	1
8	Bluberry	5
9	HOHENSTEIN	4
10	GSM	1
11	Strength UV reli RSP Pvt. Ltd.	1
12	Butex	4
13	BSTI	4
14	ISO	1
15	Oekotex	4
16	B.U.T	1
17	BGAPMEA	1

The table 2.1 exhibits the names of the testing institutions and frequency of using these institutes by the garments accessories and packaging units. During the survey, it was found that only 8 types of garments accessories and packaging products are tested out of 19 categories. The

remaining 11 types are not tested. The table explicates that the highest frequency of use of testing institutes by the surveyed units is SGS (30), followed Bureau Veritas (15), ITS (6), Blueberry (5), HOHEN (4), BUTEX (4), BSTI (4), Oekotex (4), Walmart. This might be because of the following reasons:

- Tests involve high costs;
- Clients consider it as wastage of time;
- Tests give faulty results, etc.

2.2 Current Requirements for Testing

The tests commonly used by GAP UNITS include the following:

i) Standard Package of Tests for products e.g. Polybag Tests, Corrugated Carton Tests, Hanger Tests, Elastic Tests, Resin Tests, Label Tests and Thread Tests;

ii) Testing of different aspects of products e.g. Microbiological Test, Azo Test, Chemical Test, Color Fastness Test, GSM Test, P^H Test, MR% Test, Formal dehyde Test, Nickel Test.

Since garments have to face competition with others it is crucially important to maintain quality and standard of products. .

Beneficial aspects of testing facilities include, among others, the following:

a) Prevents losses by cutting down rejections;
b) Increase demand for products by its quality standards;
c) Increase productivity and production.

Although all the products are subject to qualitative tests, the requirement for testing are different for different products. Survey data reveal that GAP industries require tests like-Corrugated cartoon, Polybag, Azo test, Slider, Hanger, Resin, Elastic, Labels, Padding, Zipper launching test, Microbiological test, Chemical test, Particular size determination, Water absorption by dried film, Screen print, Sewing thread properties test, GSM test, Thread strength, Formaldehyde test, Bursting test, Dye identified, Yarn strength test, Yarn TPI, P.A.H.S test, Elongation test, Zipper strength test, M.R% test, P^H test. These tests are required to critically analyze the followings:

- Quality of raw materials used;
- Design of the products;
- Variety of models;
- Type, size, shapes, colors adaptation to standards,
- Durability resistance to climatic conditions;
- Ease and reliability of packing and packaging during shipping, handling;
- Design of labels;
- Quality impression, etc.

2.3 Time Requirement for Testing

The following Table exhibits the time requirement for testing. Duration of time for testing depends on:

- the qualitative nature of items/ products;
- sincerity of the institutions to do tests;
- Prime / exclusive responsibility.

From the table- 6 it is evident that tests like fusing takes minimum time, while testing of Hangtag requires one month followed by Photo Card (one month), Size Tag (one month), Neck Board (25 days). The factors responsible for such delays are: (a) testing facility for some of the items are not available in Dhaka and as such the testing institute send the sample abroad for testing which delays the delivery; and (b) the existing testing institutions are overloaded with big customers from RMG sector and other sectors and therefore they overlook the smaller items of GAP sector.

Table 6 Time Requirement for Testing

Sl. #	Name of the Test	Time required
1.	Fusing	1 hour
2.	Impact	1 day
3.	Pool Test	1 day
4.	GSM Test	2 days
5.	Bonding Test	3 days
6.	Lode Test	3 days
7.	Adhesive Tape	3 days
8.	Yarn Strength	3 days
9.	Hyliget Test	3 days
10.	Chemical Test	3-5 days
11.	C/F Test	3-5 days
12.	Penoling Test	5 days
13.	Tissue Paper	5 days
14.	Nickel	5-10 days
15.	Moisture	5 days
16.	Box Compression	3-7 days
17.	Twill Tape	7 days
18.	Lace	7 days
19.	B/F Test	7 days
20.	Screen Print	10 days
21.	Color Test	15 days
22.	Neck Board	25 days
23.	Photo Card	1 month
24.	Size Tag	1 month
25.	Back Board	1 Month
26.	Hangtag	1 month

2.4 Cost Involvement

Data collected from the sample units under the survey are presented in the following table, which exhibits the costs incurred for testing different garments accessories and packaging materials. The cost involved in undertaking tests range from Tk. 3000/- to Tk. 20,000/-. Respondents expressed their dissatisfaction over the high cost for undertaking tests. Moreover, in many occasions repetition of the same tests for more clear results are undertaken with additional cost. The table -7 shows cost as one of the causes of dissatisfaction.

Table 7 Cost involved in Testing

SL. No.	Type of tests	Cost
1	Carton	TK. 2,500
2	Bursting test	TK. 3,000
3	GSM test	TK. 3,000
4	Top Stop Holding	TK. 3,000
5	Bottom stop holding	TK. 3,000
6	Resin	TK. 3,500
7	Box compression	TK. 4,000
8	Moisture test	TK. 4,000
9	Chain crosswise	TK. 4,000
10	Separating crosswise	TK. 4,000
11	Crush test	TK. 7,000
12	P^H value	TK. 8,000
13	Sewing thread	TK. 8,500
14	Color fastness	TK. 8,500
15	Slider	TK. 15,000
16	Labels	TK.16,000-20,000
17	Azo test	TK. 20,000
18	Hanger	TK.20,000
19	Polybag	TK.20,000
20	Elastic	TK.20,000

Chapter-3

Assessment and Requirement of GAPTL

3.1 General Requirement

The General requirements for the GAPTL is the formal statement of the range of activities for which the laboratory has been accredited; the Scope is recorded in detail on a laboratory's accreditation certificate. A laboratory's scope should be defined as precisely as possible so that all parties concerned know accurately and unambiguously the range of tests and/or tests covered by that particular laboratory's accreditation. The schedule format should typically define the laboratory's accreditation in terms of:

(i) The range of products, materials or sample types tested;
(ii) Types of tests carried out;
(iii) The specification or method/technique used;
(iv) The concentration range and accuracy/precision.

3.1.1 Scope of reliability

Where non-routine testing is carried out, it is recognized that a more flexible approach to scope may be necessary, but the scope must be as specific as is feasible and the quality assurance system maintained by the laboratory must ensure that the quality of the results is under control. Frequently, a single measurement technique may be used for different tests in a wide variety of samples. This measurement stage may be covered by a single method. However, the methods used to prepare the samples for subsequent analysis may vary considerably according to the nature of the analytics involved for the sample. Thus several methods may be required to cover different tests combination. Depending on the matrix, a diverse range of methods may be used to prepare tests such as Zipper strength test etc.

3.1.2 Scope of reliability

The laboratory uses analytical tools such as bursting strength test, color fastness test etc., it may be appropriate to use the terms qualitative and/or quantitative analysis under the type of test heading. However, the onus will be on the laboratory to demonstrate to the assessors that in using these techniques, it is meeting all of the criteria for accreditation. In particular, the experience, expertise and training of the staff carrying out the tests and those interpreting the data involved will be a major factor in determining whether or not such analyses can be accredited.

It is accepted that sometimes it is not practicable for laboratories to use a (fully documented) standard method in the conventional sense, which specifies each sample type and determinant. In this case, the laboratory must have its own method or procedure for the use of the instrument in question, which includes a protocol defining the approach to be adopted when different sample types are analyzed. Full details of the procedures, including instrument parameters, used must be recorded at the time of each analysis such as to enable the procedure to be repeated in precisely the same manner at a later date. Where a particular analysis subsequently becomes routine, a full method is required and must be in written format.

Whenever there is deviations from standard method or inadequate clarification in Standard Method, the laboratory needs to develop effective procedure for ensuring the quality of results.

3.1.3 Approach

The approach to extending or amending the scope of accreditation/certification should be as flexible as possible. Normally the laboratory will give written notice of the tests, which it wishes to add to its scope, quoting Standard method references (where applicable) and providing copies of documented validated in-house methods before surveillance and reassessment.

3.2 Terms and Definitions

3.2.1 Selectivity

Selectivity of a method refers to the extent to which it can determine particular tests in a complex mixture without interference from the other components in the mixture. A method which is perfectly selective for an analytics or group of analytics is said to be specific. The applicability of the method should be studied using various samples, ranging from pure standards to mixtures with complex matrices. In each case the recovery of the tests of interest should be determined and the influences of suspected interferences duly stated. Any restrictions in the applicability of the technique should be documented in the method.

3.2.2 Range

For quantitative analysis the working range for a method is determined by examining samples with different analytical concentrations and determining the concentration range for which acceptable accuracy and precision can be achieved. The working range is generally more extensive than the linear range, which is determined by the analysis of a number of samples of different concentrations and calculating the regression from the results, usually using the method of least squares. The relationship of tests response to concentration does not have to be perfectly linear for a method to be effective.

3.2.3 Linearity

Linearity is determined by the analysis of samples with testing concentrations spanning the claimed range of the method. The results are used to calculate a regression line against standard test calculation using the least squares method. It is convenient if a method is linear over a particular range but it is not an absolute requirement. Where linearity is unattainable for a particular procedure, a suitable algorithm for calculations should be determined.

3.2.4 Sensitivity

Sensitivity is the difference in analyte concentration corresponding to the smallest difference in the response of the method that can be detected. It is represented by the slope of the calibration

curve and can be determined by a least squares procedure, or experimentally, using samples containing various concentrations of the samples.

3.2.5 Limit of Detection

Limit of detection of an analyte is determined by repeat analysis of a blank test portion and is the analyte concentration whose response is equivalent to the mean blank response plus 3 standard deviations. Its value is likely to be different for different types of sample.

3.2.6 Limit of Quantitation

Limit of quantitation is the lowest concentration of analyte that can be determined with an acceptable level of accuracy and precision. It should be established using an appropriate standard or sample, i.e. it is usually the lowest point on the calibration curve (excluding the blank). It should not be determined by extrapolation.

3.2.7 Ruggedness

Sometimes also called **robustness**. Where different laboratories use the same method they inevitably introduce small variations in the procedure, which may or may not have a significant influence on the performance of the method. The ruggedness of a method is tested by deliberately introducing small changes to the method and examining the consequences. A large number of factors may need to be considered, but because most of these will have a negligible effect, it will normally be possible to vary several at once. Ruggedness is normally evaluated by the originating laboratory, before other laboratories collaborate.

3.2.8 Accuracy

The accuracy of a method is the closeness of the obtained analytical value to the true value. It can be established by analyzing a suitable reference material. Where a suitable reference material is not available, an estimation of accuracy can be obtained by spiking test portions with chemical standards. The value of spiking is limited; it can only be used to determine the accuracy of those stages of the method following the spiking. Accuracy can also be established by comparison with results obtained by a definitive method or other alternative procedures and via inter comparison studies.

3.2.9 Precision

Precision of a method is a statement of the closeness of agreement between mutually independent test results and is usually stated in terms of standard deviation. It is generally dependent on sample composition, and this dependence should be determined and documented. It may be stated in different ways depending on the conditions in which it is calculated. Repeatability is a type of precision relating to measurements made under repeatable conditions, i.e. same method; same material; same operator; same laboratory; narrow time period. Reproducibility is a concept of precision relating to measurements made under reproducibility

conditions, i.e. same method; different operator, different laboratories; different equipment; long time period.

3.2.10 Reference Material

A reference material (RM) is a material or substance or one or more properties of which are sufficiently established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

3.2.11 Certified Reference Material

A certified reference material (CRM) is a reference material one or more of whose property values are certified by a technically valid procedure, accompanied by, or traceable to a certificate or other documentation which is issued by a certifying body.

3.2.12 Sample

A portion of material selected to represent a larger body of material.

3.2.13 Sample handling

This refers to the manipulation to which samples are exposed during the sampling process, from the selection from the original material through to the disposal of all samples and test portions.

3.2.14 Sub-sample

This refers to a portion of the sample obtained by selection or division; an individual unit of the lot taken as part of the sample or; the final unit of multistage sampling.

3.2.15 Sample preparation

This describes the procedures followed to select the test portion from the sample (or subsample) and includes: in-laboratory processing; mixing; reducing; coning and quartering; riffling; and milling and grinding.

3.2.16 Test portion

This refers to the actual material weighed or measured for the analysis.

Environmental standard, safety and accommodational conditions:

I. Samples, reagents and standards should be stored so as to ensure their integrity. The laboratory should guard against deterioration, contamination and loss of identity.

II. The Laboratory shall meet the safety requirements applicable to the test procedure wherever the published standard specifications mention the requirements.

III. It may be necessary to restrict access to particular areas of laboratory because of the nature of the work carried out there. Restrictions might be made because of security, safety, or sensitivity to contamination. Typical examples might be work involving explosives, radioactive materials, carcinogens, toxic materials and trace analysis. Where such restrictions are in force, staff should be aware of:

- The intended use of a particular area;
- The restrictions imposed on working within such areas;
- The reasons for imposing such restrictions

IV. Frequently, it will be necessary to segregate certain types of work which are prone to interferences from other work, or which present particular problems or hazards. Examples are trace analysis (where physical separation from high-level is necessary) and carcinogen analysis. When selecting designated areas for special work, account must be taken of the previous use of the area. Before use, checks should be made to ensure that the area is free of contamination. Once in use, access to such areas should be restricted, and the type of work undertaken there carefully controlled.

V. The laboratory shall provide appropriate environmental conditions and controls necessary for particular tests, including temperature, humidity, freedom from vibration, freedom from airborne and dust borne microbiological contamination, special lighting, radiation screening. Critical environmental conditions should be monitored.

VI. One key responsibility of the laboratory management is to provide an adequate and safe working environment. Laboratory facilities should reflect due consideration of space, design, security, health and safety. It is recognized that laboratories will be required to comply with Government building and safety legislation. The provisions of such legislation shall be considered as additional essential requirements.

3.3 Assuring the quality of Test Results

3.3.1 Assurance and Quality Control

Analytical performance must be monitored by using quality control procedures appropriate to the type and frequency of the testing undertaken. The range of quality control activities available to laboratories include the use of

- Reference collections
- Certified reference materials
- Internally generated reference materials
- Replication or duplication of samples
- Independent checks by other analysts/examiners
- Statistical tables
- Positive and negative controls
- Control charts

- Replicate testing
- Alternative methods
- Spiked samples, standard additions and internal standards
- Correlation of results for different characteristics of an item
- Retesting of retained items

Depending on the particular test/examination, one or more of these examples may be appropriate. Quality control procedures must be documented. A record must be retained to show that appropriate quality control measures have been taken, that quality control results are acceptable or, if not, that remedial action has been taken. Where appropriate, quality control data must be recorded in such a way that trends in analysis can be readily evaluated. It is desirable to participate in proficiency testing for better quality assurance of test results

3.3.2 Internal Quality Control

The level adopted should be demonstrably sufficient to ensure the validity of the results. As a guide, as per demand tests the level of internal QC typically should be not less than 5% of the sample throughout, i.e. 1 in every 20 samples tested should be a QC sample. For more complex procedures, 20% is not unusual and on occasions even 50% may be required. For tests performed infrequently, a full system validation should be performed on each occasion. This may typically involve the use of a reference material containing a certification, followed by replicate tests of the sample and spiked sample (a sample to which a known amount of the analyte has been deliberately added). Those tests undertaken more frequently should be subject to systematic QC procedures incorporating the use of control charts and check samples

Chapter-4

Assessment and Requirement of Physical Facilities

Currently as many as1232 industrial units are manufacturing 19 major types of garments accessories and packaging items. These industrial units require wide range of tests for their products.

A further investigation into the issue reveals that in Bangladesh GAP sector lacks exclusive testing laboratory for garments accessories and packaging materials. The testing institutions, which are currently providing testing services to garments accessories and packaging units, are mostly foreign origin. They are offering these services through opening their offices at Dhaka with very limited facilities. In majority cases these offices send the samples abroad for testing and as such testing involves huge costs and longer time. Whatever testing facilities available in the country, are not often fully equipped with necessary facilities to provide testing services to the accessories and packaging industries. Moreover, the test results of these local testing institutes are not quite often acceptable to the foreign buyers. In view of the prevailing situation and realities stated above, the industrial units under GAP sector need the support of an exclusive testing laboratory to meet their specific needs.

From the survey, it is revealed that the member units of GAP sector, numbering around 1232, are in need of a testing laboratory with facilities for undertaking wide range of tests of their products. The proposed laboratory may be named as, Accessories & Packaging Testing Laboratory (GAPTL) and should carry out the following important activities:

- Offer testing services on a wide range of areas, as identified and described in Section 2.1.3, to the accessories and packaging units in Bangladesh.
- Keep contact with international testing agencies and continuously update it technical capability through sharing information and attaining affiliations with internationally reputed testing outfits.
- Arrange workshops, seminars, training etc. for the technical and Q.C. officials of member units of BGAPMEA to develop awareness and help update their knowledge and skill to maintain high quality of their products.
- Provide consultancy services to member units on quality assurance, international affiliation with Oeko-tex, ISO certification etc.
- Maintain close liaison with member units and provide them technical assistance to upgrade quality control system.
- Conduct research and development on identification of the best and most cost effective ways of undertaking various types' tests of the products of accessories and packaging industries at minimum cost and time.

4.1 Physical and other Facilities for the Testing Institute

In keeping with the objectives and functions, the institute will have facilities and manpower to

undertake testing of wide range of products. The institute will be housed in a five storied building situated on a piece of land. The total built up area will be 25,000 sqft. The laboratory building will have several Testing Laboratories, Demonstration Room, Office Room, Directors Room, Library, Archive laboratory, etc. The implementation of **ISO/IEC 17025:2005** for the setup of laboratory must be followed.

4.1.1 Land and Building

The most important resource in the test laboratory is land and building. It is imperative to resist the temptation to staff as many test Workspace as possible into the laboratory. Testing is not just about using the software, testers also need to refer to test plans, test scripts, take notes etc. Assessment of the space adequate for class rooms, library, conference room, laboratory, office space, etc. has been carried out meticulously. It has been found that a total of 60,000 sqft of floor space is required to accommodate all the facilities. A multistoried building should be constructed on a piece of land covering around 1.0 (one acre of land).

4.1.2 Laboratory Equipment's

A tentative list of testing equipment and machinery has been prepared in keeping with the nature and types of tests, now being undertaken by the GAP units under survey (See table 3.2.2) list will be finalized by inclusion of the suggestions/inputs from BGAPMEA and ttz. The detailed specification, price etc. of these testing equipment and machinery are given at Annexure-A of this report

4.1.3 Office Furniture

Good quality office furniture is required because just as the testers are unlikely to be motivated if confined to the least attractive office in the building, they will also not appreciate the discarded office furniture. Have good quality office chairs and tables. There must be plenty of cupboard space. It is good practice to keep all physical test results (hardcopies, used test scripts, Usp's etc.) in the test laboratory

Other invaluable aids in the lab are flipcharts, a pinboard, and a whiteboard – useful for having pieces of vital information visible for all to see. A good example of this is information which is likely to change e.g. if you change the system date from the actual calendar date – write the current date in the test environment in large letters on the whiteboard.

4.1.4 Air conditioning

As it is quite clear large amount of equipment's will be involved in this laboratory which will produce waste heat then air conditioning is a must. Not only it is the need to keep the equipment's at a controlled temperature, but also for the personnel's who are working in the laboratory.

4.1.5 Use of Computers

In these kinds of testing laboratories. The required amount of computers are minimum 25 pieces with the Management software, computers have a wide variety of uses including:

- control of critical environmental conditions;
- monitoring and control of inventories;

- calibration and maintenance schedules;
- stock control of reagents and standard materials;
- design and performance of statistical experiments;
- scheduling of samples and monitoring of work throughput;
- control chart generation;
- monitoring of test procedures;
- control of automated instrumentation;
- capture, storage, retrieval, processing of data, manually or automatically;
- matching of sample and library data;
- generation of test reports;
- word processing;
- communication

4.1.6 Office supplies / stationery

Ensure that the test laboratory is stocked with adequate supplies of:

- Paper (notebooks and printer paper, etc.)
- Pens, pencils, sharpeners, erasers, stapler, hole punch etc
- Post-items, sticky tape etc
- Printer toner etc

The testers may only be on assignment for a short time and not have access to the normal channels for office supplies. Keeping a supply on hand in the test lab prevents frustration and helps keep testing on schedule.

4.1.7 Reference material

This includes:

- Test plans, test scripts, test case descriptions
- User manuals for hardware and software, including the manual for the application under test, if available
- Telephone list & email list – with the phone numbers of all the important contact people in case of problems
- Checklists, pointers to the nearest photocopier etc.

Table 8 Tentative List of Equipment & Machinery for GAPTL

Sl.	Device/Apparatus	Name of the Source/Supplier	Price in Euro/US$	Price in BDTk.
1	2	3	4	5
1	TruBurst pneumatic bursting strength tester	James heal, UK	20400	1983043
2	Paper board crush test machine	GESTER International Co. Ltd., China	3500	340228
3	Print quality scuff proofness tester	Labthink Instruments Co. Ltd., China	8800	855430
4	Ply bond strength tester KJ-1065B	Dongguan Kejian Instrument Co. Ltd., China	2600	252741
5	Drop tester	KOMEG Technology Ind Co. Ltd., China	4400	427715
6	Taber stiffness tester	Precisa International (Shanghai) Co., Ltd., China	6000	583248
7	Gurley COBB paper sizing tester 4180BN	Precisa International (Shanghai) Co. Ltd., China	700	68046
8	Air pressure Leakage tester	GESTER International Co. Ltd., China	1800	174974
9	Vibration tester	GESTER International Co. Ltd., China	4400	427715
10	Folding endurance tester GT-N16	GESTER International Co. Ltd., China	1800	174974
11	Puncture resistance tester	GESTER International Co. Ltd., China	900	87487
12	Elmendorf tear strength tester	GESTER International Co. Ltd., China	3500	340228
13	Computer controlled carton compression tester	GESTER International Co. Ltd., China	8800	85543
14	Hanatek IPT inclined plane friction tester	RHOPOINT INSTRUMENTS, UK	3500	340228
15	Bendsten smoothness and porosity tester	M.C. TEC, Netherlands	5000	486040
16	Rain tester	LEADER TECHNOLOGY SCIENTIFIC, Malaysia	28700	2789870
17	Gann Moisture meter H-35	MESSBAR., Germany	200	19442
18	High performance liquid chromatography (HPLC)	Bruker Daltonik GmbH, Germany	17700	1720582
19	Scion triple quadrupole mass spectrometer (TQGC)	Bruker Daltonik GmbH, Germany	61700	5997734
20	UV/Vis spectrophotometer	Analytik Jena AG, Germany	6000	583248
21	Velcro tape strength tester	GESTER International Co. Ltd., China	5300	515202
22	Titan universal strength tester	James heal, UK	25600	2488525
23	HP Textile yarn package hardness tester	Check line Europe Ltd., UK	400	38883
24	Button impact tester	GESTER International Co. Ltd., China	700	68046
25	Sharp edge tester	GESTER International Co. Ltd., China	400	38883
26	Garment button pull tester	Shandong Drick Instruments Co., Ltd., China	4400	427715

27	Perspirometer and Incubator	James heal, UK	4200	408274
28	Crockmaster color fastness tester	James heal, UK	3500	340228
29	Wascator standardized machine	James heal, UK	14400	1399795
30	Dynawash shrinkage, appearance retention, shade change tester	James heal, UK	7000	680456
31	Thermaplate color fastness to dry heat and stability	James heal, UK	3800	36939
32	Sample cutter model 230/100	Checkline Europe Ltd., UK	600	58325
33	Weighing balance	BD Weight Scale Corporation, Bangladesh	500	48604
34	Electronic balance	BD Weight Scale Corporation, Bangladesh	200	19442
35	Digital pH meter	BD Meter Solution, Bangladesh	100	9721
36	Laboratory muffle furnace	B-TEX Engineering, India	600	58325
37	Die punch for sample preparation	Universal Engineering Corporation, India	2000	194416
38	LIMS	Mountain States Consulting, LLC, USA	25000	2430200
		Total	289100	27000495

* Prices are converted according to the conversion rate on the date of writing this document and may subject to change.

Table 9 Tentative list of testing products with equipment's

Sl.	Name of the Product with HS Code	Name of the Raw materials required for the corresponding Product (with HS Code)	Type of Test the corresponding Product Needs	Name of the required Machine to do the corresponding Test with HS Code	Physical dimension of the Machine	Testing Methodology	Installation Procedure of the corresponding Machine
1	2	3	4	5	6	7	8
01.	Corrugated Carton (4819.10.00)	Corrugating / Fluting / Medium Paper (4805.11.00, 4805.92.00), Kraft / Test / White Liner Paper (4804.11.00, 4805. 24.00, 4804.39.00, 4804.49.00, 4804.41.00), Stitching Wire (7217.20.00), Starch (1108.11.00), Glue/Gum (3505.20.00), Com Starch (1108.12.00), Sodium Hydroxide (Caustic Soda) (2815.11.00), Borax (2840.20.00), Glue & Bond (3506.10.00), Coating Liquid (3923.90.90), Tape & Band (3923.10.00), Pallet (3923.90.10), Rubber Pallets (4005.10.10), Printing Ink (3215.11.00)	Bursting test	TruBurst pneumatic bursting strength tester	400×400×700	see Appendix	Supplier
			Edge crust test (ECT)	Paper board crush test machine	810×400×860	see Appendix	Supplier
			Rub proofness of print test	Print quality scuff proofness tester	260x230x360	see Appendix	Supplier
			Internal bond strength test	Ply bond strength tester KJ-1065B	580x580x1250	see Appendix	Supplier
			Drop test	Drop tester	1700×1200×2830	see Appendix	Supplier
			Stiffness and resiliency properties test	Taber stiffness tester	394×254×381	see Appendix	Supplier
			Absorption of water, oil and other liquids test	Gurley COBB paper sizing tester 4180BN	480×400×420	see Appendix	Supplier
			Leakage test	Air pressure Leakage tester	430x330x170	see Appendix	Supplier
			Vibration during transportation test	Vibration tester	1100x1310x650	see Appendix	Supplier
			Folding test	Folding endurance tester GT-N16	500x300x700	see Appendix	Supplier
			Resistance to puncture test	Puncture resistance tester	860x490x790	see Appendix	Supplier
			Tear strength tester	Elmendorf tear strength tester	560×420×530	see Appendix	Supplier
			Stacking crush test, resistance to compression test	Computer controlled carton compression tester	4000×1500×2000	see Appendix	Supplier
			Frcition test	Hanatek IPT inclined plane friction tester	300×225×180	see Appendix	Supplier
			Smoothness and porosity test	Bendsten smoothness and porosity tester	340×260×480	see Appendix	Supplier
			Rainproof capability	Rain tester	3000x2000x200	see Appendix	Supplier

			Moisture test	Gann Moisture meter H-35	140×90×50	see Appendix	Supplier
02.	Waxing Box (3923.10.00, 4819.20.00)	Paraffin Wax (2712.20.00)	Bursting test	TruBurst pneumatic bursting strength tester			
			Edge crust test (ECT)	Paper board crush test machine			
			Rub proofness of print test	Print quality scuff proofness tester			
			Internal bond strength test	Ply bond strength tester KJ-1065B			
			Drop test	Drop tester			
			Stiffness and resiliency properties test	Taber stiffness tester			
			Absorption of water, oil and other liquids test	Gurley COBB paper sizing tester 4180BN			
			Leakage test	Air pressure Leakage tester			
			Vibration during transportation test	Vibration tester			
			Folding test	Folding endurance tester GT-N16			
			Resistance to puncture test	Puncture resistance tester			
			Tear strength tester	Elmendorf tear strength tester			
			Stacking crush test, resistance to compression test	Computer controlled carton compression tester			
			Friction test	Hanatek IPT inclined plane friction tester			
			Smoothness and porosity test	Bendsten smoothness and porosity tester			
			Rainproof capability	Rain tester			
			Moisture test	Gann Moisture meter H-35			
03.	Back Board, Neck Board	Duplex Board (4810.92.00)	Internal bond strength test	Ply bond strength tester KJ-1065B			
			Stiffness and resiliency properties test	Taber stiffness tester			

	(4810.92.00)		Folding test	Folding endurance tester GT-N16			
			Tear strength tester	Elmendorf tear strength tester			
04.	Tissue Paper (4803.00.00, 4818.50.00)	Tissue Paper (4803.00.00, 4818.50.00)	Bursting test	TruBurst pneumatic bursting strength tester			
			Smoothness and porosity test	Bendsten smoothness and porosity tester			
05.	Hang Tag, Photo Card, Bar Code, Photo In-Lay etc. (4821.10.00, 3926.90.90, 4821.10.00)	Art Card/Card Board (4810.99.00), Flexo Printing Ink (3215.19.00)	Quantity of nitrosamine	High performance liquid chromatography (HPLC)	1500×1000×1500	see Appendix	Supplier
			Rub proofness of print test	Print quality scuff proofness tester			
			Color fastness to dry heat	Thermaplate color fastness to dry heat and stability			
06.	Printed Poly Bag (6305.32.00, 3921.90.10)	PP Film Grade (3902.10.00), LDPE/LLDPE Film Grade (3901.10.00), Thinner/Reducer (3814.00.00), Flexo Printing Ink (3215.19.00)	Bursting test	TruBurst pneumatic bursting strength tester			
			Tear strength tester	Elmendorf tear strength tester			
			Stiffness and resiliency properties test	Taber stiffness tester			
			Rub proofness of print test	Print quality scuff proofness tester			
			Determination of chlorotoluene and chlorobenzene	Scion triple quadrupole mass spectrometer (TQGC)	280×570×460	see Appendix	Supplier
			Determination of cadmium	UV/Vis spectrophotometer	500×600×300	see Appendix	Supplier
07.	Poly and Others	Self-Adhesive Tape (3919.90.00)	Peel strength test	Hanatek IPT inclined plane friction tester			
			Holding power test	Velcro tape strength tester	450×550×570	see Appendix	Supplier
			Rub proofness of print test	Print quality scuff proofness tester			
			Determination of chlorotoluene and chlorobenzene	Scion triple quadrupole mass spectrometer (TQGC)			
			Determination of cadmium	UV/Vis spectrophotometer			
08.	Elastic, Drawstring,	Polyester Textured Yarn	Elongation test	Titan universal strength tester	300×260×1200	see Appendix	Supplier

	Label etc. (5806.10.00, 8447.90.90, 4821.10.00, 5807.10.00)	(5402.33.00, 5402.43.00, 5406.20.00), Cotton Yarn (5205.11.00), Nylon Yarn (5402.32.00), Rubber Thread (4007.00.00)	Winding density test	HP Textile yarn package hardness tester	50×50×110	see Appendix	Supplier
			Determination of chlorotoluene and chlorobenzene	Scion triple quadrupole mass spectrometer (TQGC)			
			Determination of cadmium	UV/Vis spectrophotometer			
09.	Collar Insert, Butter Fly (3926.20.90)	PVC Sheet Rigid Film (3920.49.10, 3917.23.10)	Determination of chlorotoluene and chlorobenzene	Scion triple quadrupole mass spectrometer (TQGC)			
			Stability to dry heat	Thermaplate color fastness to dry heat and stability			
10.	Nonfuseable Interlinings: T/C 65/35 Fabrics, 100% Cotton Fabrics, Oven Interlining, Non Oven Interlining (5513.19.90, 5603.11.00, 5603.12.00, 5603.13.00, 5603.92.00, 5603.93.00, 5208.12.00, 5208.19.00, 5208.22.00, 5208.29.00, 5210.11.00, 5210.21.00, 5212.11.00, 5212.12.00, 5212.21.00, 5212.22.00, 5901.90.00, 5903.90.10, 5903.90.90)	Interlining (5901.00.00, 5603.00.00)	Determination of chlorotoluene and chlorobenzene	Scion triple quadrupole mass spectrometer (TQGC)			
			Phenolic yellowing test, color fastness to sea water test	Perspirometer and Incubator			
			Detection of carcinogenic dyestuffs	High performance liquid chromatography (HPLC)			
			Dye migration test, Rubb test, Color fastness test	Crockmaster color fastness tester			
			Color fastness to dry heat	Thermaplate color fastness to dry heat and stability			

11.	Chemical	Pigment (3212.90.00)	Determination of lead content	High performance liquid chromatography (HPLC)			
			Determination of chlorotoluene and chlorobenzene, formaldehyde	Scion triple quadrupole mass spectrometer (TQGC)			
12.	BOPP Bag (3921.90.20)	OPP/BOPP (Film Grade) (3920.20.20)	Bursting test	TruBurst pneumatic bursting strength tester			
			Tear strength tester	Elmendorf tear strength tester			
			Stiffness and resiliency properties test	Taber stiffness tester			
			Rub proofness of print test	Print quality scuff proofness tester			
			Determination of chlorotoluene and chlorobenzene	Scion triple quadrupole mass spectrometer (TQGC)			
			Determination of cadmium	UV/Vis spectrophotometer			
13.	Pasting of exportable items	Self Adhesive Paper (4811.41.00)	Peel strength test	Hanatek IPT inclined plane friction tester			
			Holding power test	Velcro tape strength tester			
			Rub proofness of print test	Print quality scuff proofness tester			
14.	Security Sticker (6211.39.00, 4821.10.00)	Synthetic Card (3920.00.00, 3920.10.10, 3920.10.90), Sticker Paper (4811.21.00)	Peel strength test	Hanatek IPT inclined plane friction tester			
			Holding power test	Velcro tape strength tester			
			Rub proofness of print test	Print quality scuff proofness tester			
15.	Zipper (9607.19.00, 9607.11.00)	Monofilament for Nylon (5404.11.00), Cord Thread (5607.90.00), Sewing Thread (5401.10.00), Polyester Yarn (5402.62.00), Pome Resin (3911.10.00), Brass Strip For Teeth Making (7409.21.00), Brass Strip For	Strength test, elongation test	Titan universal strength tester			
			Release of nickel test	High performance liquid chromatography (HPLC)			
			Determination of chlorotoluene and chlorobenzene	Scion triple quadrupole mass spectrometer (TQGC)			

		Top & Bottom Stop (7409.21.00), Aluminum Strip For Teeth Making (7606.12.00), Aluminum For Top & Bottom Stop (7606.12.00), Nylon Film For Zipper Welding (3921.19.90), Slider (9607.20.00), Box Pin (9607.20.00), H-Type Bottom Stop (9607.20.00), Paint (3210.00.90), Hardener (3824.90.90), Wax (3404.90.00), Coating Agent (3824.90.90), Paint Remover (3824.90.90), Dido line (Solvents) (3824.90.90), Thinner (3814.00.00)					
16.	Button (9606.10.00)	Polyester Resin (3907.91.00), Styrene Monomer (3903.90.00), Cobalt (2822.00.00), Ultra Violet (3210.00.10), Pigment (3212.90.00), MEKP (2914.23.00), Paraffin Wax (2712.90.00), Acetone (2914.11.00), Acetic Acid (2915.21.00), Pumic Powder (2513.10.00), Pumic Stone (2513.11.00), Polishing	Cracking, chipping, breakage and impact resistance of plastic sew	Button impact tester	238×200×342	see Appendix	Supplier
			Determination of sharp edges	Sharp edge tester	290×190×100	see Appendix	Supplier
			Holding and breaking strength	Garment button pull tester	500×300×1150	see Appendix	Supplier
			Release of nickel test	High performance liquid chromatography (HPLC)			
			Determination of chlorotoluene and chlorobenzene	Scion triple quadrupole mass spectrometer (TQGC)			

		Cream/Wax (3405.10.00/3404.90.00), Armajol/Kerocil/Aerocil Powder (3824.79.00), Blessing Powder (2828.10.00), Blessing Powder (2828.10.00),					
17.	Ribbon (5807.90.00, 5806.39.00, 5807.10.00)	Paper/Satin Ribbon (5807.90.00, 5806.39.00, 5807.10.00)	Strength test, elongation test	Titan universal strength tester			
			Phenolic yellowing test, color fastness to sea water test	Perspirometer and Incubator	400×420×360	see Appendix	Supplier
			Detection of carcinogenic dyestuffs	High performance liquid chromatography (HPLC)			
			Detection of formaldehyde	Scion triple quadrupole mass spectrometer (TQGC)			
			Dye migration test, Rubb test, Color fastness test	Crockmaster color fastness tester	100×400×150	see Appendix	Supplier
18.	100% Spun Polyester Filament Yarn (5401.10.00, 5402.31.00), 100% Polyester Textured Yarn (5402.33.00, 5402.20.00)	Woven Label (5807.10.00)	Breaking force test, strength test, elongation test	Titan universal strength tester			
			Winding density test	HP Textile yarn package hardness tester			
			Color fastness to dry heat	Thermaplate color fastness to dry heat and stability			
			Washing fastness to shrinkage, dimensional stability and appearance	Wascator standardized machine	720×690×1315	see Appendix	Supplier
19.	Self Adhesive Tape (3919.10.00)	Self Adhesive Gum Tape (3919.10.00, 3919.90.00), Self Adhesive Tape (3919.10.00)	Breaking force test, strength test, elongation test	Titan universal strength tester			
			Peel strength test	Hanatek IPT inclined plane friction tester			
			Determination of chlorotoluene and chlorobenzene	Scion triple quadrupole mass spectrometer (TQGC)			

			Determination of cadmium	UV/Vis spectrophotometer			
20.	Velcro Tape (5806.10.00)	Nylon Yarn (5402.11.00, 5402.61.00), Acrylic Resin (3906.90.00), Disperse Dyes/Dying Stuff (3204.11.00), Chemical Auxiliaries for Dyeing/Unividaine D/P, Eganol MLDU (3402.90.00, 3402.19.10, 3809.91.00), MEKP (2914.12.00), Acetic Acid (2915.21.00), Polyethylene (3901.10.10),	Holding power test	Velcro tape strength tester			
			Strength test, elongation test	Titan universal strength tester			
			Detection of carcinogenic dyestuffs	High performance liquid chromatography (HPLC)			
			Determination of chlorotoluene and chlorobenzene	Scion triple quadrupole mass spectrometer (TQGC)			
			Determination of cadmium	UV/Vis spectrophotometer			
21.	Screen Print	Acrylic Polymer in Primary Form: Ink for Screen Printing, Polyvinyl Acetate Emulsion, Plastisol Inks, Pigment Dyes & Preparation (3208.20.90, 3824.90.90, 3905.91.00, 3215.19.00, 3215.11.00, 3506.91.90, 3809.91.00), Adhesive/Hot Melt Powder (3506.10.00, 3506.99.00, 3907.91.00)	Print durability	Dynawash shrinkage, appearance retention, shade change tester	670×665×840	see Appendix	Supplier
			Detection of formaldehyde	Scion triple quadrupole mass spectrometer (TQGC)			
			Lead	High performance liquid chromatography (HPLC)			
			Determination of chlorotoluene and chlorobenzene, formaldehyde	Scion triple quadrupole mass spectrometer (TQGC)			
			Color fastness to dry heat	Thermaplate color fastness to dry heat and stability	400×400×200	see Appendix	Supplier
22.	General laboratory equipments		General sampling	Sample cutter model 230/100	Dia×H 165×110	see Appendix	Supplier
			General weighing	Weighing balance	305×380×915	see Appendix	Supplier
			General weighing	Electronic balance	100×70×15	see Appendix	Supplier

			General pH test	Digital pH meter	60×50×25 without probe	see Appendix	Supplier
			General tests	Laboratory muffle furnace	460×460×460	see Appendix	Supplier
			General sampling	Die punch for sample preparation	400×550×600	see Appendix	Supplier
			Computerised system administration	LIMS		see Appendix	Supplier

Equipments HS Code can be obtained from the Bangladesh Customs Department or National Board of Revenue Bangladesh.

The equipment's and suppliers are chosen by keeping in view about the best quality according to the international standards and the cheap transportation to minimize the construction of testing laboratory. Detailed contact information about the suppliers can be found in the Appendix. TTZ, Bremerhaven have made efforts to acquire the current price of the equipment's but it may deviate from the prices given above in the table which depend upon the market currency conversion rates and transportation cost and the custom duties which are also not included in the given prices.

The humidification and temperature control unambiguously depends upon the size of the room and the environmental conditions whether dry or humid. HX Holding GmbH, Bochum, Germany offers products for the humidification and temperature control with the brand name DENCO. It can be used for both cooling and heating options with the options of humidity. The contact details of the company is given in the Appendix.

The water purifications system can only be available after the accurate data of use/requirement, water conditions at the proposed site of laboratory for e.g. brackish water, sea water and other necessary parameters.

Dimensions of the equipment's yield a total of 100 m2 area for the equipment's along with the space for the sample handling. However the walking area in the room is not included. The design and running of such a laboratory should follow the ISO/IEC 17025:2005. It contains all of the requirements that testing and calibration laboratories have to meet if they wish to demonstrate that they operate a management system, are technically competent, and are able to generate technically valid results. The use of this International Standard will facilitate cooperation between laboratories and other bodies, and assist in the exchange of information and experience, and in the harmonization of standards and procedures. The price is included in the standard lists table 10.

The former Kaiser Wilhelm Institut für Eisenforschung which has been copied by a number of laboratories all over Europe. The main building, A, usually accommodates the office premises, library and control laboratories that use light-weight instruments. The testing halls marked B have rather large floor areas and are suitable for heavier measuring equipment-tensile test machines, fatigue test machines and so on.

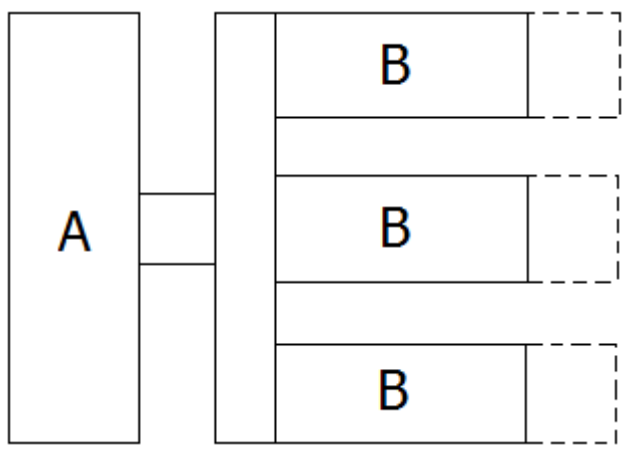
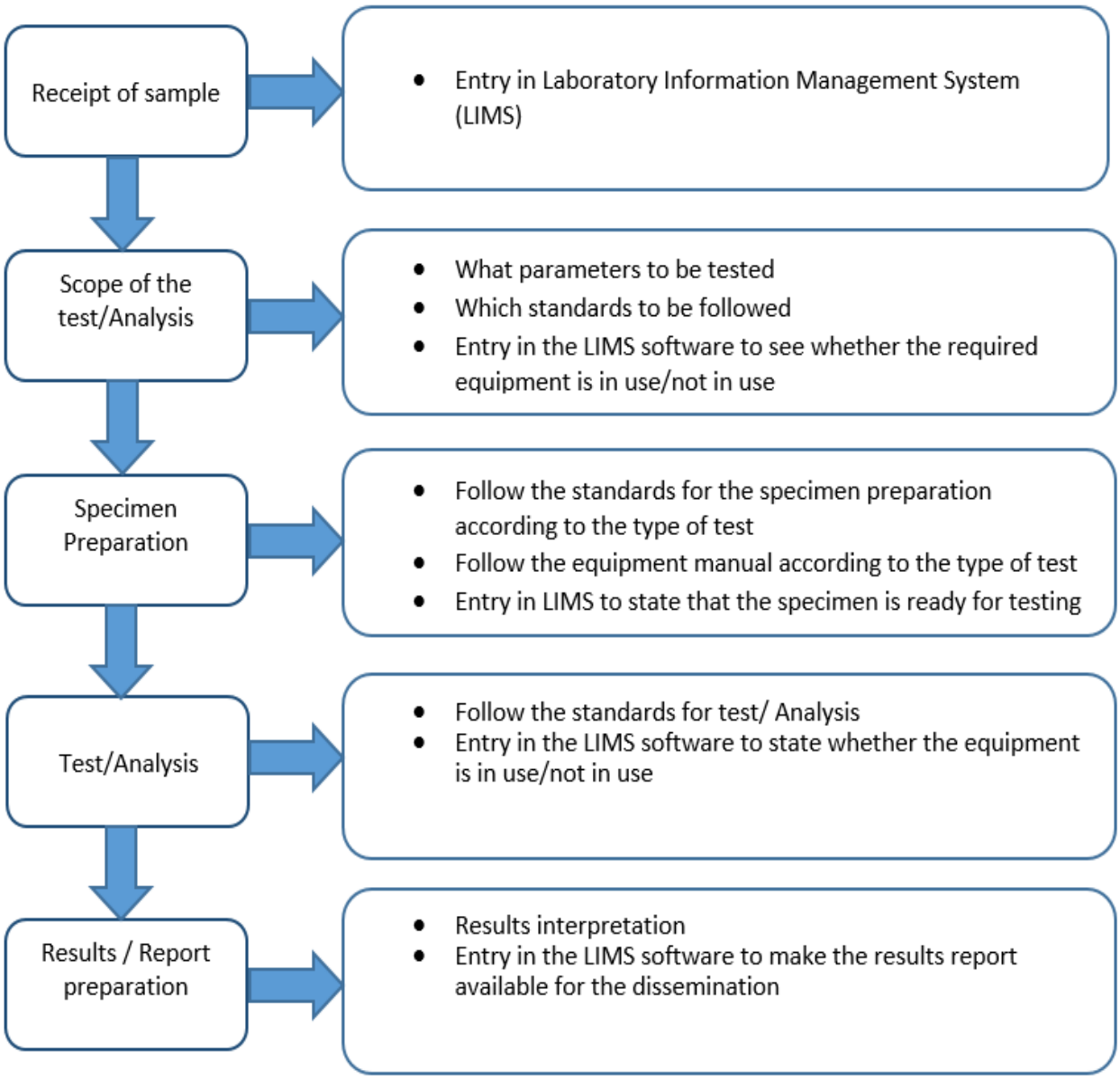


Figure 1 General layout of a central laboratory
A, main building, height 3.5m per floor.
B, hall, height 4.5 m.

An advantage of this layout is that extensions are simple, (as indicated by the dashed lines in the figure 1). Another advantage is the possibility of embedding heavier equipment in the fully supported ground floor structure. Testing halls for heavy machines and ordinary test equipment should be designed to a maximum height of 4.5 m, unless exceptionally tall equipment is needed. Other laboratories should be not more than 3.5 m in height. **The detailed layout is given in the Appendix.**

The departments should be divided according to their responsibilities. The sample receiving department has its own room for the receiving of the samples and prepare the samples according to the test requirements. After that samples should be forwarded to the concerned department for the tests and the final results are forwarded to the reporting department. The operations from receiving the samples/orders to the final report can be managed by the **Lab Information Management System (LIMS™)**. Such type of software's are indispensable for the smooth running of every day laboratory tasks.

Process flow diagram for GAPTL testing laboratory



Standards

Processes are standardized so that the work be performed always in the same way regardless of people and time. Thus the standardization forms the basis for the continuous improvement of process. Under standardization is understood to be the uniform expression and implementation of marketing activities in the different countries in which we operate. The basic objectives standardization can be divided in the achievement of efficiency benefits and cost advantages. Similarly, the market effect increased by a uniform market presence and a resulting uniform global image. Standards cover a huge range of activities undertaken by organizations and used by their customers. The point of a standard is to provide a reliable basis for people to share the same expectations about a product. This helps to:

- Facilitate trade
- Provide a framework for achieving economies and efficiencies.
- Enhance consumer protection and confidence.

Use of standardization in laboratory testing plays a vital role for simplification, cost reduction and acceleration. In this agreed way of doing laboratory testing, will not only satisfy the customer needs but also fine-tune the performance and manage the risks while operating in more efficient and sustainable ways.

There are a number of institutes who provide the templates for the standardization among which DIN, ISO and BS are well renowned. In the table below some of the main standards are listed which are most important and cannot be overlooked to have the world market attention. **The details of the standards can be seen in the Appendix.**

Table 10 Required standards for the laboratory testing

S.No.	Test	Standard	Apparatus	Price in Euro*	Price in Taka*
1	Determination of cadmium	BS EN 1122:2001	ICP-MS	109	10,630
2	Determination of pH	BS EN 1413:1998			
3	Determination of Aromatic amines	BS EN 14362-1:2012	GC	107	10,383
4	Safety of Toys-Migration of certain elements	DIN EN 71-3/A1	GC-MS	46	4,433
5	Detection of Diperse Dyestuffs (carcinogenic)	DIN 54231	GC-MS, LC-MS	52	5,094
6	Release of Nickel	DIN EN 1811:2012-10	GC-MS		
7	Determination of Organotin compounds	DIN EN ISO 17353:2005-11	GC-MS	99	9,585
8	Determination of Chromium VI	DIN EN ISO 17075:2008-02	UV-VIS Spectrometer	82	7,942
9	Determination of Pentachlorphenol	DIN EN ISO 17070	GC-MS	71	6,935
10	Determination of monomeric diisocyanates	DIN EN ISO 10283:2007-11	GC	82	7,942
11	Determination of PAH	ISO 18287:2006	GC-MS	73	7,111
12	Determination of Formaldehyde Part1	ISO 14184-1:2011	LC	48	4,687
13	Determination of Formaldehyde Part2	ISO 14184-1:2011	LC	48	4,687
14	Chemical determination of Formaldehyde	ISO 17226-1:2008	LC	32	3,071
15	Determination of Color fastness-saliva	DIN 53160-1		49	4,763
16	Colorfastness to laundering	ISO 105-C06:2010		48	4,687
17	Colorfastness to water	ISO 105-E01:2013		32	3,071
18	Colorfastness to rubbing	ISO 105-X12:2001		32	3,071
19	Colorfastness to perspiration	ISO 105-E04:2013		32	3,071
20	Colorfastness to sea water	ISO 105-E02:2013		32	3,071
21	Colorfastness to dry cleaning	ISO 105-D01:2010		32	3,071
22	Colorfastness to artificial light: Xenon	ISO 105-B02:2014		131	12,767
23	Domestic washing and drying for textile testing	ISO 6330:2012		115	11,151
24	Color fastness to chlorinated water (swimming pool)	ISO 105-E03:2010		32	3,071
25	Color fastness: Potential to phenolic yellowing	ISO 105-X18:2007		32	3,071
26	Quantity of nitrosamine in rubber components	GB/T 24153-2009	LC-MS	97	9,457
27	Determination of Alkylphenol ethoxylates (APEO)		LC-MS		
28	Determination of Aromatic organic solvents	SNV 195 651	GC-MS		

29	Determination of Chlorinated organic solvents		GC-MS		
30	Determination of Hydrazine		UV-VIS Spektrometer		
31	Determination of NMP N-methyl 2-pyrrolidone		GC-MS, LC-MS		
32	Determination of Phthalate Esters	EPA 8061A	GC-MS		
33	Determination of Polychlorinated Biphenyls (PCBs)	EPA 8082	GC-MS		
34	General requirements for the competence of testing and calibration laboratories	ISO/IEC 17025:2005		135	13,088
			Total	**1,795 €**	**৳ 174,533**

* Prices are converted according to the conversion rate on the date of writing this document and may subject to change.

Chapter-5

TECHNICAL AND ADMINISTRATIVE VIABILITY

5.1 Technical Viability

5.1.1 Market Potentials- Imperative Analysis

The proposed Testing laboratory will be a need based testing outfit of international standards. The laboratory will be exclusively for GAP industries and it will be managed and administered by the BGAPMEA efficiently. Since there is a huge gap between demand for and availability of testing facilities for the GAP sector, the proposed laboratory would be in a strategic position to meet the needs of testing. Other attributes of the proposed laboratory are:

1. Since the proposed laboratory will be established under the sponsorship of BGAPMEA, member units will get the testing facilities at minimum costs and time;
2. In addition to testing reports, the proposed GAPTL will provide a good number of other technical supports and counseling on, such issues as, critical analysis of the quality of raw materials, design of products, variety of models, type, size, shapes, colors adaptation to standards, durability resistance to climatic conditions, ease and reliability of packing and packaging during shipping, handling, design of labels, quality impression, etc.
3. Establishing of the GAPTL will help the industrial units under GAP sector to maintain present market share, capture new markets and raise productivity.

5.1.2 Location Analysis of the Laboratory

(1) Ideally the location of any organization is dependent on a number of important factors namely (a) Nearness to the clients (demand side); (b) Availability of the physical facilities and manpower (supply side); (c) Developed infrastructure and connectivity and (d) Availability of support services, like- environmental support, availability of schools, colleges, houses, hostels etc. In consideration of the above four categories of factors, it seems logical and justified that the proposed training institute should be located at Dhaka which will ensure:

a. Nearness to the client organizations i.e. large number of member industrial units of BGAPMEA is located at and ground Dhaka city.
b. Accessibility and connectivity of Dhaka city are also very favorable for the clients of the training institute;
c. Dhaka also has environmental advantages, such as hostels/ accommodation facilities for the faculty and trainees, available schools, hospitals and other factors.

The above factors should be taken into consideration in choosing the exact location in Dhaka city.

5.1.3 Technology Transfer and Adaptability

Testing technology is fast changing. Continuous research & development helps in the discovering of new technologies and modern machineries for testing. Establishment of GAPTL will necessitate procurement and installation of those latest equipment's for undertaking tests of various types of products. The manpower of GAPTL will also be trained on the application of these latest technology. The technical manpower of GAPTL will also carry out research on the testing equipment which will ultimately innovate and adopt modern technologies and to disseminate. Thus the services of GAPTL will be as follows:

i) Carry out R&D on the use of testing equipment and design, develop and adopt latest testing technology;

ii) Train the QC manpower of GAP sector and transfer knowledge, skills and technology so that they can help produce industrial products free of defects.

iii) Organize workshops, in-company training etc. to develop awareness amongst the floor level employees about how to manufacture products which can easily pass any quality testing.

iv) The GAPTL will also design, print and circulate leaflet, brochure, booklets describing in-housing testing of products as well develop small laboratory within factory with relatively simple devices for in-house testing of their products.

v) All these activities of GAPTL will help transfer, adoption and adaptation of testing technology in the industrial units of GAP sector.

5.2 Administrative viability

The objective of this assessment work is to optimize the manpower requirement so that all the processes may run smoothly and all the functioning of administrative work may perform in an efficient way without any disturbance.

Further possibility of automation / mechanization is to be identified, so that the requirement of manual procedures/operations can be reduced in due course of time. The matter of the study is also to check the possibility where multi-tasking is essential and where the job can be combined with other workers.

The scope of study includes all the clerical staff, administrative staff, technical workers (skilled and non-skilled), officers and executives (technical and non-technical) and other supportive workers. One of the important aspect of the study is to save the cost based on the manpower utilization.

5.2.1 Manpower

No	DESIGNATION	No. of Staff
1	Director	**1**
2	Deputy Director (Technical and Administration)	**1**
3	Senior Scientific Officer	**3**
4	Scientific Officer	**4**
5	Laboratory Technician	**8**
6	Laboratory Assistant	**8**
7	Documentation Assistant	**1**
8	Dark Room Assistant	**1**
9	Accountant	**1**
10	Computer operator /Clerks	**2**
11	Electrical and Mechanical Supervisor	**2**
12	MLSS	**2**
13	Security Guard	**3**
14	Cleaner	**2**

The testing laboratory shall be headed by a person preferably having a post graduate degree in chemistry or equivalent.

The minimum qualification for the technical staff in testing laboratory shall be Graduate in Science with physics, chemistry, mathematics, chemical engineering, mechanical engineering as one of the main subjects or have Diploma in chemical, instrumentation technology, mechnical or equivalent or specialization in relevant fields like Textiles, Polymer etc. The staff should have sufficient training and exposure to analytical chemistry and good hands on analysis and testing of appropriate samples.

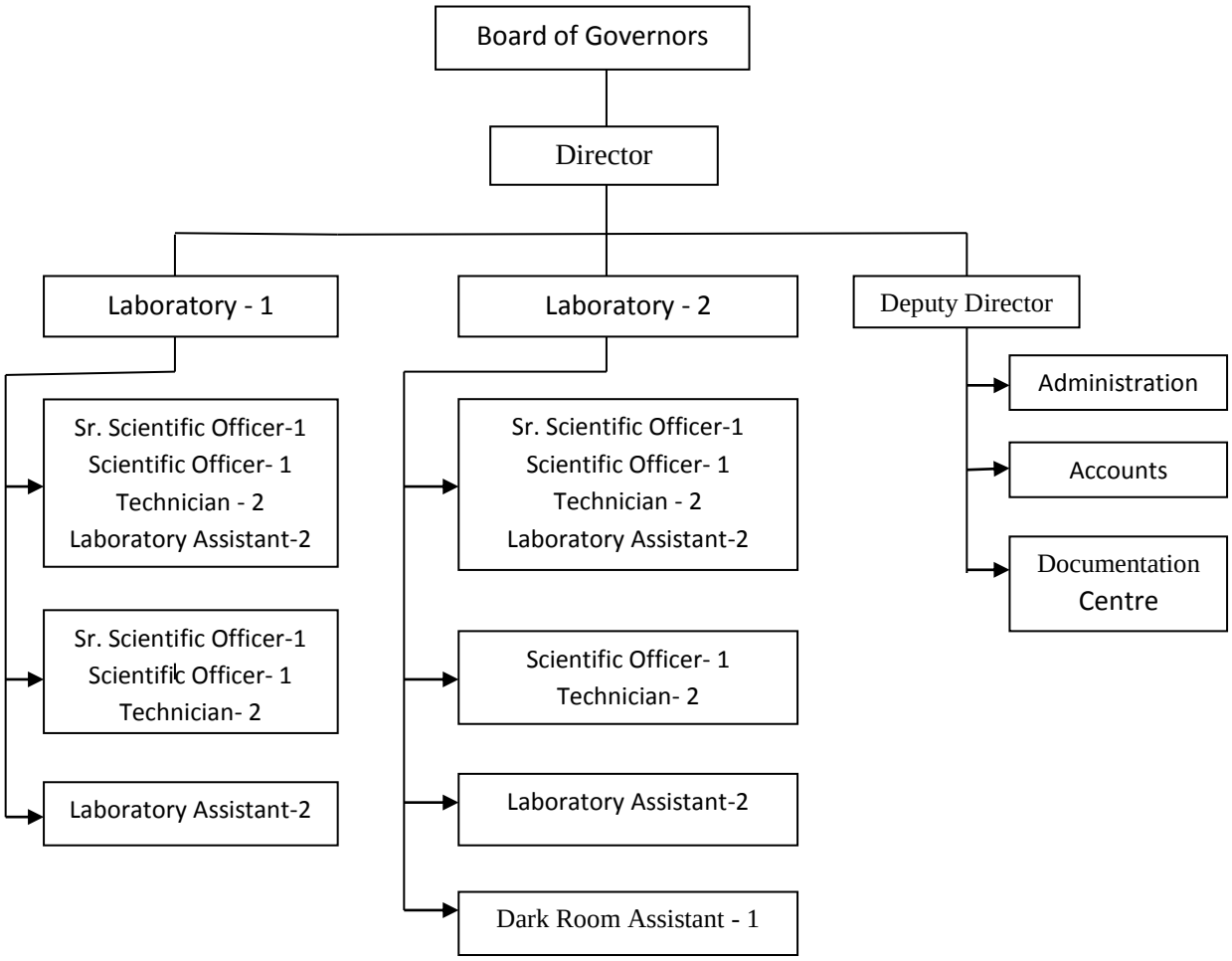
The laboratory Technicians or equivalent should have higher secondary certificate in science / Intertek Testing Services ITS and minimum one year experience or Training in a relevant laboratory. Testing laboratory involved in testing variety of products shall have a Supervisor for each area. The group Supervisor should have adequate relevant experience in addition to the minimum qualification.

There shall be a system for imparting periodic, internal and external training to the laboratory technical staff at different levels whenever required before assigning any analytical and testing work. Internal Training alone is not considered adequate to make the staff knowledgeable on the latest status of science and technology. The laboratory should ensure the availability of necessary infrastructure either internally or externally, for training. Evidence of effective trainings in specific field should be available in terms of performance in quality checks. All the technical

staff working should be sufficiently trained in all physical, chemical and instrumental methods of analysis for the particular product under concern.

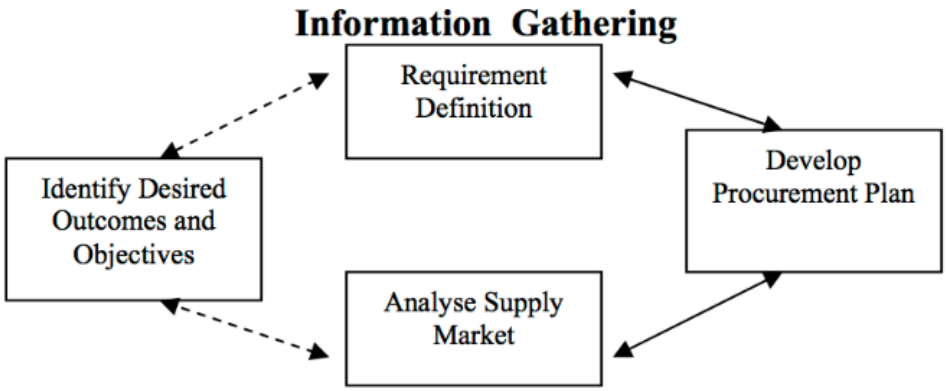
For meeting the requirement of internal audit, there should be at least one technical personnel apart from the head with suitable qualification and experience, irrespective of the size of the laboratory, who has received a formal training on internal audit. The laboratory shall be operated by the personnel who are permanently employed or appointed on long-term contract basis, provided laboratory ensures availability of technical personnel with adequate experience. A laboratory is not expected to be operated by trainees. Where additional personnel are required, the laboratory shall ensure that such personnel are supervised and that their work does not put at risk of the laboratory's compliance.

Organization and Management of the GAPTL



5.2.2 Procurement Plan

Procurement planning is the process of deciding what to buy, when and from what source. During the procurement planning process the procurement method is assigned and the expectations for fulfillment of procurement requirements determined. A series of procurement steps are followed to finalize the procurement process for the testing laboratory. Based on the current availability of amount under the project. The diagram below shows each of the stages in the individual procurement planning process.



Based on the current availability of Budget under the project. The following table 11 shows which equipment's are necessary to buy at first stage, to initiate laboratory.

Table 11 List of equipment's developed under Procurement Plan

Sl.	Device/Apparatus	Name of the Source/Supplier	Price in Euro/US$	Price in BDTk.
1	2	3	4	5
1	Hanatek IPT inclined plane friction tester	RHOPOINT INSTRUMENTS, UK	3500	340228
2	Gann Moisture meter H-35	MESSBAR., Germany	200	19442
3	UV/Vis spectrophotometer	Analytik Jena AG, Germany	6000	583248
4	Titan universal strength tester	James heal, UK	25600	2488525
5	HP Textile yarn package hardness tester	Check line Europe Ltd., UK	400	38883
6	Perspirometer and Incubator	James heal, UK	4200	408274
7	Crockmaster color fastness tester	James heal, UK	3500	340228
8	Thermaplate color fastness to dry heat and stability	James heal, UK	3800	36939
9	Sample cutter model 230/100	Checkline Europe Ltd., UK	600	58325
10	Electronic balance	BD Weight Scale Corporation, Bangladesh	200	19442
11	Die punch for sample preparation	Universal Engineering Corporation, India	2000	194416
		Total	**50000**	**4527950**

*Equipments are selected based on the suggestion from Bureau Veritas and TTZ Analytics department. Layout plan is in Appendix.

5.2.3 Equipment selection, viability and cost effectiveness

As it is difficult to cover the all of the important machineries in the low budget, ttz Bremerhaven compiled a list of equipment's in cooperation with Bureau Veritas which necessarily cover the testing's of the main GAP sectors to the final transportation. The equipment's listed in the table 11 cover almost 20 tests covering all the major standards. The viability of the laboratory equipment's is compared with a number of manufacturers worldwide and the manufacturers which are selected for the procurement plan are markedly renowned for the laboratory testing equipment's.

James heal, UK is an internationally well accepted laboratory manufacturer with the UKAS and ISO certification. The costs of European manufacturers are seemly high but the outcomes are much better with almost no maintenance cost and the reliable testing and accurate results. The equipment's manufactured by the James heal, UK cover and follow all the up-to-date standards and regulations.

GESTER International Co. Ltd, China is one of the most feasible supplier of the Garment accessories and packaging testing equipment's. All the main standards are covered in the products of this company namely ISO, ASTM, DIN, EN GB, BS and TAPPI. The cost compared with the other manufacturers is also reasonable with the same capability of functions and standards.

The functionality and the viability of these instruments are also proven and accepted for the required mode of functionalities.

5.2.4 Layout plan of equipment's

According to the physical dimensions of the equipment's about 100 m^2 of space required for the proper installation and adequate functioning with the extra space for the sample preparation and placement. Furthermore the following points must be noticed that the equipment's should:

- ✓ be placed to facilitate smooth and efficient workflow
- ✓ have sufficient operational area
- ✓ be safely positioned
- ✓ avoid placement in high traffic area
- ✓ avoid placement that requires frequent moving for cleaning and maintenance
- ✓ avoid direct placement under air conditioners
- ✓ avoid nearness to sinks and wet benches
- ✓ avoid direct proximity to heat source (instrument or sunlight)
- ✓ allow adequate space between instrument back and wall

The ISO/IEC 17025 details the specific layout for setting up the laboratory which is included in the list of standards to be bought in the table 11.

5.2.5 Staff

For carrying out the experiments and tests, 2 personnel should be employed. These can be designated as the

Laboratory technician: One laboratory technician must be B.Sc. in chemistry with 2+ year of working experience from UKAS certified testing laboratory.

Laboratory assistant: One laboratory assistant must be diploma in Mechanical engineering with 1+ year of working experience from UKAS certified testing laboratory.

On-the-job training should be provided to the technicians when new techniques or equipment are introduced. For this role the employees should:

- ✓ have a good understanding of science
- ✓ have a methodical mind
- ✓ have good practical and technical skills, including IT
- ✓ be a strong communicator
- ✓ work well with others
- ✓ have good literacy and numeracy skills
- ✓ have a good eye for color
- ✓ follow health and safety procedures, especially when handling chemicals

5.2.3 Salient Features of the Laboratory

At the top of the organigram, there is **a Board of Governors** (BOG) with the representatives of BGAPMEA & GAPTL to deal with the authority of hiring and firing of the Principal, frame and approve management systems and rules such as, service rules, financial rules, procurements rules etc., approve budgets and monitor the performance of the institute.

The Director Laboratory will work as the Chief Executive Officer (CEO) of the laboratory and will be responsible for running the organization with optimum utilization of its resources and manpower under the overall guidance of the BOG. He will directly supervise the activities of the laboratories. The Deputy Director will be responsible for the supervision of staff in planning, organizing, and implementing administrative systems. The Deputy Director maintains the staff by recruiting, selecting, orienting and training employees. The responsibilities also includes the infrastructure and maintenance/modification work of the laboratory along with the safety trainings and ensure the availability of the safety equipment's. The purchasing of machineries, materials, negotiating prices and ensure the delivery of goods. The Deputy Director will also be in authority of achieving financial objectives by anticipating requirements, submitting information for budget preparation, schedule expenditures, monitoring costs and analyzing variances. The Dy. Director will be responsible mainly for effective operation of all the support departments, such as Administration, Accounts & Finance, Security, Archive etc. under the guidance of the Director.

The Director and his team will be responsible for efficient management of GAPTL, by adopting the most cost-effective ways and means to undertake different types of tests. It will assess future testing needs, costs of tests etc. The GAPTL will have two wings i.e. Laboratory-1 & Laboratory-2. The Laboratory-1 will be used for chemical testing while the Laboratory-2 will perform physical/mechanical tests. Both the laboratories will be operated by a team of highly qualified and skilled technical staff with brilliant academic background & experience in relevant fields.

Effective management of laboratory greatly depends on a highly qualified and motivated team of scientists and technicians. To ensure this, three critical issues must be ensured, namely, a) recruitment of manpower with brilliant academic background; b) Systematic and periodical training of the manpower of the GAPTL both at home and abroad and c) attractive salary and inventive schemes. Technical assistance from the donor agencies may be useful in this respect.

Chapter-6

Cost Estimation

6.1 Introduction

Cost estimating is one of the most important steps. A cost estimate establishes the base line of the project cost at different stages of the development of the project. A cost estimate at a given stage of the project development represents a prediction provided by the cost engineer or estimator on the basis of available data. According to the American Association of Cost Engineers, cost engineering is defined as that area of engineering practice where engineering judgment and experience are utilized in the application of scientific principles and techniques to the problem of cost estimation, cost control and profitability.

Virtually all cost estimation are performed according to one or some combination of the following basic approaches:

6.2 Project Cost and its functionalities

6.2.1 Production function

In microeconomics, the relationship between the output of a process and the necessary resources is referred to as the production function. In construction, the production function may be expressed by the relationship between the volume of construction and a factor of production such as labor or capital. A production function relates the amount or volume of output to the various inputs of labor, material and equipment. For example, the amount of output Q may be derived as a function of various input factors x^1, x^2... x^n by means of mathematical and/or statistical methods. Thus, for a specified level of output, we may attempt to find a set of values for the input factors so as to minimize the production cost. The relationship between the sizes of a building project (expressed in square feet) to the input labor (expressed in labor hours per square foot) is an example of a production function for construction.

6.2.2 Empirical cost inference

Empirical estimation of cost functions requires statistical techniques which relate the cost of constructing or operating a facility to a few important characteristics or attributes of the system. The role of statistical inference is to estimate the best parameter values or constants in an assumed cost function. Usually, this is accomplished by means of regression analysis techniques.

6.2.3 Unit costs for bill of quantities

A unit cost is assigned to each of the facility components or tasks as represented by the bill of quantities. The total cost is the summation of the products of the quantities multiplied by the corresponding unit costs. The unit cost method is straightforward in principle but quite laborious

in application. The initial step is to break down or disaggregate a process into a number of tasks. Collectively, these tasks must be completed for the construction of a facility. Once these tasks are defined and quantities representing these tasks are assessed, a unit cost is assigned to each and then the total cost is determined by summing the costs incurred in each task. The level of detail in decomposing into tasks will vary considerably from one estimate to another.

6.2.4 Allocation of joint costs

Allocations of cost from existing accounts may be used to develop a cost function of an operation. The basic idea in this method is that each expenditure item can be assigned to particular characteristics of the operation. Ideally, the allocation of joint costs should be causally related to the category of basic costs in an allocation process. In many instances, however, a causal relationship between the allocation factor and the cost item cannot be identified or may not exist. For example, in construction projects, the accounts for basic costs may be classified according to (1) labor, (2) material, (3) construction equipment, (4) construction supervision, and (5) general office overhead. These basic costs may then be allocated proportionally to various tasks which are subdivisions of a project

6.2.5 Estimated Salary Statement

Sl.	Name of the Post	No. of the Posts	Salary (Taka)	Annual Pay (Taka)
1.	Director	01	80,000	9,80,000
2.	Dy. Director	01	75,000	9,00,000
3.	Senior Scientific Officer	3	65,000	23,40,000
4.	Scientific Officer	4	55,000	26,40,000
5.	Laboratory Technicians	08	40,000	38,40,000
6.	Laboratory Assistant	08	35,000	33,60,000
7.	Documentation Assistant	1	35,000	4,20,000
8.	Dark room Assistant	1	35,000	4,20,000
	Sub- Total	27		
	Support Staff			
9.	Accountant	01	45,000	5,40,000
10.	Computer Operator/ Clerk	02	35,000	8,40,000
11.	Electrical & Mechanical Supervisor	02	37,000	8,88,000
12.	MLSS	02	25,000	6,00,000

13.	Security Guard	03	25,000	9,00,000
14.	Cleaner	02	25,000 x 2	6,00,000
	Sub-Total	12		
	Total	39		1,92,68,000 Say 2,00,00,000

6.2.6 Estimated Fixed Cost of the Project

Sl. No.	Items of Expenditure	Costs (in million Taka)
1.	Land(50decimal*Tk. 2.00 million per decimal)	100.00
2.	Building(25,000 s. ft.) as per PWD rate	50.00
3.	Electric substation, generator etc.	8.00
4.	Lab. Equipment's	150.00
5.	Training Equipment's	3.00
6.	Furniture and Office Equipment's	8.00
7.	Electrification and Installation	1.00
8.	Operating Fund	23.50
	Total	**343.50**

6.2.7 Breakup of the Estimated Cost according to the Nature of Cost

Total cost of the proposed project is estimated at Tk. **235.50** million of which **Operating cost** stands at Tk. 15.50 million (about 14%) and **fixed cost** amount amounts to Tk.220.00 million (86%). Components of fixed cost are-Land, Building, Electric Sub-station, Generator, Laboratory, Equipment's, Training Equipment's, Furniture and Office Equipment's, Electrification and Installation, etc., while operating costs include salary, overhead expenditures, misc. expenditures, etc.

Sl. No.	Items of Fixed Cost	Costs (in million Taka)
1.	Land(50decimal*Tk. 2.00 million per decimal)	100.00
2.	Building(25,000 sqft.) as per PWD rate	50.00
3.	Electric substation, generator etc.	8.00
4.	Lab. Equipment's	150.00

5.	Training Equipment's	3.00
6.	Furniture and Office Equipment's	8.00
7.	Electrification and Installation	1.00
	Sub Total	**320.00**
	Items of Operating Cost	
1.	Salary	20.00
2.	Testing Materials	1.50
3.	Overhead Expenditures	1.00
4.	Misc. Expenditures	1.00
	Sub Total	**23.50**
	Total	**343.50**

This report contains Balance Sheet, Income Statement and Calculation of Depreciation on Fixed Assets for 5 years. Description of Balance Sheet, Income Statement and Calculation of Depreciation Sheet are given in the following pages.

6.3 Balance Sheet

Balance Sheet shows the Sources and Applications of funds. Endowment fund for capital expenditures will amount to Tk. 320.00 million. The institute will spend this fund for purchasing land; construction of building and electric substation, procurement of laboratory, equipments, training equipments, furniture and office equipments, vehicle, electrification and installation ,etc.

Sources of Funds	**Pre-operational**	1st year	2nd year	3rd year	4th year	5th year
Endowment Fund	32,00,00,000	32,00,00,000	32,00,00,000	32,00,00,000	32,00,00,000	32,00,00,000
Revenue Surplus	-	20,00,000	1,78,00,000	3,27,80,000	4,76,38,000	5,83,71,800
Total Sources of Fund	32,00,00,000	32,20,00,000	33,78,00,000	35,27,80,000	36,76,38,000	37,83,71,800
Application of Funds						

Fixed Assets at Cost	32,00,00,000	32,00,00,000	32,00,00,000	32,00,00,000	32,00,00,000	32,00,00,000
Less depreciation	-	2,20,00,000	1,98,00,000	1,78,20,000	1,60,40,000	1,44,50,000
Total Net Fixed Assets	32,00,00,000	29,80,00,000	30,02,00,000	30,21,80,000	30,39,60,000	30,55,50,000
Current Assets						
Cash		20,000	15,000	15,000	20,000	25,000
Bank		2,59,80,000	4,42,85,000	5,89,55,000	7,06,23,000	8,02,86,500
Current Liabilities		20,00,000	67,00,000	83,70,000	69,65,000	74,89,700
Net Current Assets		2,40,00,000	3,76,00,000	5,06,00,000	6,36,78,000	7,28,21,800
Application of Funds	32,00,00,000	32,20,00,000	33,78,00,000	35,27,80,000	36,76,38,000	37,83,71,800

6.4 Income Statement

Income statement of GAPTL project has been presented below for initial 5 years. The Income Statement shows total earnings and total expenses. Sources of income will include earnings from short term and long term training programs and consultancy services. Expenses will be incurred for payment of salary, overhead and other expenses. In the initial years, expenditure will supersede income. For developing earning capacity the proposed GAPTL should be recognized and accredited to Bangladesh Accreditation Board, Bangladesh Standard and Testing Institution, Ministry of Textile, Ministry of Shipping, Ministry Civil Aviation. The GAPTL may be authorized as nodal agency to conduct the various performance tests on garments accessories and package products and also to certificates.

As on last date of each years' operation

Earnings	**Year-1**	**Year-2**	**Year-3**	**Year-4**	**Year-5**
	15,00,00,0000	15,00,00,0000	15,00,00,0000	15,00,00,0000	15,00,00,0000
Capacity utilization	30%	40%	50%	60%	70%
Earnings from Tests	4,50,00,000	6,00,00,000	7,50,00,000	9,00,00,000	10,05,00,000

Earnings from consultancy	100,00,000	1,20,00,000	1,32,00,000	1,45,00,000	1,62,00,000
Total Earnings	5,50,00,000	7,20,00,000	8,82,00,000	10,45,00,000	11,67,00,000
Operating Costs					
Testing materials	10,00,000	16,00,000	20,00,000	24,00,000	28,00,000
Administrative Expenses(Salary, Overhead Expenditure, etc. including Depreciation)	5,00,00,000	5,05,00,000	5,10,00,000	5,18,00,000	5,26,00,000
Other Expenses	20,00,000	22,00,000	24,20,000	26,62,000	29,28,200
Total Cost	5,30,00,000	5,42,00,000	5,54,20,000	5,68,62,000	5,83,28,200
Revenue Surplus	20,00,000	1,78,00,000	3,27,80,000	4,76,38,000	5,83,71,800

6.5 Calculation of Depreciation

Depreciation on fixed asset of GAPTL has been calculated for 5 years and presented below in 5 separate tables on the following pages. Depreciation has been calculated following the Reduced Balanced Method. Depreciation on all assets have been calculated @ 10%.

6.5.1 Depreciation on Fixed assets for the Year ended Ist year

Particulars		**Original Cost**				**Depreciation**		**Written down Value**
	Balance	**Addition**	**Total Cost**	**Rate (%)**	**Balance**	**Charge**	**Total**	
Land(50decimal*Tk. 2.00 million per decimal)		100.00	100.00	0	0	0	0	100.00
Building(30,000 sqft.) as per PWD rate		50.00	50.00	10		5.00	5.00	45.00
Electric substation, Generator, etc.		8.00	8.00	10		0.80	0.80	7.20

Lab. Equipment's		150.00	150.00	10		15.00	15.00	135.00
Training Equipment's		3.00	3.00	10		0.30	0.30	2.70
Furniture and Office Equipment's		8.00	8.00	10		0.80	0.80	7.20
Electrification and Installation		1.00	1.00	10		0.10	0.10	0.90
Total		320.00	320.00			22.00	22.00	298.00

6.5.2 Depreciation on Fixed assets for the Year ended 2nd year

Particulars		**Original Cost**				**Depreciation**		**Written down Value**
	Balance	**Addition**	**Total Cost**	**Rate (%)**	**Balance**	**Charge**	**Total**	
Land(50decimal*Tk. 2.00 million per decimal)	100.00		100.00	0	0	0	0	100.00
Building(30,000 sqft.) as per PWD rate	50.00		50.00	10	5.00	4.50	9.50	40.50
Electric substation, Generator, etc.	8.00		8.00	10	0.80	0.72	1.52	6.48
Lab. Equipment's	150.00		150.00	10	15.00	13.50	28.50	121.50
Training Equipment's	3.00		3.00	10	0.30	0.27	0.57	2.43
Furniture and Office Equipment's	8.00		8.00	10	0.80	0.72	1.52	6.48
Electrification and Installation	1.00		1.00	10	0.10	0.09	0.19	0.81
Total	320.00		320.00		22.00	19.80	41.80	278.20

6.5.3. Depreciation on Fixed assets for the Year ended 3rd year

Particulars		**Original Cost**				**Depreciation**		**Written down Value**
	Balance	**Addition**	**Total Cost**	**Rate (%)**	**Balance**	**Charge**	**Total**	
Land(50decimal*Tk. 2.00 million per decimal)	100.00		100.00	0	0	0	0	100.00
Building(30,000 sqft.) as per PWD rate	50.00		50.00	10	9.50	4.05	13.55	36.45
Electric substation, Generator, etc.	8.00		8.00	10	1.52	0.65	2.17	5.83
Lab. Equipments	150.00		150.00	10	28.50	12.15	40.65	109.35
Training Equipments	3.00		3.00	10	0.57	0.24	0.81	2.19

Furniture and Office Equipments	8.00		8.00	10	1.52	0.65	2.17	5.83
Electrification and Installation	1.00		1.00	10	0.19	0.08	0.27	0.73
Total	320.00		320.00		41.80	17.82	59.62	260.38

6.5.4 Depreciation on Fixed assets for the Year ended 4th year

Particulars		**Original Cost**				**Depreciation**		**Written down Value**
	Balance	**Addition**	**Total Cost**	**Rate (%)**	**Balance**	**Charge**	**Total**	
Land(50decimal*Tk. 2.00 million per decimal)	100.00		100.00	0	0	0	0	100.00
Building(30,000 sqft.) as per PWD rate	50.00		50.00	10	13.55	3.65	17.20	32.80
Electric substation, Generator, etc.	8.00		8.00	10	2.17	0.58	2.75	5.25
Lab. Equipments	150.00		150.00	10	40.65	10.94	51.59	98.41
Training Equipments	3.00		3.00	10	0.81	0.22	1.03	1.97
Furniture and Office Equipments	8.00		8.00	10	2.17	0.58	2.75	5.25
Electrification and Installation	1.00		1.00	10	0.27	0.07	0.34	0.66
Total	320.00		320.00		59.62	16.04	75.66	244.34

6.5.5 Depreciation on Fixed assets for the Year ended 5th year

Particulars		**Original Cost**				**Depreciation**		**Written down Value**
	Balance	**Addition**	**Total Cost**	**Rate (%)**	**Balance**	**Charge**	**Total**	
Land(50decimal*Tk. 2.00 million per decimal)	100.00		100.00	0	0	0	0	100.00
Building(30,000 sqft.) as per PWD rate	50.00		50.00	10	17.20	3.28	20.48	29.52
Electric substation, Generator, etc.	8.00		8.00	10	2.75	0.53	3.28	4.72
Lab. Equipments	150.00		150.00	10	51.59	9.84	61.43	88.57
Training Equipments	3.00		3.00	10	1.03	0.20	1.23	1.77
Furniture and Office Equipments	8.00		8.00	10	2.75	0.53	3.28	4.72
Electrification and Installation	1.00		1.00	10	0.34	0.07	0.41	0.59
Total	320.00		320.00		75.66	14.45	90.11	229.89

6.6 Cost Effectiveness Analysis of the Project

As has been stared earlier, much of the benefits from the GAPTL will not be directly visible; rather most of the benefits are indirect and are derived from the additional revenues generated from improvement of quality of products, higher productivity, lower rate of waste, reduced rate of machinery breakage etc. Instead of financial cost benefit analysis, cost effectiveness analysis is more appropriate in the case of GAPTL. In this case, the cost-structure of prevailing private testing laboratory has been accepted for comparison with that of the laboratory. Such comparison has been done with the help of the following criteria:

i) Cost per test;

ii) Annual Fixed Cost for Tests;

iii) Annual variable costs for tests.

6.6.1 Comparative Cost analysis: Prevailing versus Proposed (GAPTL)

GAPTL is a testing laboratory and will generate considerable amount of income by undertaking tests of different products. But the main objective of GAPTL will not be to earn more revenues. Rather, the GAPTL will concentrate on providing quality services at least cost. So, instead of cost-benefit analysis, cost effectiveness analysis has been carried out. In order to assess the cost effectiveness of the project, the operating cost per unit of test in GAPTL has been compared with the average prevailing cost of test. Our study reveals that the tests are of multifarious types and the cost also varies widely from one type of test to another, as well as from on testing company to another company. In spite of this variations, a comparative analysis will give an indicative picture of cost effectiveness of the Project.

a) Data on Prevailing average Cost of the Private Testing Laboratories/ Companies

i) Cost per Test :Tk. AboutTk.8950.00

ii) Time required for Testing: 02 to 10 days; (on average 06 days)

Since all the tests will be done locally, the duration of time for undertaken testing will be reduced to range between 2 days and 10 days; giving average of 6 days.

b) Data on Operational Costs of GAPTL

i) Yearly Operational Costs: Tk. 23.50 million;

ii) Total No. of Tests (Annual): About 13647.00;

iii) Cost per unit of Test: Tk. AboutTk.1,722;

iv) Time required for Testing: 10 to 15 days; (on average 12 days)

c) Comparative Cost Analysis

Sl. No.	Elements of Costs	Private Testing Institutions/Companies	GAPTL	Difference
1.	Yearly Operational Costs	-	Tk.23.50 million	-
2.	Average Cost per Test	Tk.8,950	Tk.1,722	Tk.7228
3.	Average time taken for Test	15 days	6 days	9 days

6.6.2 Cost Effectiveness Analysis of the Proposed Testing Institute

The Laboratory will be a specialized testing institute and center of excellence to provide testing facilities for garments accessories and packaging products. It will be have modern and highly sophisticated equipment's and technically educated , experienced and skilled manpower which will be its strategic advantage over other private testing laboratories. Because of this specialty, cost of tests by proposed laboratory will be lower than other private testing laboratories. Important features of the cost effectiveness analysis are:

1. Annual operating cost of private testing laboratories are not available, while annual operating cost of the proposed testing laboratory will be about Tk. 23.50 million;
2. Average cost per test has been found to be Tk. 8,950.00 for private laboratories as against Tk. 1,722.00 for GATPL. The average cost per test at GATPL is much lower than same at private testing laboratories;
3. Average time required for undertaking each testing will be reduced to 6 days from the 12 days required by existing testing institutions. Thus, the reduction of testing time by about 50% will be an important contribution in terms of time efficiency of GAPTL.

All these lead to the conclusion that the testing facilities of the proposed laboratory will be cost effective compared to that of leading existing testing institute/ companies. In consideration of the above benefits and effectiveness, GAPTL will be a cost effective testing outfit for the GAP sector.

Chapter-7

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

7.1 Summary of Findings

7.1.1 Garment accessories & packaging, although constitute insignificant percentage of cost of the products, occupies most important position in production economics. Accessories and packaging sector is inseparably related with export market and because of this fact importance of up gradation of quality of the products of this sector to the international level is attracting serious attention. The international buyers are increasingly pressing for improving quality of products for environmental and social compliance. They are imposing conditions for compliance of quality testing's and quality assurance which can be achieved through conducting broad spectrum of testing of different aspects of the products. So, testing services have become a basic necessity for survival of the products in the world market. In this back drop, establishment of a testing laboratory under Bangladesh Garment Accessories & Packaging Manufacturers & Exporters Association (BGAPMEA) is essential to provide internationally acceptable testing facilities for various types of products manufactured by the industrial units under BGAPMEA.

With these objectives ,the study has covered a number of important issues, such as, assessment of the requirement of testing facilities (both total and type-wise) for the units under GAP Sector, designing Accessories and Packaging Testing Laboratory (GAPTL) Project along with necessary physical facilities (such as land, building, laboratory, furniture and fixture etc.), machineries and equipment for each testing laboratory, energy, fuel and other logistic supports, analysis of financial viability and social desirability and so on;

7.1.2 Currently there are as many as 1232 companies under the GAP sector divided into 19 categories of industrial units which produce more than 100 types of products. In order to make an in-depth assessment of testing needs, the study has selected sample units (55) from each category following PPS method. Data were collected both from primary (sample units) and secondary source (BGAPMEA and other stakeholders). While selecting the sample units, special attention has been given to geographical locations of the units under BGAPMEA. Data were collected to assess the existing testing services availed by the GAP units, their requirement for testing services, cost and time requirement for the testing services used by them, and various other issues;

7.1.3 The study reveals that garments accessories and packaging products require several types

of tests. Some of these tests are known according to the nature of test (e.g. Azo test, Nickel Content test etc.), while others are known by products test (e.g. Zipper Test namely, the test of strength, durability etc. of zipper). The study shows that only 8 types of garments accessories and packaging products are tested out of 19 categories. Remaining 11 types are not tested. This might be because of such reasons as, the existing tests involve high costs, more time and in some cases these tests were found to give faulty results in the past;

7.1.4 Our survey reveals that the most common types of tests undertaken by the GAP units include product tests, namely, Polybag Tests, Corrugated Carton Tests, Hanger Tests, Elastic Tests, Resin Tests, Label Tests, Thread Tests etc., and Chemical tests, such as Microbiological Test, Azo Test, Chemical Test, Color Fastness Test, GSM Test, PH Test, MR% Test, Formaldehyde Test, Nickel Test etc.;

7.1.5 The study reveals that the most frequently used testing institutes include, among others, SGS , BUREAU VERITAS , ITS , Blueberry , HOHEN , BUTEX , BSTI , Oeko-tex and Walmart;

7.1.6 The study reveals that some of the tests take very short time e.g. fusing test takes only one day, while some items take very long time e.g. Hangtag test (one month), Photo Card (one month), Size Tag (one month) and Neck Board (25 days). Undesirable longer time for such testing depends on such factors, as the qualitative nature of items/ products, availability of testing facilities (sometimes the testing institute send the sample abroad for testing which delays the delivery) and responsibility and sincerity of the institutions to carry out the tests, (the existing testing institutions are overloaded with big customers from RMG sector and other sectors and, therefore, they overlook the smaller items of GAP sector) and so on;

7.1.7 The cost involved in undertaking tests range from Tk. 3000/- to Tk. 20,000/- which is considered very high by the GAP units. Quite often, additional costs involve in the repetition of the same tests for more clear and accurate results. The owners of GAP units are very unhappy with such high cost of testing;

7.1.8 The study reveals that in Bangladesh GAP sector lacks exclusive testing laboratory for garments accessories and packaging materials. The testing institutions, currently engaged in providing testing services to garments accessories and packaging units, are mostly of foreign origin. They provide testing services through their local offices at Dhaka with very limited facilities. In majority cases these offices send the samples abroad for testing and as such testing involves huge costs and longer time. Whatever testing facilities available in the country, are not often fully equipped with necessary facilities to provide testing services to the accessories and packaging industries. Moreover, the test results of these local testing institutes are not quite often acceptable to the foreign buyers. In view of the prevailing situation and realities stated above, the

industrial units under GAP sector need the support of an exclusive testing laboratory to meet their specific needs.

7.2 Laboratory visits

To have an overview and adequate information, ttz Bremerhaven communicated with the several well-known laboratories located in the Germany. The company names and communication details are listed in the table 12 below:

Table 12 Testing Institutes in Germany

Company name	Address	Contact Person	Remarks
Bureau Veritas Consumer Products Services GmbH	Wilhelm-Hennemann-Str. 8, 19061 Schwerin, Germany	**Dr. Joerg Ruhkamp** Manager Operations Analytical Tel: +49 40 74041 1001 email: Joerg.Ruhkamp@de.bureauveritas.com	• Detailed lab visit (complete analytical branch) • Standards identification • Equipment's & suppliers information • Recruitment of staff information • Every day operation procedure • Administrative & management procedures
SGS	Roedingsmarkt 16 D-20459 Hamburg	**Steffen Heycke** Market Manager CTS Non Food Phone: +49 (0) 40 30101-838 Mobile:+49 (0) 152 22618637 email: Steffen.Heycke@sgs.com	• Due to strict rule of non-disclosure and confidential information it was not possible for them to collaborate in the visit
DTNW Deutsches Textilforschungszentrum Nord-West e.V.	Adlerstraße 1 D-47798 Krefeld	**Monika Frische** Dipl.Ing.(FH) Telefon: +49 (0) 21 51-843-203 Fax: +49 (0) 21 51-843-143 email: monika.frische@dtnw.de	• Due to strict rule of non-disclosure and confidential information it was not possible for them to collaborate in the visit
INTERTEK CONSUMER GOODS GmbH	Würzburger Str. 152 90766 Fürth	**Bernd Dannhorn** Director Softlines Fax: +49 911 74075-30 Mobile: +49 1520 9338 099 email: bernd.dannhorn@intertek.com	• They recommended us that the association can visit their laboratory in Bangladesh. Due to privacy policy they cannot offer us access to the laboratory in Germany. • **Bangaldesh Contact:** Dr. Karthik. N.D Director Intertek Bangladesh
Institute of Textile Technology and Process Engineering Part of the German Institutes for Textile and Fiber Research	Koerschtalstrasse 26, D-73770 Denkendorf	**Hartmut Haid** Head of Central Testing Laboratory Tel.: +49 (0)7 11 / 93 40 - 221 Fax: +49 (0)7 11 / 93 40 - 297 E-Mail: hartmut.haid@itv-denkendorf.de http://www.itv-denkendorf.de	• The privacy policy hindered the visit to the laboratory.

7.3 Conclusions

7.2.1 The findings described in the section-7.1 lead to the following conclusions:

i) Garment accessories and packaging products require several types of tests. Some of these tests are known according to the nature of test (e.g. Azo test, Nickel Content test etc.), while others are known as product test (e.g. Zipper Test, Button Test, Carton Test etc.);

ii) The existing testing outfits, most of which are foreign origin, are highly expensive, time consuming and grossly inadequate to meet the requirement of the GAP sector;

iii) The assessed needs for testing justify the establishment of a separate testing laboratory entitled Accessories and Packaging Testing Laboratory (GAPTL) under BGAPMEA to cater to the testing needs of the GAP sector;

iv) The survey result also justifies that the proposed testing laboratory (i.e. GAPTL) should have adequate physical infrastructure, manpower, laboratory equipment's etc., suitable to undertake the various types of tests with highest accuracy and at lower cost;

v) The proposed Testing laboratory will be a need-based testing outfit of international standard. The laboratory should be exclusively for GAP industries and it would be managed and administered by the BGAPMEA efficiently;

vi) Our comparative analysis confirms that the proposed GAPTL will offer testing services at **much lower average cost** (i.e. Tk.1,722 in place of Tk. 7,228 currently charged by existing testing laboratories); and within less time (i.e. on average 6 days in place of 15 days currently taken by existing testing laboratories);

vii) The GAPTL should be managed by BGAPMEA through a Governing Body consisting of the representatives from BGAPMEA, GAPTL and one or two distinguished experts in relevant field. Appropriate management systems should be developed in keeping with the systems and procedures prevailing in similar testing laboratories at home and abroad;

viii) In addition to testing services, the proposed GAPTL will provide a good number of other technical supports and counseling on such issues as, critical analysis of the quality of raw materials, design of products, variety of models, type, size, shapes, colors adaptation to standards, durability resistance to climatic conditions, ease and reliability of packing and packaging during shipment, handling, design of labels, quality impression, etc.

7.4 General Recommendations

7.3.1 On the basis of the meticulous analysis and discussion of the findings and conclusions of the study, briefly presented in the previous sections, a number of recommendations relating to physical, technical, managerial and financial feasibility have been developed and briefly summed up below:

i) The proposed GAPTL should have all the required physical facilities, such as, sufficient space for office accommodation, laboratory, archive center etc. It has been estimated that a built in area of 25,000 sqft. Is recommended for GAPTL with scope for further expansion based on needs;

ii) An area of 50 decimal of land located at any prime area of Dhaka city should be selected for GAPTL. Issues which should be taken into consideration for identification of appropriate location include among others are: nearness to the clients (demand side), availability of physical facilities and required technical manpower (supply side), developed infrastructure and connectivity and availability of support services;

iii) The GAPTL should be organized as one of the most modern testing outfit in the country. The laboratory equipped with modern testing equipment's for rendering testing services to member industrial units of BGAPMEA and the archive center should have modern preservation facilities and documentation system;

iv) The GAPTL should be implemented with an estimated total cost of Tk. 343.50 million, of which fixed cost will be Tk. 320.00 million and operating cost will assume Tk 23.50 million. Financial analysis, such as sources & application of fund, income statement, Calculation of depreciation on fixed assets for 5 years, etc. confirm the viability of the project. It should be mentioned here that testing laboratory and research projects are not usually found to be financially profitable, although it generates considerable indirect benefits & income. In view of this, instead of financial cost-benefit analysis, cost-effectiveness analysis has been carried out by comparing with a similar testing laboratory / institute (namely, SGS and others). Such cost-effectiveness analysis confirms the viability of the GAPTL Project;

v) The proposed GAPTL may be recognized and accredited to Bangladesh Accreditation Board,, Bangladesh Standard and Testing Institution, Ministry of Textile, Ministry of Shipping, Ministry Civil Aviation, EN ISO/IEC 17025, ISO 9000, ISO 14000, UKAS, CPSCIA, TÜV, BUREAU VERITAS, and SGS;

vi) The GAPTL may be authorized as nodal agency to conduct the various performance tests on garments accessories and package products and also to certificates.

7.4 Funding Recommendations:

Based on assessment during the whole task (excellence, risks, fit to scheme etc.). we would like to recommend BGAPMEA some funding opportunities which can help them to continue the laboratory development. Below some funding schemes are listed as an introduction in.

Switch Asia II:

The Programme aims at **identifying and scaling up successful SCP practices in Asia** in order to induce a systematic change in consumption and production patterns and behavior. Furthermore, lessons learnt indicate that the consumption side of SCP needs more appreciation and that access to finance is a key bottleneck for a sustainable switch to SCP practices for SMEs in Asia. For Further information please go through their website: http://www.switch-asia.eu/

Horizon 2020:

Horizon 2020 is the biggest EU Research and Innovation programme ever with nearly €80 billion of funding available over 7 years (2014 to 2020) – in addition to the private investment that this money will attract. It promises more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market.

Recommendation on Govt. support

There are some possibilities where Government could possibly support for financing physical infrastructure development namely land and building for GAPTL. With the reference to the current report on setting up testing laboratory by **EUB** and **TTZ** the next step for **BGAPMEA** is to prepare a subsequent proposal based on the facts and figures stated in the report which clearly states what the requirements are and what will be the cost. This proposal must be presented to Ministry of Industries to justify the focus and need for the laboratory. The sources of funding could be done partially by Ministry and donor agencies such as **World Bank, Asian development bank or European Commission**. The Government can also support in receiving loan from the bank. The annual turnover according to cost estimation is quite high.

TTZ-Bremerhaven can provide support to **BGAPMEA** in funding acquisition from **Switch Asia II, Ministry of Industry, World Bank, Asian development Bank** and especially from **Horizon 2020**.

Appendix

I. Function of equipments

S.No.	Device	Function
1	TruBurst pneumatic bursting strength tester	Truburst Pneumatic bursting strength tester is an extraordinary machine, capable of conducting efficiently and accurately bursting strength and fatigue tests on textiles and other materials. It is used to test the burst strength of a variety of materials including textiles, nonwovens, paper, board, plastics and medical products. Initially designed for testing textiles, the list of applications for TruBurst keeps growing. Some of the more recent materials include plastic bags, food packaging, tissues and wound dressings.
2	Paper board crush test machine	The equipment is used to test the Ring Crush Test (RCT), Edge Crush Test (ECT), Peel Strength Test (PAT), and Flat Compression Test (FCT).
3	Print quality Scuff proofness tester	This equipment is intended to evaluate the Rub Proofness of prints on paper or board. It can also be used to measure / evaluate Colour Transfer from printed / coated surface during rubbing. The application can be extended for measurement of abrasion resistance of some Plastic materials / Aluminum Foils.
4	Ply bond strength tester (KJ-1065B)	The equipment is used for multi-layered materials (duplex paper, coated paper), the internal bond strength between the layers is an important property which determines processability during printing or after coating. During tests the load must be perpendicular to the surface of the specimen. In order to eliminate the influence of grips or fixtures on the separation of the layers in a test, the tensile force must remain perpendicular to the specimen at failure, making high lateral stiffness and absolute parallelism of the specimen holders a critical requirement. Zwick's special arrangement for this test incorporates specimen carriers arranged at 90 ° to each other which allow five tests to be performed with a single application
5	Drop tester (Mechanical)	The equipment is desinged to the focus of the drop test is to ensure robustness during shipping and handling. These drop tests tend to be free-fall type tests and the electronics tends to be packaged in a manner similar to that used during transportation. A good example of this type

		of test is MIL-STD-810G, Method 516.5 Shock. As a result, these tests assess a combination of packaging and electronics design
6	Taber Stiffness tester	The tester is used to evaluate stiffness and resiliency properties of materials up to 10,000 Taber Stiffness Units. This precision instrument provides accurate test measurement to ±1.0% for specimens 0.004" to 0.219" thickness. Materials include paper products, cardboard, plastics, metals, textiles, rubber, wire, tubing, felts and other sheet materials.
7	Gurley™ COBB paper sizing tester 4180BN	The equipment is used for water absorptiveness of paper board or other materials is a function of various characteristics such as sizing, porosity, etc. The Gurley-Cobb sizing test can be used to test absorption or resistance to absorption of water, oil and other liquids.
8	Air pressure (Leakage tester)	It is used for the determination of gross leaks in flexible packaging containing a headspace gas by bubble emission. The test is conducted by submerging the test specimen in the immersion fluid within the confines of a vacuum chamber. If bubbles or seepage of fluid within specimen attributable to a leak are observed, then the specimen fails the test.
9	Vibration tester	A vibration meter is used in inspection, manufacturing and production, and the laboratory. The vibration meter is used to measure vibrations and https://www.pce-instruments.com/english/measuring-instruments/meters/vibration-meter-kat_40108_1.htmoscillations in many machines and installations, as well as in the development of products such as tools or components. Measurements of the vibration meter provide the following parameters: vibration acceleration, vibration velocity and vibration displacement. In this way the vibration is recorded with great precision. The vibration meter is a portable device and its readings can be stored and retrieved for later use.
10	Folding Endurance Tester (GT-N16)	Folding endurance tester has various functions, such as, parameter testing, parametric transformation, parameter regulation, parameter display, parameter memory and parameter print. The tester has data processing function which can directly output result of statistical data with convenient operation, easy regulation and stable performance. The main functions are shown as following, compact structure, light weight, abundant functions, horizontal type and stable performance, so the tester is suitable for different paper and boards.

11	Puncture Resistance tester	Puncture resistance is the measure of the maximum force required to penetrate a material. Resistance to puncture is a major mechanical property of materials such as roofing, packaging materials, protective gloves, needle disposal facilities, drywall, etc. Puncture tests help assess the protective qualities of these materials.
12	Elmendorf Tear Strength Tester	A pendulum impact tester is used to measure the force required to propagate an existing slit a fixed distance to the edge of the test sample. One use of these results would be for the specification of material and thickness for plastic film used in packaging. Depending upon the application, a low propagation force or a high propagation force might be more desirable.
13	Computer controlled carton compression tester	Box compression testers are PC-controlled systems primarily used in the packaging industry for determination of the compression strength of cartons, containers, cardboard boxes, etc. The described model is the lower cost hydraulic microcomputer system with indicator for general testing purposes.
14	Hanatek IPT Inclined Plane Friction Tester	The Hanatek Advanced Friction tester is the most comprehensive tool available for measuring the coefficient of friction of plastic film, printed cartons, packaging substrates or paper. This flexible instrument can also be used to measure and display the frictional values of any flat surface including rubber, flooring plastics textile and leather. In addition to providing static and dynamic slip values for a surface , the instrument allows the full friction force output to be displayed, stored and compared. This unique ability helps a manufacturer to relate the feeding and running speeds of a product to its surface characteristics. The instrument is available with optional extras to measure peel strength of adhesives, tear strength of substrates and the blocking of plastic films and coated cartons.
15	Bendsten smoothness and porosity tester (Andersson and Sorensen)	The tester determines the smoothness and porosity of paper and board, based on mass flow meter principle. Provided with imported sensor and accessories -Measuring Range: 0-300ml/min, 0-3000ml/min. -DIGITAL BASED with Roughness and Porosity value on 4.5 Digit seven segment display. -MICROCONTROLLER BASED system with parameter inputs and all

		output of Roughness, Porosity and Permeability on LCD display and inbuilt Printer.
16	Rain tester	The Rain Tester is designed in such a way which is able to test a wide range of materials including: Films, Textiles, Leather, printing, paints, ink, Automotive parts, Hand phone, Electronic parts and components and etc. in testing the materials Rainproof capability and functionability. Through advanced technology and quality engineering company has produced this Rain Tester which is accurate and easy to use. Powerful as a standalone unit.
17	Gann Moisture meter H-35	The H 35 is an electronic **moisture meter** based on the electric resistance measurement principle. It is designed for precise measurement (up to 180 mm thick), particleboards and veneers. The device is ideal for both single and series measurements
18	High Performance Liquid Chromatograph y (HPLC)	The Compass OpenAccess LC-MS system which consists of an Agilent 1200 binary HPLC, equipped with an autosampler, column temperature control compartment, a six port column switching valve and a UV/Vis detector coupled to a Bruker HCT ultra ion trap mass spectrometer equipped with a standard electrospray source (ESI). All of the latter LC-MS system modules are controlled through Compass HyStar software. Mass spectrometric analysis (MS) has been routine in the characterisation of molecules for many years and the analytical power of the technology is commonly increased by the introduction of a high performance liquid chromatography (HPLC) front end. The development of rapid chromatographic methods along with robust ionisation techniques means that the timescale for LC-MS analysis is frequently only minutes making the tool ideal for real time monitoring of reaction progress and rapid quality control (QC) work. However, access to analytical instrumentation is fre-quently limited by the training required to enable users to successfully operate both LC and MS instrumentation. In some cases improper instrument use can result in significant laboratory down-time. The Bruker Compass OpenAccess system is a multi-user software tool that eliminates this learning curve allowing users new to LC-MS the ability to generate valuable data with a minimal amount of training

19	Scion TQ GC Triple Quadrupole Mass Spectrometer	The SCION TQ is the chromatographer's choice for triple quadrupole mass detector; it is designed to match your most stringent needs for analytical performance and productivity. The SCION TQ offers superior sensitivity and robustness based on the innovative ion optics, and fast and easy methods development for multi-component quantitation following the unique Compound Based Scanning (CBS) approach with MRM library. The SCION TQ GC-MS/MS system defines a new standard of usability for routine analysis and has the smallest bench footprint in the industry
20	UV/Vis Spectrophotometers	UV/Vis spectrophotometers work on the method of molecular absorption spectroscopy with ultraviolet and visible radiation mainly on liquid samples measured in transmittance or absorbance. Measurements on solid and gaseous samples are also possible. Thereby, one can obtain qualitative information (like purity of substances, substances identification or binding conditions) as well as quantitative information (like concentration via endpoint measurement or via kinetic).
21	Velcro tape strength tester	VELCRO tape strength tester is used for molded plastic hook and a heavy duty, water-resistant adhesive for superior holding power on smooth surfaces, including plastic. Designed for indoor and outdoor use.
22	Titan universal strength tester	Titan universal strength tester is an outstanding tester designed specifically for testing textiles, non wovens and leather goods in various forms, yarns, fabrics, garmnets accessories. The tester includes following main informations - Compact, desktop, standards-compliant Universal Strength Tester - Operates as standard in both tension and compression -Extensive range of tool-free, interchangeable specimen grips -Choice of three load cells - up to 3000N (approx 300kg): load cells supplied in cartridge form to improve protection and to facilitate safe handling and storage.
23	HP Textile Yarn	HP Textile Yarn Package Hardness Tester accurately measure the winding density of textile bobbins, beams, spools, spindles, cones,

	Package Hardness Tester	quills, dye packages, rolls, etc. - Operation is as easy as pressing the spring-loaded knurled aluminum shell down to the red line. - Constant-pressure indicating system assures uniform test pressure eliminating false readings due to differences between operators
24	Button Impact tester	Buttom Impact Tester is used determine the impact resistance of plastic sew-through flange buttons to a falling mass of 0.84kg (29.5 oz), released from a height of 67mm (2.625 inch) or other heights as required. Cracking, chipping or breakage constitute failure.
25	Sharp edge tester	Sharp edge ester is the original sharp edge tester that was developed to satisfy Standard ISO 8124-1,ASTM F963, EN-71, 16CFR 1500 for the "determination of sharp edges".
26	Garment button pull tester	It is used to determine the holding or breaking strength of prong-ring attached snap fasteners onto garments to ensure button and firmware can be fixed on the ready-made garments properly,avoiding button drop from garment to brought danger to baby swallow. Button Pull Test Machine used for test the vertical orientation tension of button and added touch.Consists of an Upper Snap Clamp, a Lower Fabric Clamp & Force Gauge mounted on a Stand. The snap component is gripped by the Upper Snap Clamp and the garment is fixed to the lower Fabric Clamp. By turning the Top Flywheel, the operator can apply a specific force and the holding force or the breaking strength can be recorded.
27	Perspirometer and Incubator (colour fastness and phenolic yellowing tester)	The Perspirometer is used to determine colour fastness to perspiration, cold water and sea water. The same instrument is employed to predict the potential of white or pastel- coloured textiles to yellow in transit or storage. After insertion of the specimens, the Perspirometer is transferred to an Incubator for a pre-determined period. The Perspirometer comprises a stainless steel frame, having top and bottom plates and an intermediate spring plate. The springs, which act on this plate, are designed to maintain a uniform pressure on the specimens, as they are drying out in the Incubator. Perspiration fastness testing is carried out by immersing the specimens in both alkaline and acidic solutions, and we recommend the use of separate units to prevent

		cross- contamination. Acrylic separator plates are used for colour fastness tests and glass plates for phenolic yellowing tests. Incubation temperatures for colour fastness and phenolic yellowing tests are 37°C and 50°C respectively. Incubators are designed to hold these relatively low temperatures within the specified tolerances. Two sizes of Incubator are offered - 30 litres and 60 litres. Both models are fan-assisted to promote uniform temperature distributio in the heated chamber.An Incubator is a low-powered oven. If temperatures in excess of 50°C are required for other tests, they can be achieved up the maximum figures, stated in the table below, but the rate of temperature rise is slow. If in doubt, please consult with us.
28	Crockmaster colour fastness to rubbing	Colour fastness to rubbing is the most basic of colour fastness tests, yet Crockmaster is designed with exquisite attention to detail.. Available as a manual or motorised device, Crockmaster is used to determine colour fastness to wet and dry rubbing. Apart from textiles, Crockmaster is used to test the colour fastness to rubbing of carpets, laminates, and printing inks, as well as the microscratch resistance of lacquers, coatings and painted surfaces. - Rubbing Finger - Specimen clamp - Loading weight
29	Wascator standardrized machine (wash fastness)	The Wascator, the latest model being FOM71 CLS, has long since established itself as the standard reference washing machine for textile laboratories. Used to determine shrinkage, dimensional stability and appearance after washing (including wrinkle free assessment), the Wascator meets fully the requirements of European standards (ISO) and of Retailers' Test Methods.
30	Dynawash shrinkage, appearance retention, shade change tester	The Dynwash is used mainly to determine fabric or garment shrinkage and appearance after washing and complies fully with the requirements of European standards and retailers' own test method.

31	Thermaplate colour fastness to dry heat and stability	Thermaplate Colour fastness and stability tester, is used in the laboratory to evaluate colour fastness to dry heat, hot pressing and sublimation, as well as thermal stability. Thermaplate complements our suite of instruments for testing colour fastness to light, washing, dry cleaning, chlorinated water, perspiration and water. The top plate is designed so that its weight (and the subsequent pressure on the specimen) can be easily checked.
32	Sample cutter Model 230/100	The equipment is designed to precisely cut samples of various materials, such as woven, non-woven, knitted fabric, carpet, films or paper. Typical used to determination weight per unit area of fabric , paper etc. - For quick cuts with size of 100 cm^2 - 4 High quality blades for precision cut. - Includes cutting board and 4 spare blades
33	Weighing balance (A&D FG-150K 150 kg)	To measure the weight
34	Electronic balance precision 0.01	To measure the weight
35	Digital pH meter	To determine pH
36	Laboratory Muffle furnace	Many experiments and procedures taken in the lab requiring extreme heat environment. For this purpose, the high temperature muffle furnace steps in as the necessary part of laboratory equipment. vacuum box furnace, crucible furnace, dental furnace, hydrogen furnace, vertical furnace, and etc. The sizes of the muffle furnace various from the smaller furnaces which are conveniently placed on a workbench, to the larger units that has a coveted capacity and competent for all duty.
37	Die punch for sample preparation	The Precision Test Strip Punch & Die Cutters are intended for accurate and rapid preparation of test pieces for use in tensile strength tests, ring crush tests, folding endurance test, water absorbency test and other similar tests without any deformation and damage**.** It is suitable for

		cutting a very wide range of sheet material such as plastics, textiles, paper and paperboard. Multi test samples cutting is simultaneously feasible.
38	Laboratory information management system	A Laboratory Information Management System (LIMS), is a software-based laboratory and information management system that offers a set of key features that support a modern laboratory's operations. Those key features include — but are not limited to — workflow and data tracking support, flexible architecture, and smart data exchange interfaces, which fully "support its use in regulated environments. The features and uses of a LIMS have evolved over the years from simple sample tracking to an enterprise resource planning tool that manages multiple aspects of laboratory informatics.

II. Apparatus with standards covered

S.No.	Apparatus	Standard
1	TruBurst Digital Bursting Strength Tester	ISO 139382 ASTM D3786 TWCTM29 Edana 80.3 (nonwoven) WSP 30.2 (nonwoven) NEXT TM22 M&S P27 adidas 4.09 ISO 2758 (paper)
2	Paper board crush test machine	ISO3035; ISO3073; ISO 7263
3	Print quality scuff proofness tester	ASTM D5264,TAPPI T830, JIS K5701 and GB 7706
4	Ply bond strength tester KJ-1065B	ISO/TS 11405
5	Drop tester	ISO 02248
6	Taber stiffness tester	ISO2493, ASTM D 5342, ATSM D 5650
7	Gurley COBB paper sizing tester 4180BN	ISO 535 & TAPPI T205 (- 100, 25 and 10 sq cm. Cylinders)
8	Air pressure Leakage tester	GB/T 15171, ASTM D3078, GB/T 27728

9	Vibration tester	ASTM D999
10	Folding endurance tester GT-N16	ISO 5626,GB/T 2679.5,QB/T 1049
11	Puncture resistance tester	ISO 3036, GB/T 2679.7
12	Elmatear digital tear tester	ASTM D 1424 DIN 53862 EN ISO 139371 ISO 46742 ISO 9290 M&S P29 NEXT 17 NF G07149
13	Computer controlled carton compression tester	ISO2872, ISO2874, ASTM D642
14	Hanatek IPT inclined plane friction tester	ASTM D4918, TAPPI T815
15	Bendsten smoothness and porosity tester	ISO 8791-2, ISO 5636-1, ISO 5636-3
16	Rain tester	SAE: J575E, JIS: D0203, D5500, CNS: 7138, MIL: 810D, 810E, IEC: 60529
17	Gann Moisture meter H-35	General
18	High performance liquid chromatography (HPLC)	ISO-14184-1:2011, ISO 17226-1:2008, GB/T 24153-2009
19	Scion triple quadrupole mass spectrometer (TQGC)	BS EN 1122:2001, DIN EN 71-3/A1, DIN 54231
20	UV/Vis spectrophotometer	DIN EN ISO 17075:2008-02
21	Velcro tape strength tester	DIN 3415 BS EN ISO 22776
22	Titan Universal Strength Tester 110-230V 50/60Hz	ASTM D5034 ISO 5081 ASTM D5035 M&S P11 EN ISO 13934-1 M&S P11A EN ISO 13934-2 M&S P11B EN ISO 1421 M&S P11C ISO 9073-3 M&S P43 ISO 3376 (IUP 6) Next TM27 ISO 5082 Next TM36 **Peel Bond /Delamination** EN ISO 2411 ASTM D5170 EN ISO 11644 (IUF 470) ASTM D2724 M&S P13 DIN 54310

		M&S P13A **Compression** ASTM D6797 EN 14704-2 ASTM D3787 EN 388 ASTM D4830 ISO 3303 ASTM D5748 ISO 9073-5 ASTM D751 WSP 110.5 EN 12332-1 EN 71-1 Yarn Strength ASTM D1578 ISO 6939 ASTM D2256 M&S P70 BS 1932-2 BS 1932-2 EN ISO 2062 **Tear Strength** ASTM D5587 EN ISO 13937-2 ASTM D2724 EN ISO 13937-3 ASTM D2261 EN ISO 13937-4 ASTM D2212 EN ISO 11644 (IUF 470) ASTM D5735 BS 3424: Part 5 Next TM25 **Attachments** BS 4162 M&S P115 series EN 15598 M&S P122 ASTM D4846 M&S P124 ASTM D7142 Next TM37 ASTM D2061 Next TM42 BS 3084 Next TM45 ASTM F963 Next TM46 EN 71-1 **Seam Strength & Seam Slippage** EN ISO 13935-1 ASTM D5822 EN ISO 13935-2 ASTM D4034 EN ISO 13936-1 M&S P12 EN ISO 13936-2 M&S P12A EN ISO 13933-3 M&S P12B ASTM D434 M&S P12C ASTM D1683 Next TM16 series Stretch & Recovery (Cyclic) EN 14704-1 M&S P14 series BS 4952 M&S P15 series ASTM D4964 Next TM21 series ASTM D6614
23	HP Textile yarn package hardness tester	ASTM D-2240

24	Button impact tester	ASTM D5171
25	Sharp edge tester	ISO 8124-1,ASTM F963, EN-71, 16CFR 1500
26	Garment button pull tester	GB/T 12914-1991
27	Perspirometer and Incubator	ISO 105 E01 – Colour Fastness to Water ISO 105 E02 – Colour Fastness to Sea Water ISO 105 E04 – Colour Fastness to Perspiration BS 1006: UKTB – Colour Fastness to Shampooing of Textile Floor Coverings BS 1006: UKTJ – Colour Fastness to Water of Textile Floor Coverings AATCC 15 – Colour Fastness to Perspiration AATCC 106 – Colour Fastness to Water: Sea AATCC 107 – Colour Fastness to Water ISO 105X18
28	Crockmaster colour fastness to rubbing tester	AATCC 8 AATCC 165 BS 2543 BS 3424: Part 14 ISO 105X12
29	Wascator standardised european washing machine	EN 26330:1993 EN ISO 6330:2000 ISO 6330:1984 EN ISO 6330:2012
30	Dynawash shrinkage, appearance retention, shade change test	M&S C15 Print Durability M&S P5 Durability Wash for Garments and Components M&S P6 Durability Wash for Pleat Retention M&S P7 Durability of Waddings and Quilted Waddings to Washing M&S P69 Cockling NEXT TM 8 Appearance for Garments and Products BHS TM 12A Durability Wash for Prints and Flock BHS TM 12B Durability Wash for Special Effects: Pleats, Crinkle & Seersucker BHS TM 12C Appearance Washes for Fused Collars and Cuffs Arcadia Group CA10a Print Durability for Textiles BS 7907:2007: Code of Practice for the design and manufacture of children's clothing to promote mechanical safety

31	Thermaplate colour fastness to dry heat and stability	AATCC 117 AATCC 133ISO EN ISO 105P01 EN ISO 105X11
32	Sample cutter model 230/100	Sample cutout 100 cm2, thickness 10 mm
33	Weighing balance	General
34	Electronic balance	General
35	Digital pH meter	General
36	Laboratory muffle furnace	General
37	Die punch for sample preparation	General

III. Standards with price and Abstracts

1. Plastics. Determination of cadmium. Wet decomposition method

BS EN 1122:2001

Cross References ISO 3696:1987, ISO 3856-4:1984

Price £86.00

Overview

This European Standard describes a method for the determination of the total Cadmium (Cd) content in plastics in the range of 10 mg Cd/kg to 3 000 mg Cd/kg. It is not suitable for polyfluorinated plastic materials.

Wet decomposition of organic compounds and dissolution of cadmium compounds in a sample involves the atomization of a solution in the flame of an atomic absorption spectrophotometer and the measurement of the absorbance at a wavelength of 228.8 nm.

Requirements for the reagents, apparatus, repeatability and reproducibility are given as part of this test method.

2. Textiles. Determination of pH of aqueous extract

BS EN 1413:1998

Cross reference: ISO 3071:2005

Abstract

ISO 3071:2005 specifies a method for determining the pH of the aqueous extract of textiles. The method is applicable to textiles in any form.

3. **Textiles. Methods for determination of certain aromatic amines derived from azo colorants. Detection of the use of certain azo colorants accessible with and without extracting the fibres**

Replaces BS EN 14362-1:2003, BS EN 14362-2:2003

BS EN 14362-1:2012

Price £84.00

4. **Safety of toys - Part 3: Migration of certain elements; German version EN 71-3:2013/FprA1:2014**

DIN EN 71-3/A1

Price EUR 45.60

5. **Textiles - Detection of disperse dyestuffs (sensitizing and carcinogenic dyes)**

DIN 54231

Price EUR 52.40

6. **Reference test method for release of nickel from all post assemblies which are inserted into pierced parts of the human body and articles intended to come into direct and prolonged contact with the skin; German version EN 1811:2011 + AC:2012**

DIN EN 1811:2012-10

Nickel is found in alloys used for metal accessories on garments such as buttons, zippers and rivets. Some people are allergic to nickel and may experience serious skin irritation when in contact with nickel-containing accessories for an extended period. The release of NIckel is restricted under the EU REACH Regulation (EC) No 1907/2006, Annex XVII.

7. **Water quality - Determination of selected organotin compounds - Gas chromatographic method (ISO 17353:2004); German version EN ISO 17353:2005**

DIN EN ISO 17353:2005-11

Price EUR 98.60

Legal background: Legal Limit: 0.1% by weight Dioctyltin (DOT), dibutyltin (DBT) compounds and trisubstituted organostannic compounds such as tributyltin (TBT) are listed in annex XVII of the
Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH).

Tributyltin oxide (TBTO), 56-35-9, is listed on the Candidate List of Substances of Very High Concern for authorization of the Regulation (EC) No 1907/2006 of the European Parliament and of the Council (REACH)

Characteristics: Tributyltin, dibutyltin and dioctyltin compounds are different chemical substances that are toxic and dangerous for the environment. Bioaccumulative and persistent.

Use: Dibutyltin compounds (DBT) and dioctyltin compounds (DOT) are used in consumer products as stabilizers or catalysts.

Comments: The alternative to antibacterial agents during use is satisfactory washing.

8. **Leather - Chemical tests - Determination of chromium (VI) content**

DIN EN ISO 17075:2008-02

Price EUR 81.70

9. **Testing of leather - Determination of the content of Pentachlorphenol**

DIN EN ISO 17070

Price $88.00 USD

10. **Binders for paints and varnishes - Determination of monomeric diisocyanates in isocyanate resins**

DIN EN ISO 10283:2007-11

Price 81.70 EUR

11. **Soil quality -- Determination of polycyclic aromatic hydrocarbons (PAH) – Gas chromatographic method with mass spectrometric detection (GC-MS)**

ISO 18287:2006

Price CHF 88

12. **Textiles -- Determination of formaldehyde -- Part 1: Free and hydrolysed formaldehyde (water extraction method)**

ISO 14184-1:2011

Price CHF 58

13. **Textiles -- Determination of formaldehyde -- Part 2: Released formaldehyde (vapour absorption method)**

ISO 14184-2:2011

Price CHF 58

Some background on Formaldehyde

The Australian National Industrial Chemicals Notification and Assessment Scheme1
Has identified that the critical health effects of formaldehyde exposure from any sources are:

- sensory irritation via inhalation exposure to formaldehyde gas (vapour), aerosol or mist;
- skin sensitization following dermal exposure to formaldehyde solutions; and
- Carcinogenicity via inhalation exposure to formaldehyde gas (vapour) or mist.

Formaldehyde is classified as a hazardous substance under the Hazardous Substances and New Organisms Act having a number of hazardous properties, including skin and eye irritation, skin sensitization and carcinogenicity.

Formaldehyde resin products used in the textile industry include printing inks, dyes and textile finishing products. The concentrations of free formaldehyde in these products are generally less than 2%2. These formaldehyde-based materials help bind dyes and pigments to fabrics, prevent colors from running, improve a fabric's resistance to wrinkles, ease clothing care and maintenance and prevent mildew3.

Proposed Acceptable Limits of Formaldehyde in Clothing and Other Textiles

Formaldehyde limits considered acceptable in clothing and textiles are proposed as follows -

- For clothes for babies and infants under 2 years of age: no greater than 30ppm (30mg/kg);
- For clothing specifically designed and marketed as for people (both children and adults) with sensitive skin or to avoid any sensitive reaction with skin: no greater than 30ppm (30mg/kg);
- For clothing and textiles in direct contact with skin: no greater than 100ppm (100mg/kg), or no greater than 100ppm (100mg/kg) after wash if there is a label or instruction recommending to "wash before first use";

For clothing and textiles not in direct contact with skin: no greater than 300ppm (300mg/kg). A product is deemed to be in direct contact with skin if a large proportion of its surface comes into direct skin contact when used as intended (e.g. shirts, underwear, and bed linen). A product where no part or a small proportion of its surface comes into direct skin contact is deemed to be not in direct contact (e.g. jackets, curtains, rugs).

International formaldehyde limits in clothing and other textiles (parts per million (ppm))

Austria	Textiles that contain 1500ppm or above must be labelled
Finland and Norway	Textiles for babies under 2 years: 30ppm Textiles in direct skin contact :100ppm Textiles not in direct skin contact: 300ppm
France	For products intended to come in contact with human skin – Textiles for babies: 20ppm Textiles in direct skin contact :100ppm Textiles not in direct skin contact: 400ppm
Germany	Textiles that normally come into contact with the skin and release more than 1500ppm formaldehyde must bear the label "Contains formaldehyde> Washing this garment is recommended prior to first time use in order to avoid irritation of the skin."
Japan	Textiles for infants: not detectable (20ppm) Textiles in direct skin contact :75ppm
Netherlands	Textiles in direct skin contact must be labelled "Wash before first use" if they contain more than 120ppm formaldehyde and the product must not contain more than 120ppm after wash.
China	Textiles for infants and babies ≤ 20ppm Textiles in direct skin contact ≤ 75ppm

	Textiles not in direct skin contact ≤ 300ppm

14. Leather -- Chemical determination of formaldehyde content -- Part 1: Method using high performance liquid chromatography

ISO 17226-1:2008

Price CHF 38

Abstract

ISO 17226-1:2008 specifies a method for the determination of free and released formaldehyde in leathers. This method is based on high performance liquid chromatography (HPLC). It is selective and not sensitive to coloured extracts.

The formaldehyde content is taken to be the quantity of free-formaldehyde and formaldehyde extracted through hydrolysis contained in a water extract from the leather under standard conditions.

15. Determination of the colourfastness of articles for common use - Part 1: Test with artificial saliva

DIN 53160-1

Price 48.80 EUR

Overview

This standard specifies a method of testing the resistance of articles of daily use to artificial saliva. The method is particularly suitable for those articles of daily use that are intended to be taken into the mouth, or for which it can be foreseen that they will, when used, be taken into the mouth or come into contact with the mucous membranes. With this test it is established whether colouring materials can migrate from the articles of daily use to the mouth or to the mucous membranes. This standard does not apply to articles that are intended to come into contact with foodstuffs or to those parts of articles of daily use whose function is the release of colouring materials, or for articles of daily use for which this is the case in their entirety. Examples of the latter are wax crayons and leads of pencil crayons. The test method is applicable to all articles of daily use, independent of the colouring procedure applied (for instance, dyeing, staining, and coating). Possible mechanical wear, for example, exposure of a coloured layer after mechanical abrasion of a finishing coat is not taken into account. The following changes have been made with respect to DIN V 53160-1:2002-10: a) the scope has been modified; b) clause "Terms and definitions" has been added; c) clingfilm has been added to clause "Apparatus and materials"; d) the contents have been editorially revised and adapted to the currently valid design rules. This document has been prepared by NPF/NAB Joint Working Group NA 078-00-14-01 GAK "Speichel- und Schweißechtheit" ("Saliva and sweat resistance") of NPF/NAB Working

Committee NA 078-00-14 GA "Analysenverfahren für Farbmittel" ("Methods of analysis for colouring materials").

16. Textiles -- Tests for color fastness -- Part C06: Color fastness to domestic and commercial laundering

ISO 105-C06:2010

Price CHF 58

Abstract

ISO 105-C06:2010 specifies methods intended for determining the resistance of the colour of textiles of all kinds and in all forms to domestic or commercial laundering procedures used for normal household articles using a reference detergent. Industrial and hospital articles may be subjected to special laundering procedures which may be more severe in some aspects.

The color loss and staining resulting from desorption and/or abrasive action in one single (S) test closely approximates to one commercial or domestic laundering. The results of one multiple (M) test may in some cases be approximated by the results of up to five domestic or commercial launderings at temperatures not exceeding 70 °C. The M tests are more severe than the S tests because of an increase in mechanical action.

These methods do not reflect the effect of optical brighteners present in commercial washing products.

These methods are designed for the detergents and bleach systems given. Other detergents and bleach systems may require different conditions and levels of ingredients.

17. Textiles -- Tests for colour fastness -- Part E01: Colour fastness to water

ISO 105-E01:2013

Price CHF 38

Abstract

ISO 105-E01:2013 specifies a method for determining the resistance of the colour of textiles of all kinds and in all forms to immersion in water.

18. Textiles -- Tests for colour fastness -- Part X12: Colour fastness to rubbing

ISO 105-X12:2001

Price 38 CHF

19. Textiles -- Tests for colour fastness -- Part E04: Colour fastness to perspiration

ISO 105-E04:2013

Price CHF 38

Abstract

ISO 105-E04:2008 specifies a method for determining the resistance of the colour of textiles of all kinds and in all forms to the action of human perspiration.

20. Textiles -- Tests for colour fastness -- Part E02: Colour fastness to sea water

ISO 105-E02:2013

Price CHF 38

Abstract

ISO 105-E02:2013 specifies a method for determining the resistance of the colour of textiles of all kinds and in all forms to immersion in sea water.

21. Textiles -- Tests for colour fastness -- Part D01: Colour fastness to drycleaning using perchloroethylene solvent

ISO 105-D01:2010

Price CHF 38

Abstract

ISO 105-D01:2010 specifies a method for determining the resistance of the colour of textiles of all kinds and in all forms to drycleaning using perchloroethylene solvent.

This method is neither suitable for the evaluation of the durability of textile finishes, nor is it intended for use in evaluating the resistance of colours to spot and stain removal procedures used by the drycleaner.

This test covers colour fastness to drycleaning only; commercial drycleaning practice normally involves other operations, such as water spotting, solvent spotting and steam pressing, etc., for which other standard test methods are available if the full response to drycleaning of a textile is to be assessed.

The presence of absorbed water in drycleaning solvent, or the presence of a detergent and water in a drycleaning solvent, are known to alter the colour fastness properties of some materials. This test requires the assessment of the material under test in a dry state, using solvent alone, within containers that do not contain water.

Fastness to drycleaning, without further qualification in ISO 105-D01:2010, means fastness to drycleaning in perchloroethylene. However, if required, other solvents that are used for textile cleaning can be used.

22. Textiles -- Tests for colour fastness -- Part B02: Colour fastness to artificial light: Xenon arc fading lamp test

ISO 105-B02:2014

Price CHF 158

Abstract

ISO 105-B02:2014 specifies a method intended for determining the effect on the colour of textiles of all kinds and in all forms to the action of an artificial light source representative of natural daylight (D65). The method is also applicable to white (bleached or optically brightened) textiles.

This method allows the use of two different sets of blue wool references. The results from the two different sets of references may not be identical.

23. Textiles -- Domestic washing and drying procedures for textile testing

ISO 6330:2012

Price CHF 138

24. Textiles -- Tests for color fastness -- Part E03: Color fastness to chlorinated water (swimming-pool water)

ISO 105-E03:2010

Price CHF 38

Abstract

ISO 105-E03:2010 specifies a method for determining the resistance of the colour of textiles of all kinds and in all forms to the action of active chlorine in concentrations such as are used to disinfect swimming-pool water (break-point chlorination).

Three alternative test conditions are specified. The active chlorine concentrations of 50 mg/l and 100 mg/l are intended for swimwear. The active chlorine concentration of 20 mg/l is intended for accessories such as beach robes and towels.

25. Textiles -- Tests for color fastness -- Part X18: Assessment of the potential to phenolic yellowing of materials

ISO 105-X18:2007

Price CHF 38

Abstract

ISO 105-X18:2007 specifies a method intended for assessment of the potential to phenolic yellowing of textile materials.

The method is specific to phenolic yellowing and does not cover the many other possible causes of yellow discoloration found on textile materials.

26. Quantity of nitrosamine in rubber components

GB/T 24153-2009

Price 120 USD

27. Determination of Alkylphenol ethoxylates (APEO)

ISO/DIS 18254

Price CHF 58

28. Determination of Aromatic organic solvents

ISO 13859:2014

CHF 158

Abstract

ISO 13859:2014 specifies the quantitative determination of 16 PAH in sludge, soil, and treated bio waste using GC-MS and HPLC-UV-DAD/FLD covering a wide range of PAH contamination levels. When using fluorescence detection, acenaphthylene cannot be measured.

The limit of detection depends on the determinants, the equipment used, the quality of chemicals used for the extraction of the sample, and the clean-up of the extract. Typically, a lower limit of application of 0, 01 mg/kg (expressed as dry matter) can be ensured for each individual PAH.

Sludge, soil, and treated bio waste can differ in properties and also in the expected contamination levels of PAH and presence of interfering substances. These differences make it impossible to describe one general procedure. ISO 13859:2014 contains decision tables based on the properties of the sample and the extraction and clean-up procedure to be used. Two general lines are followed, an agitation procedure (shaking) or use of Soxhlet/pressurized liquid extraction.

29. Determination of Chlorinated organic solvents

DIN 54232:2010-08

Price EUR 45.60

Overview:

This standard specifies a method of analysis for the determination of the chlorotoluene and chlorobenzene content in textile products and components, such as upper fabric, interlinings, laid-in fabrics, slide fasteners, buttons, labels, yarns and appliqués. The method applies to a mass fraction of 0,1 mg/kg to 10 mg/kg per single isomer. Higher and lower mass fractions can be determined if the weighed portion of the sample is selected accordingly or corresponding dilutions have been prepared during the procedure. The sample which has been cut into small pieces is extracted in an ultrasonic bath, with dichloromethane in a closed container. The extract is liberated with membrane filters from disturbing particles and fibres and analysed without additional clean-up with a gas chromatograph coupled to a mass-selective detector in selected ion mode. The Committee responsible for this standard is NA 062-05-12 AA "Textilchemische Prüfverfahren und Fasertrennung" ("Testing methods for separation and chemistry of textile fibres") at DIN.

30. Determination of NMP N-methyl 2-pyrrolidone

ISO/DIS 19070

CHF 58

31. Phthalate Esters by Gas Chromatography with Electron Capture Detection (GC/ECD)

EPA 8061A

32. Polychlorinated Biphenyls (PCBs) by Gas Chromatography

EPA 8082

33. Determination of Total Lead Content

EPA 3050B

34. 16 CFR Part 1501 - METHOD FOR IDENTIFYING TOYS AND OTHER ARTICLES INTENDED FOR USE BY CHILDREN UNDER 3 YEARS OF AGE WHICH PRESENT CHOKING, ASPIRATION, OR INGESTION HAZARDS BECAUSE OF SMALL PARTS

§ 1501.1 Purpose.

Section 1500.18(a)(9) of this chapter classifies as a banned hazardous substance any toy or other article intended for use by children under 3 years of age that presents a choking, aspiration, or ingestion hazard because of small parts. This part 1501 describes certain articles that are subject to § 1500.18(a)(9); lists certain articles that are specifically exempted; and provides a test method for determining whether an article is hazardous to children under 3 because it, or one of its components that can be detached or broken off during normal or reasonable foreseeable use, is too small.

§ 1501.2 Scope.

(a) This regulation (§ 1500.18(a)(9) and the criteria described in § 1501.4 below) applies to all toys and other articles intended for use by children under 3 years (36 months) of age that are introduced into interstate commerce after the effective date. Such articles include, but are not to limited to: squeeze toys; teethers; crib exercisers; crib gyms; crib mobiles; other toys or articles intended to be affixed to a crib, stroller, playpen, or baby carriage; pull and push toys; pounding toys; blocks and stacking sets; bathtub, wading pool and sand toys; rocking, spring, and stick horses and other figures; chime and musical balls and carousels; jacks-in-the-box; stuffed, plush, and flocked animals and other figures; preschool toys, games and puzzles intended for use by children under 3; riding toys intended for use by children under 3; infant and juvenile furniture articles which are intended for use by children under 3 such as cribs, playpens, baby bouncers and walkers, strollers and carriages; dolls which are intended for use by children under 3 such as baby dolls, rag dolls, and bean bag dolls; toy cars, trucks, and other vehicles intended for use by children under 3. In addition, such articles include any other toys or articles which are intended, marketed or labeled to be entrusted to or used by children under 3 years of age.

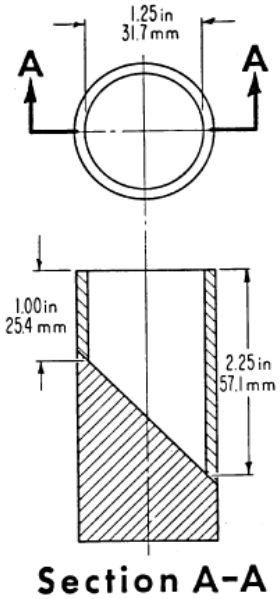


FIG I-SMALL PARTS CYLINDER

(b) In determining which toys and other articles are intended for use by children under 3 years (36 months) of age, for purposes of this regulation, the following factors are relevant: the manufacturer's stated intent (such as on a label) if it is a reasonable one; the advertising, promotion, and marketing of the article; and whether the article is commonly recognized as being intended for children under 3.
(c) This regulation does not apply to toys or articles which are solely intended for use by children 3 years of age or older. In addition, it does not apply to all articles to which children under 3 years of age might have access simply because of presence in a household. Certain articles which are specifically exempted from this regulation are listed in § 1501.3 below.

§ 1501.3 Exemptions.

The following articles are exempt from this regulation (§§ 1500.18(a)(9) and 1501.4 below):
(a) Balloons;
(b) Books and other articles made of paper;
(c) Writing materials such as crayons, chalk, pencils, and pens;
(d) Children's clothing and accessories, such as shoe lace holders and buttons;
(e) Grooming, feeding, and hygiene products, such as diaper pins and clips, barrettes, toothbrushes, drinking glasses, dishes and eating utensils;
(f) Phonograph records;
(g) Modeling clay and similar products;
(h) Fingerpaints, watercolors, and other paint sets;
(i) Rattles (as defined at 16 CFR 1510.2); and
(j) Pacifiers (as defined at 16 CFR 1511.2(a)).

§ 1501.4 Size requirements and test procedure.

(a) No toy or other children's article subject to § 1500.18(a)(9) and to this part 1501 shall be small enough to fit entirely within a cylinder with the dimensions shown in Figure 1, when tested in accordance with the procedure in paragraph (b) of this section. In testing to ensure compliance with this regulation, the dimensions of the Commission's test cylinder will be no greater than those shown in Figure 1. (In addition, for compliance purposes, the English dimensions shall be used. The metric approximations are included only for convenience.)
(b)
(1) Place the article, without compressing it, into the cylinder. If the article fits entirely within the cylinder, in any orientation, it fails to comply with the test procedure. (Test any detached components of the article the same way.)
(2) If the article does not fit entirely within the cylinder, subject it to the appropriate “use and abuse” tests of 16 CFR 1500.51 and 1500.52 (excluding the bite tests of §§ 1500.51(c) and 1500.52(c)). Any components or pieces (excluding paper, fabric, yarn, fuzz, elastic, and string) which have become detached from the article as a result of the use and abuse testing shall be placed into the cylinder, one at a time. If any such components or pieces fit entirely within the cylinder, in any orientation and without being compressed, the article fails to comply with the test procedure.

§ 1501.5 Enforcement procedure.

The Commission will enforce this regulation, unless it determines that an emergency situation exists, only in accordance with Chapter 2, Guide 2.05—Letter of Advice/Notices of Noncompliance of the CPSC Enforcement Policy and Procedural Guides, issued in January 1990 and available from the Office of the Secretary, Consumer Product Safety Commission, Washington, DC 20207. Under the procedure described in this chapter, firms must be informed by letter that they or their products may be the subject of enforcement action and must be provided ten days within which to submit evidence and arguments that the products are not violative or are not covered by the regulation, prior to the initiation of enforcement action by the Commission or by its delegated staff member. The function of approving such enforcement actions is currently delegated by the Commission to the Assistant Executive Director for Compliance and Enforcement (copies of the existing delegation documents are also available from the CPSC's Office of the Secretary).
[56 FR 46986, Sept. 17, 1991]

35. BAN OF LEAD-CONTAINING PAINT AND CERTAIN CONSUMER PRODUCTS BEARING LEAD-CONTAINING PAINT

16 CFR Part 1303

§ 1303.1 Scope and application

(a) In this part 1303, the Consumer Product Safety Commission declares that paint and similar surface-coating materials for consumer use that contain lead or lead compounds and in which the lead content (calculated as lead metal) is in excess of 0.06 percent (0.06 percent is reduced to 0.009 percent effective August 14, 2009 as mandated by Congress in section 101(f) of the Consumer Product Safety Improvement Act of 2008, Pub. L. 110-314) of the weight of the total nonvolatile content of the paint or the weight of the dried paint film (which paint and similar surface-coating materials are referred to hereafter as “lead-containing paint”) are banned hazardous products under sections 8 and 9 of the Consumer Product Safety Act (CPSA), 15 U.S.C. 2057, 2058. The following consumer products are also declared to be banned hazardous products:
(1) Toys and other articles intended for use by children that bear “lead-containing paint”.
(2) Furniture articles for consumer use that bear “lead-containing paint”.
(b) This ban applies to the products in the categories described in paragraph (a) of this section that are manufactured after February 27, 1978, and which are “consumer products” as that term is defined in section 3(a)(1) of the Consumer Product Safety Act. Accordingly, those of the products described above that are customarily produced or distributed for sale to or for use, consumption, or enjoyment of consumers in or around a household, in schools, in recreation, or otherwise are covered by the regulation. Paints and coatings for motor vehicles and boats are not included within the scope of the ban because they are outside the statutory definition of “consumer product”. In addition to those products which are sold directly to consumers, the ban applies to products which are used or enjoyed by consumers after sale, such as paints used in residences, schools, hospitals, parks, playgrounds, and public buildings or other areas where consumers will have direct access to the painted surface.

(c) The Commission has issued the ban because it has found that there is an unreasonable risk of lead poisoning in children associated with lead content of over 0.06 percent in paints and coatings to which children have access and that no feasible consumer product safety standard under the CPSA would adequately protect the public from this risk. The 0.06 percent is reduced to 0.009 percent effective August 14, 2009 as mandated by Congress in section 101(f) of the Consumer Product Safety Improvement Act of 2008, Public Law 110-314.
(d) Any ban or rule promulgated under 16 CFR 1303.1 shall be considered a regulation of the Commission promulgated under or for the enforcement of section 2(q) of the Federal Hazardous Substances Act (15 U.S.C. 1261(q)).

§ 1303.2 Definitions.

(a) The definitions in section 3 of the Consumer Product Safety Act (15 U.S.C. 2052) shall apply to this part 1303.
(b) For purposes of this part:
(1) *Paint and other similar surface-coating materials* means a fluid, semi-fluid, or other material, with or without a suspension of finely divided coloring matter, which changes to a solid film when a thin layer is applied to a metal, wood, stone, paper, leather, cloth, plastic, or other surface. This term does not include printing inks or those materials which actually become a part of the substrate, such as the pigment in a plastic article, or those materials which are actually bonded to the substrate, such as by electroplating or ceramic glazing.
(2) *Lead-containing paint* means paint or other similar surface coating materials containing lead or lead compounds and in which the lead content (calculated as lead metal) is in excess of 0.06 percent (0.06 percent is reduced to 0.009 percent effective August 14, 2009) by weight of the total nonvolatile content of the paint or the weight of the dried paint film.
(3) *Toys and other articles intended for use by children* means those toys and other articles which are intended to be entrusted to or for use by children. This would not include all articles to which children might have access simply because they are present in a household.
(4) *Furniture article* means those movable articles: (i) Used to support people or things; (ii) other functional or decorative furniture articles, including, but not limited to, products such as beds, bookcases, chairs, chests, tables, dressers, desks, pianos, console televisions, and sofas. The term "furniture article" does not include appliances, such as ranges, refrigerators, dishwashers, clothes washers and dryers, air conditioners, humidifiers, and dehumidifiers; fixtures such as bathroom fixtures, built-in cabinets, chandeliers, windows, and doors; or household items such as window shades, venetian blinds, or wall hangings and draperies.

§ 1303.3 Exemptions.

(a) The categories of products listed in paragraph (b) of this section are exempted from the scope of the ban established by this part 1303, provided:
(1) That these products bear on the main panel of their label, in addition to any labeling that may be otherwise required, the signal word "Warning" (unless some other signal word is required) and the following statement: "Contains Lead. Dried Film of This Paint May Be Harmful If Eaten or Chewed."
(2)

(i) That these products also bear on their label the following additional statement or its practical equivalent:
Do not apply on toys and other children's articles, furniture, or interior surfaces of any dwelling or facility which may be occupied or used by children.
Do not apply on exterior surfaces of dwelling units, such as window sills, porches, stairs, or railings, to which children may be commonly exposed.
Keep out of reach of children.
(ii) If the statement required by the preceding paragraph (a)(2)(i) is placed on a label panel other than the main panel, the label statement required to be on the main panel by paragraph (a)(1) of this section shall contain the following additional statement: "See other cautions on _ (insert 'side' or 'back', as appropriate) panel."
(3) That the placement, conspicuousness, and contrast of the label statements required by this section (a) comply with the requirements of the Federal Hazardous Substances Act at 16 CFR 1500.121.
(b) The following products are exempt from the scope of the ban established by this part 1303, provided they comply with the requirements of paragraph (a) of this section:
(1) Agricultural and industrial equipment refinish coatings.
(2) Industrial (and commercial) building and equipment maintenance coatings, including traffic and safety marking coatings.
(3) Graphic art coatings (i.e., products marketed solely for application on billboards, road signs, and similar uses and for identification marking in industrial buildings).
(4) Touchup coatings for agricultural equipment, lawn and garden equipment, and appliances.
(5) Catalyzed coatings marketed solely for use on radio-controlled model powered aircraft.
(c) The following products are exempt from the scope of the ban established by part 1303 (no cautionary labeling is required):
(1) Mirrors which are part of furniture articles to the extent that they bear lead-containing backing paint.
(2) Artists' paints and related materials.
(3) Metal furniture articles (but not metal children's furniture) bearing factory-applied (lead) coatings.

§ 1303.4 Banned hazardous products.

The following consumer products, manufactured after February 27, 1978, unless exempted by § 1303.3, are banned hazardous products (see definitions in § 1303.2):
(a) Paint and other similar surface-coating materials which are "lead-containing paint."
(b) Toys and other articles intended for use by children that bear "lead-containing paint."
(c) Furniture articles that bear "lead-containing paint."

§ 1303.5 Findings.

(a) *The degree and nature of the risk of injury.*
(1) The Commission finds that the risk of injury which this regulation is designed to eliminate or reduce is lead poisoning in children. The adverse effects of this poisoning in children can cause a range of disorders such as hyperactivity, slowed learning ability, withdrawal, blindness, and even

death. The final Environmental Impact Statement on Lead in Paint which is on file with the President's Council on Environmental Quality (and available for inspection in the Office of the Secretary) contains in appendix A a detailed discussion of the health effects of lead in paint. These effects will only be summarized here.

(2) Lead is a cumulative toxic heavy metal which, in humans, exerts its effects on the renal, hematopoietic, and nervous systems. Newer concepts indicate that there are three stages to childhood lead poisoning. The adverse health effects in the first stage are not clinically present but metabolic changes can be observed. During the second stage or symptomatic stage such symptoms as loss of appetite, vomiting, apathy, drowsiness, and inability to coordinate voluntary muscle movements occur. The after effects of this stage include seizure disorders as well as various behavioral and functional disorders which are often included under the heading of minimal brain dysfunction. Studies suggest that this syndrome may include hyperactivity, impulsive behavior, prolonged reaction time, perceptual disorders and slowed learning ability. The adverse health effects of the third stage may be permanent and can include blindness, mental retardation, behavior disorders, and death.

(3) The Commission notes that children with pica are of special concern with regard to lead poisoning. Pica, the repetitive ingestion of nonfood substances, occurs in 50 percent of children between the ages of one and three, and studies indicate that at this age lead is absorbed more rapidly than lead is absorbed in adults. Pica for paint is believed to be episodic and can occur 2 to 3 times a week.

(4) The Commission also notes that there are no reports of injuries caused by lead paint poisoning in the Commission's National Electronic Injury Surveillance System (NEISS) data, which reflect hospital emergency room treatment. Lead paint poisonings result from a chronic hazard rather than from an acute hazard of the type generally treated in emergency rooms; and NEISS reporting, therefore, does not reflect this type of chronic hazard or injuries.

(5) Former U.S. Surgeon-General Jesse L. Steinfeld, however, estimated in 1971 that 400,000 pre-school American children have elevated body lead burdens. The National Bureau of Standards in 1972 estimated that 600,000 young children have unduly high lead blood content.

(b) *Products subject to this ban.*

(1) The products banned by this rule are listed in § 1303.4.

(2) The term *paint* comprises a variety of coating materials such as interior and exterior household paints, varnishes, lacquers, stains, enamels, primers, and similar coatings formulated for use on various surfaces. Based on 1976 data, the Commission estimates that over 400 million gallons of paint a year valued at approximately $2.5 billion could potentially be subject to this rule.

(3) All products commonly known as toys and other articles intended for the use of children are subject to this rule. The categories of products within this classification are numerous and include items and equipment for play, amusement, education, physical fitness, and care of children. Retail sales in 1976 of products considered to be toys or other articles intended for use of children are estimated at around $4 billion.

(4) For the purposes of this rule, furniture articles are certain movable articles used to support people or things or other functional or decorative furniture articles such as couches, beds, tables, chairs, chests, and the like. Appliances and similar equipment, household fixtures, and certain other household items such as window shades, blinds, wall hangings, and the like are not included within the definition of furniture. The regulation applies to furniture for use in

households, schools, in recreation, or otherwise. In 1972, the value of shipments of items of furniture such as those named above was as follows: wood household furniture $2,716 million; metal household furniture $859 million; wood television and radio cabinets $293 million; and $190 million for other household furniture made of plastic, reed and rattan. (Not included in the above are some $2 billion worth of upholstered furniture and $300 million in convertible sofas, chair beds and studio couches.)

(c) *Need of the public for the products and effects of the rule on their utility, cost, and availability.*

(1) The public need for paints of various types and for furniture and other articles is substantial and well established. The Commission finds that the need of the public for paint containing more than 0.06 percent lead or for the affected products that are coated with materials containing more than 0.06 percent lead is limited. The Commission has determined that there are products containing more than the 0.06 percent level of lead which meet a public need and for which substitutes are either not available or are not sufficiently effective and to which access by children to the coatings or the surfaces to which they are applied is unlikely. Accordingly, these products have been specifically exempted from the scope of the regulation in § 1303.3.

(2) The Commission finds that the effects of this rule on the cost, utility, and availability of paints and painted articles will be small. The Commission notes that over 95 percent of latex-based and nearly 70 percent of oil-based paints have lead levels at or below the level set by part 1303.

(i) *Costs.* The Commission estimates that the added costs to the consumer for paints affected by this rule will not exceed 5 to 10 cents per gallon. Costs to consumers for furniture and for toys and other articles intended for the use of children are not expected to increase as the result of compliance with the regulation.

(ii) *Utility.* The Commission finds that for water-based or latex paints and coatings subject to this rule, reducing the amount of allowable lead to 0.06 percent will not have adverse effects on their utility. For certain solvent-thinned coatings, however, lead driers will have to be replaced by non-lead driers such as zirconium to comply with the 0.06 percent level (Driers are not used in latex paints). An impact on the paint industry may result because current non-lead driers may not dry satisfactorily in low temperatures or high humidity conditions, and so the painting industry in some areas at certain times of the year may suffer a reduction of effective painting time.

(iii) *Availability.* Substitutes at comparable prices are available for paints and for products banned by this rule. The Commission believes that the reduction of lead to a level of 0.06 percent will not affect the availability of water-based or latex paints. Sales of such coatings currently exceed sales of solvent-based coatings, and because of the drying problem mentioned above, the trend toward increased use of water-based paints may be accelerated somewhat by the effects of the ban.

(d) *Alternatives.*

(1) The Commission has considered other means of achieving the objective of this rule, but has found none that would cause less disruption or dislocation of manufacturing and other commercial practices, consistent with public health and safety.

(2) The Commission estimates that this ban may, because of testing costs and the necessity for improved housekeeping practices in the manufacture of paint and similar surface-coating materials to prevent lead contamination, have some relatively minor adverse effect on individual firms within some markets.

(3) The Commission, however, finds that competition will not be adversely affected by this rule. Although costs of reformulation and testing may be relatively higher for small manufacturers than large manufacturers, these costs are not so onerous as to lead to greater concentration in the industry. The period of time before the effective date is sufficient to minimize problems of compliance with the rule.

(4) The reduction of the permissible level of lead in paint will affect paint manufacturers, raw materials suppliers, professional and non-professional painters, and manufacturers of furniture and children's articles. For those producers of paint which are already subject to the regulations under the Federal Hazardous Substances Act (FHSA), the impact of this CPSA ban will involve only a change to non-lead driers since lead pigments are precluded from practical use under the 0.5 percent lead restriction now in effect under the FHSA (16 CFR 1500.17(a)(6)). The manufacturers of some painted furniture who were not affected by the 0.5 percent limit under the FHSA may now be, if they use lead pigments or driers. Producers of children's articles who were subject to the 0.5 percent FHSA limit will have to ensure that the paint they use conforms to the 0.06 percent level.

(e) *Conclusion.* The Commission finds that this rule, including its effective date, is reasonably necessary to eliminate or reduce the unreasonable risk of lead poisoning of young children that is associated with the banned products which are described in §1303.4 and that promulgation of the rule is in the public interest.

16 CFR Part 1501 - METHOD FOR IDENTIFYING TOYS AND OTHER ARTICLES INTENDED FOR USE BY CHILDREN UNDER 3 YEARS OF AGE WHICH PRESENT CHOKING, ASPIRATION, OR INGESTION HAZARDS BECAUSE OF SMALL PARTS

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children under 3; riding toys intended for use by children under 3; infant and juvenile furniture articles which are intended for use by children under 3 such as cribs, playpens, baby bouncers and walkers, strollers and carriages; dolls which are intended for use by children under 3 such as baby dolls, rag dolls, and bean bag dolls; toy cars, trucks, and other vehicles intended for use by children under 3. In addition, such articles include any other toys or articles which are intended, marketed or labeled to be entrusted to or used by children under 3 years of age.
(b) In determining which toys and other articles are intended for use by children under 3 years (36 months) of age, for purposes of this regulation, the following factors are relevant: the manufacturer's stated intent (such as on a label) if it is a reasonable one; the advertising, promotion, and marketing of the article; and whether the article is commonly recognized as being intended for children under 3.
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(a) No toy or other children's article subject to § 1500.18(a)(9) and to this part 1501 shall be small enough to fit entirely within a cylinder with the dimensions shown in Figure 1, when tested in accordance with the procedure in paragraph (b) of this section. In testing to ensure compliance with this regulation, the dimensions of the Commission's test cylinder will be no greater than those shown in Figure 1. (In addition, for compliance purposes, the English dimensions shall be used. The metric approximations are included only for convenience.)
(b)

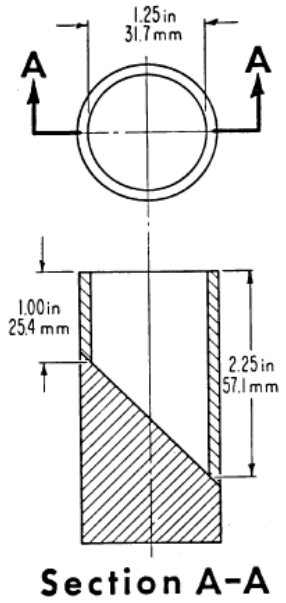

FIG I-SMALL PARTS CYLINDER

(1) Place the article, without compressing it, into the cylinder. If the article fits entirely within the cylinder, in any orientation, it fails to comply with the test procedure. (Test any detached components of the article the same way.)
(2) If the article does not fit entirely within the cylinder, subject it to the appropriate "use and abuse" tests of 16 CFR 1500.51 and 1500.52 (excluding the bite tests of §§ 1500.51(c) and 1500.52(c)). Any components or pieces (excluding paper, fabric, yarn, fuzz, elastic, and string) which have become detached from the article as a result of the use and abuse testing shall be placed into the cylinder, one at a time. If any such components or pieces fit entirely within the cylinder, in any orientation and without being compressed, the article fails to comply with the test procedure.

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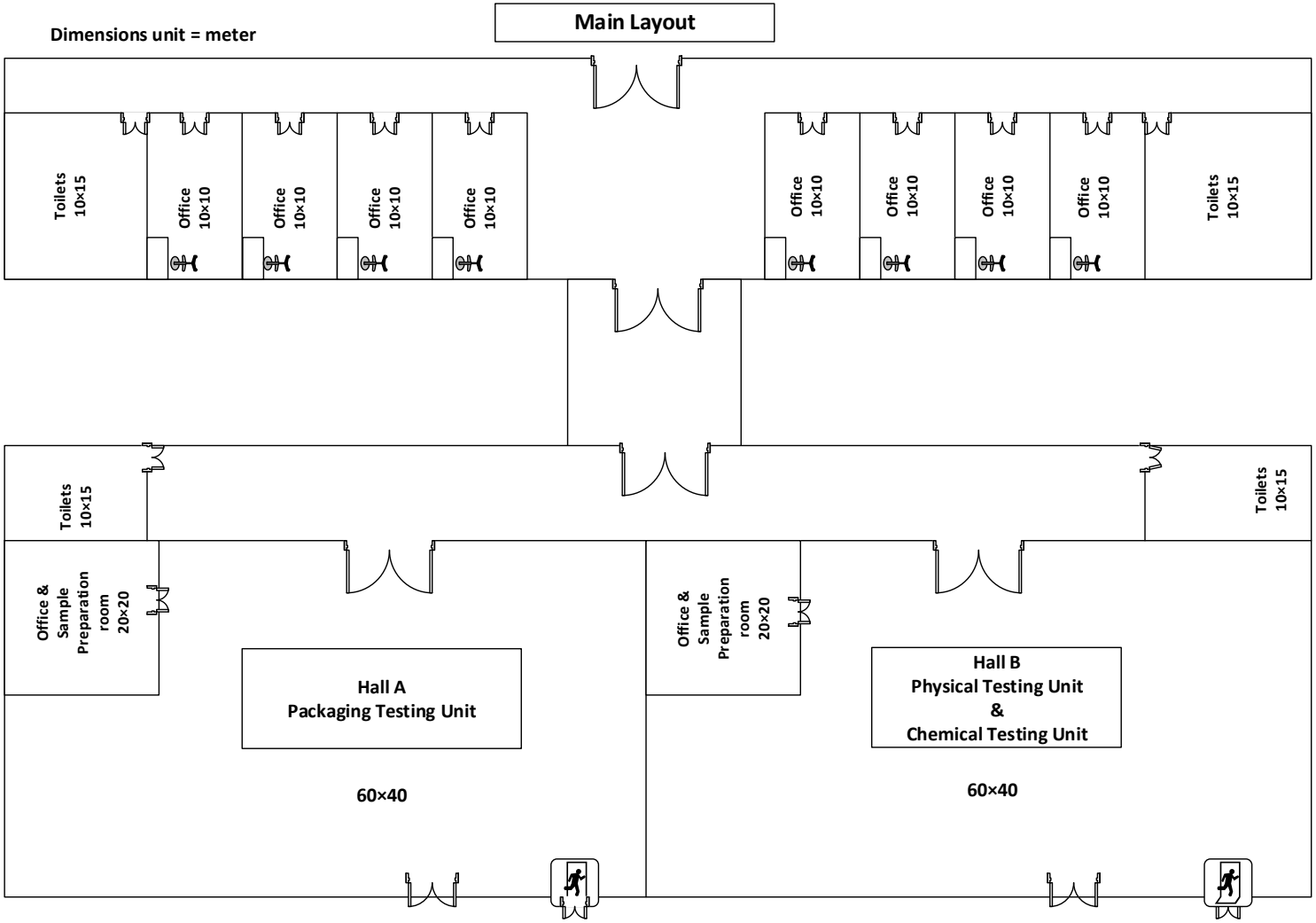
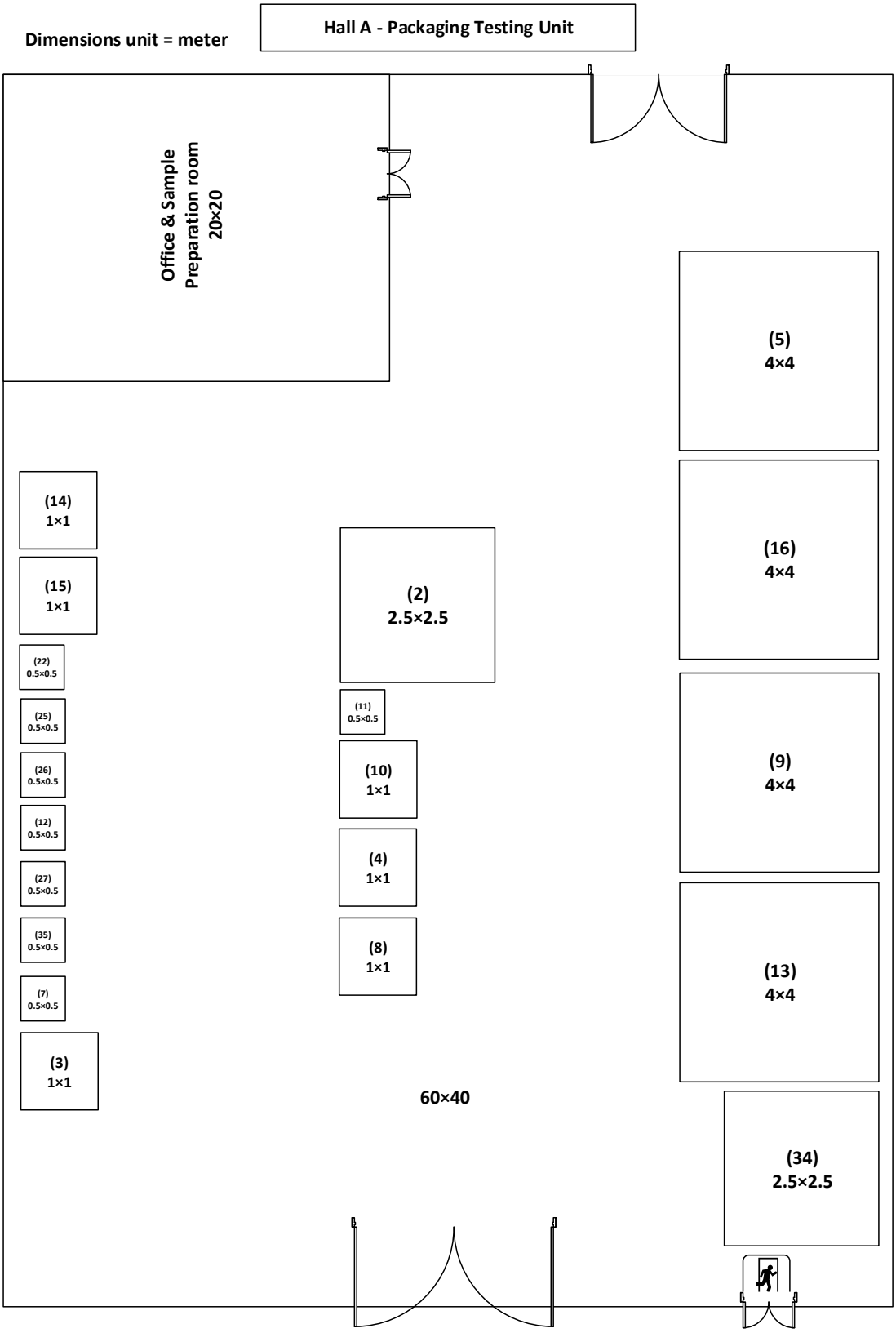
[56 FR 46986, Sept. 17, 1991]

IV. Layout Plan

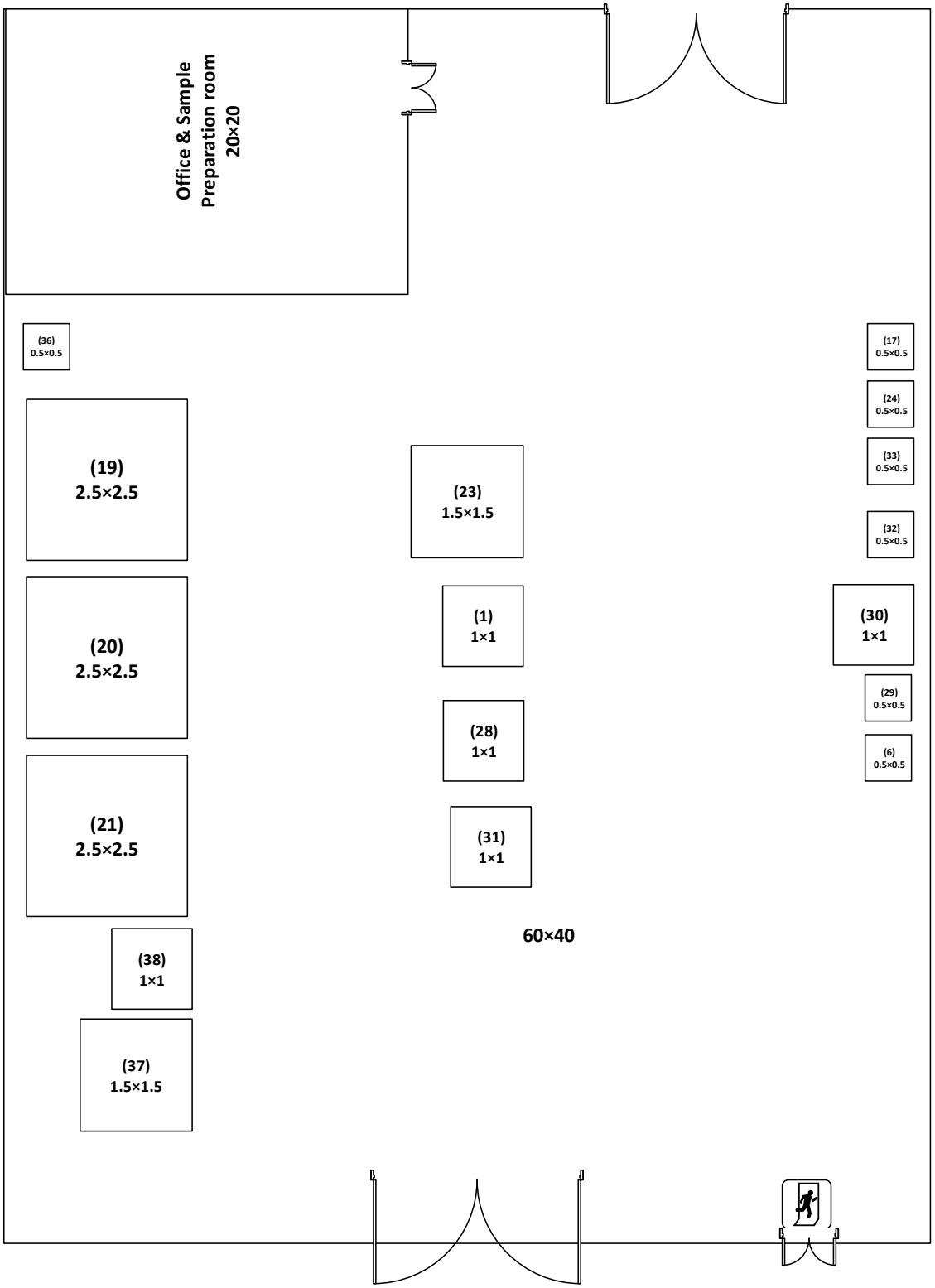
The numbers in the layout plan refers to Table 8: Tentative List of Equipment & Machinery for GAPTL

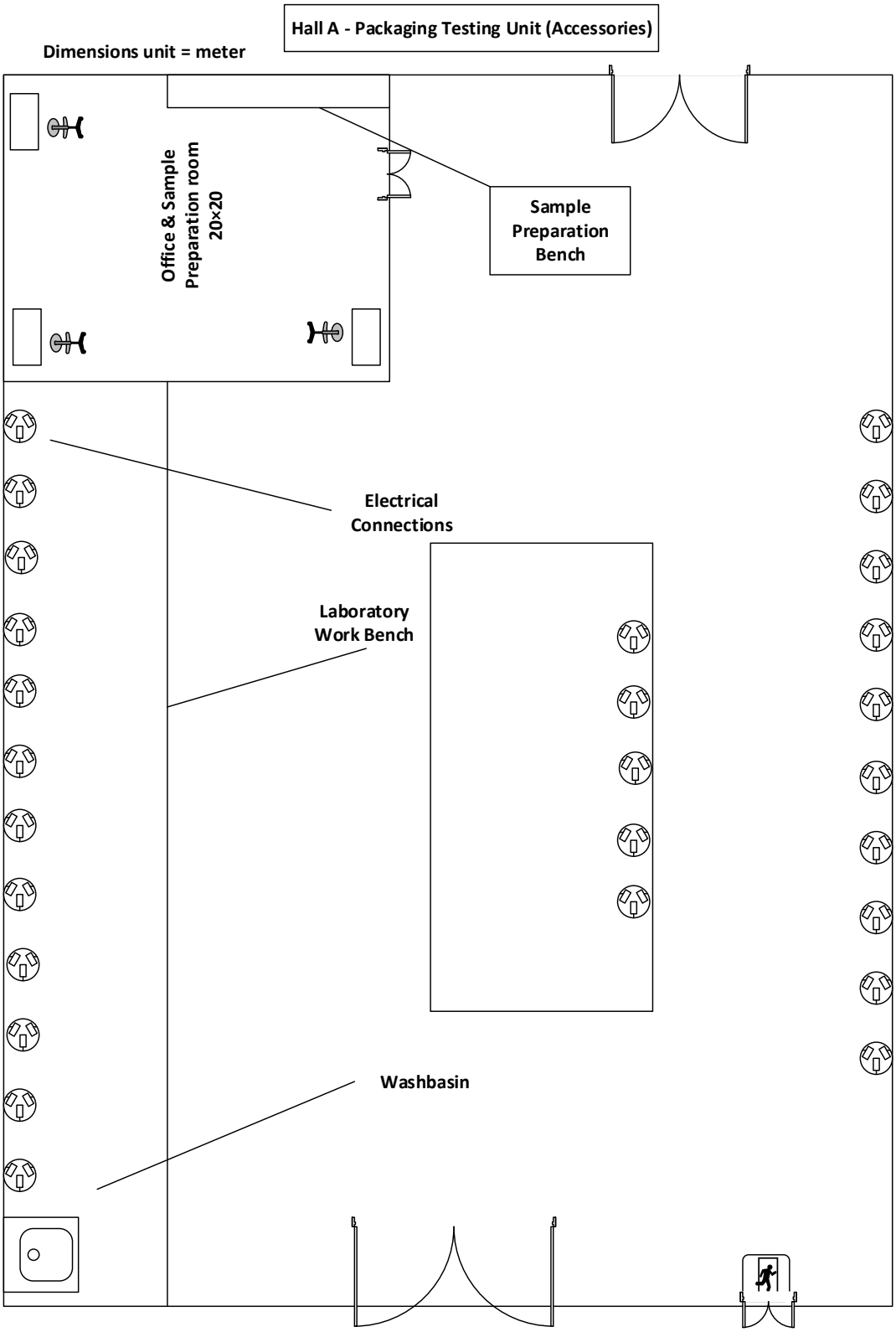


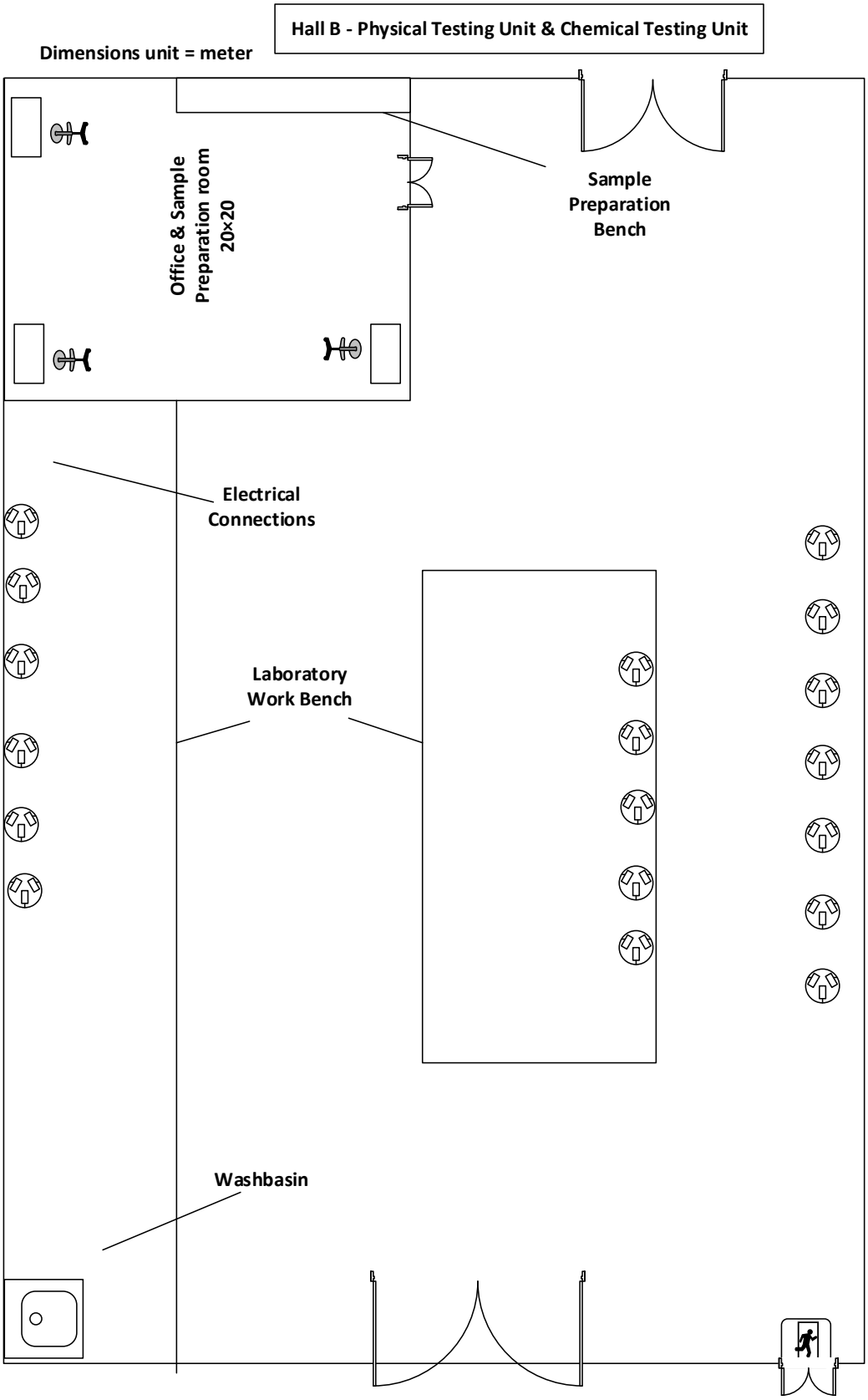

Dimensions unit = meter
Hall A - Packaging Testing Unit
Office & Sample Preparation room 20×20
(5) 4×4
(16) 4×4
(9) 4×4
(13) 4×4
(34) 2.5×2.5
(14) 1×1
(15) 1×1
(22) 0.5×0.5
(25) 0.5×0.5
(26) 0.5×0.5
(12) 0.5×0.5
(27) 0.5×0.5
(35) 0.5×0.5
(7) 0.5×0.5
(3) 1×1
(2) 2.5×2.5
(11) 0.5×0.5
(10) 1×1
(4) 1×1
(8) 1×1
60×40

Dimensions unit = meter

Hall B - Physical Testing Unit & Chemical Testing Unit

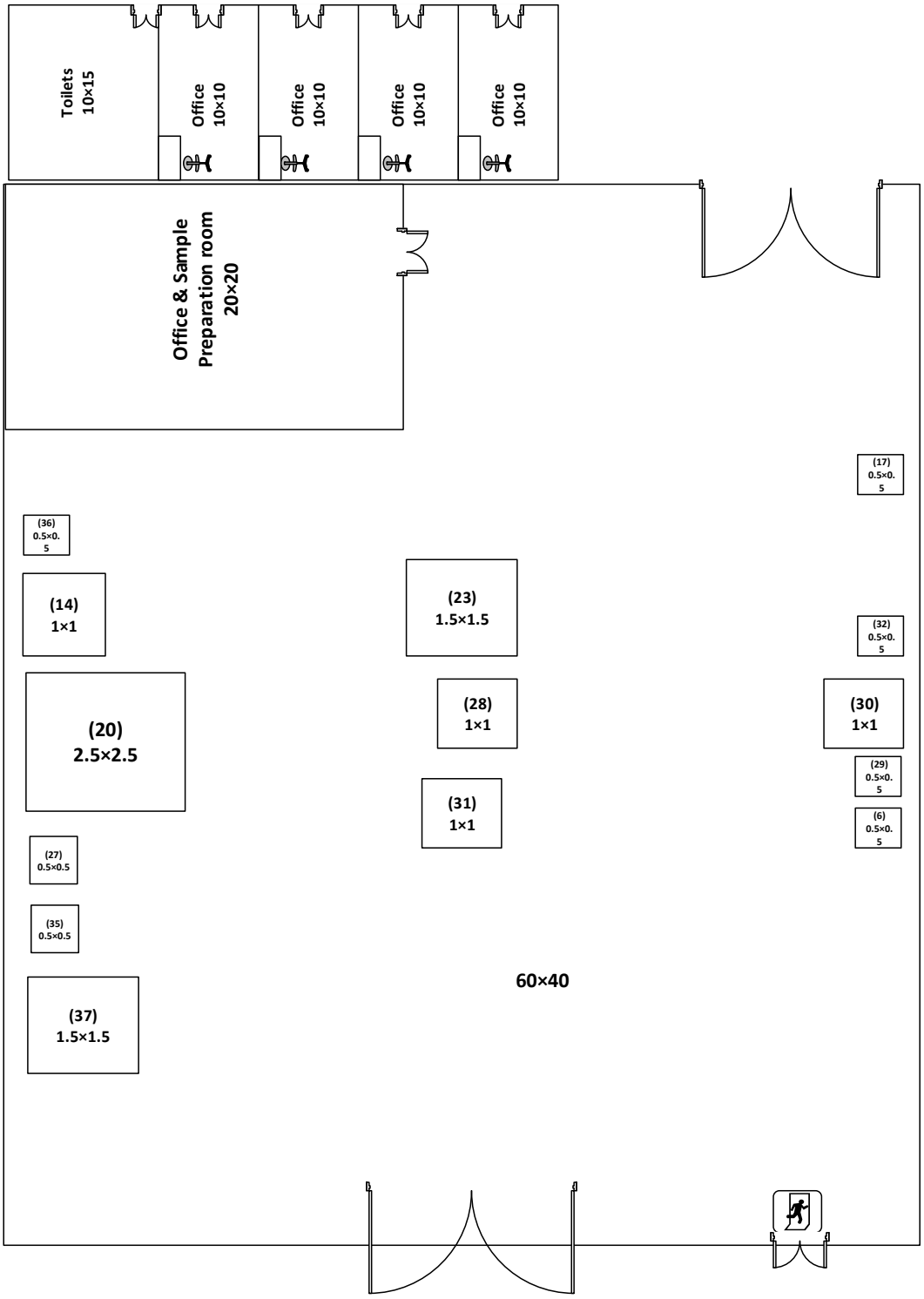



Hall A - Packaging Testing Unit (Accessories)
Dimensions unit = meter
Office & Sample Preparation room 20×20
Sample Preparation Bench
Electrical Connections
Laboratory Work Bench
Washbasin


Hall B - Physical Testing Unit & Chemical Testing Unit
Dimensions unit = meter
Office & Sample Preparation room 20×20
Sample Preparation Bench
Electrical Connections
Laboratory Work Bench
Washbasin

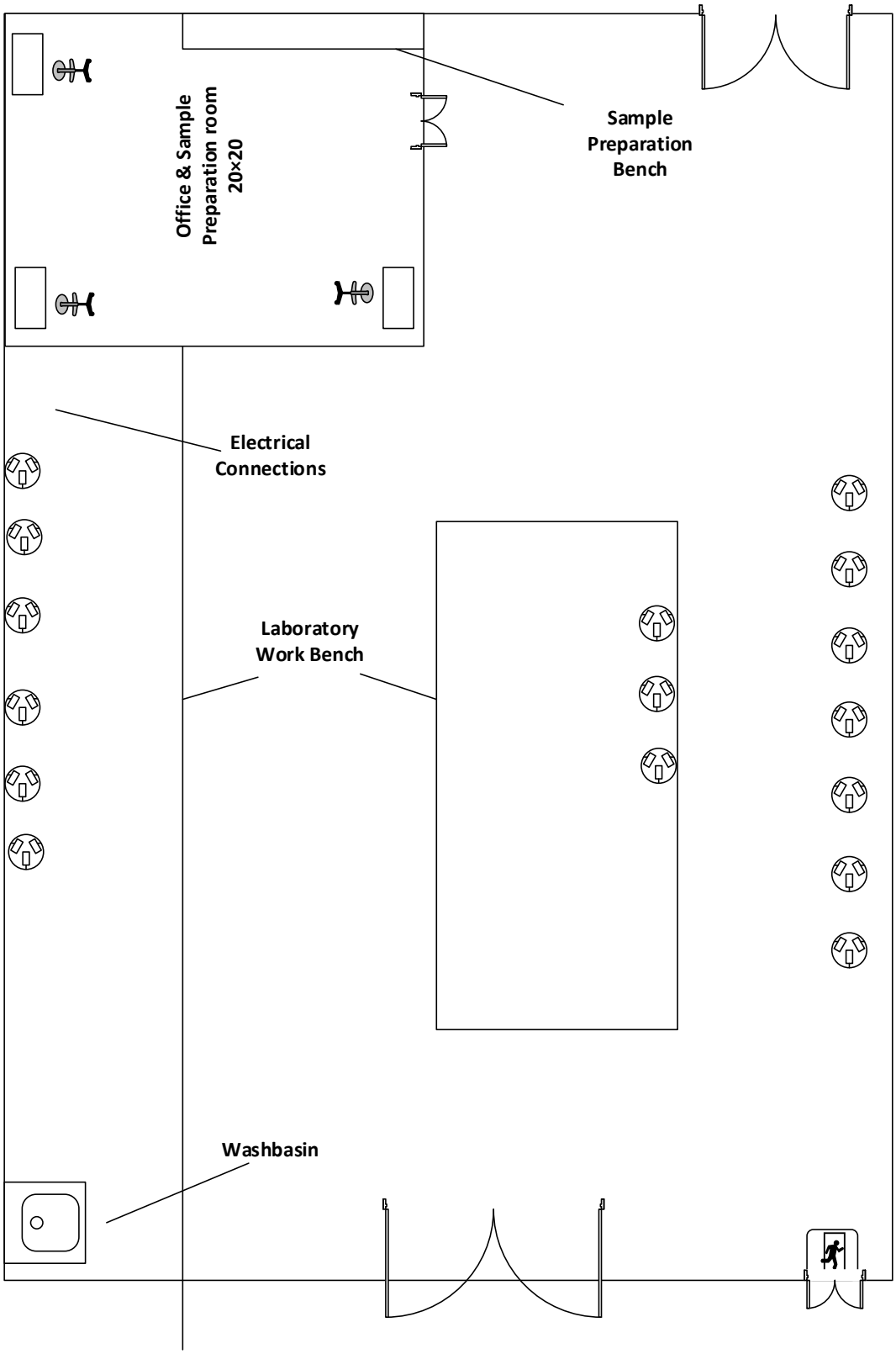
Procurment Plan

Dimensions unit = meter



Procurment Plan (Accessories)

Dimensions unit = meter



V. Laboratory equipment's supplier details:

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2	**Shandong Drick Instruments Co.,LTD** Address: West Side Of Dongyu Middle Street, Tianqiao District,Jinan,P.R.China Tel: 0086-531-85761369/66689788 Fax:0086-531-66689788 Mob:0086013356659585 E-mail: info@drktest.com	15	**Bruker Daltonik GmbH** Bremen · Germany Phone +49 (0)421-2205-0 Fax +49 (0)421-2205-103 ms.sales.bdal@bruker.com
3	**HX Holding GmbH** Dorstener Str. 484 44809 Bochum Germany Phone: +49 234 980 0 Fax: +49 234 980 2752 email: heatexchangers@gea.com web: www.gea-heatexchangers.com	16	**B-TEX Engineering** 38/4, Nr. Randhir Dyeing, B/h Sub-Jail, Khatodara, Surat-395002, Gujarat, India.
4	**New Asia Limited** Road #130, House #11A Gulshan - 1 Dhaka 1212 Bangladesh Responsible for Sales & Service Phone: +880 2 883 27 72 Fax: +880 2 882 89 53 E-Mail: allabj@dhaka.net	17	**BD Weight Scale Corporation** AH TOWER, AZOMPUR HOUSE NO-56, (FOURTEEN FLOOR) ROOM NO- 04, ROAD NO-02, SECTOR-03, Uttara Model Town Dhaka-1230, Bangladesh web: www.weightbd.com
5	**Jinan Xinghua Instruments Co.,Ltd** Address：No. 9 Jian Street Jinan Shandong China Tel：+86-531-67880131 Fax：+86-531-86906490 Email：sales@xhinstruments.com, johnxhinstruments@hotmail.com http://www.xhinstruments.com	18	**Precisa International (Shanghai) Co., Ltd.** RM 3500, NO. 2200, KAIXUAN ROAD, SHANGHAI 200030 CHINA TEL: +86-21-6447 7888 FAX: +86-21-6447 6677 Email: info@precisa.cn Web site: www.precisaitl.cn

6	**Projectina AG** Dammstrasse 2, Postfach CH-9435 Heerbrugg Schweiz/Switzerland Phone +41-71-727 28 00 Telefax +41-71-727 28 28 E-Mail: projectina@projectina.ch Internet: www.projectina.ch	19	**Universal Engineering Corporation** Sabri Mills, Ambala Road, Saharanpur - 247001 Uttar Pradesh, India Ph : +91-132-2642527, 2644494, 2648427 Fax: +91-132-2640062 Email :info@uecin.com URL : www.uecin.com
7	**BD.Meter Solution** AH TOWER, AZOMPUR HOUSE NO-56, (FOURTEEN FLOOR) ROOM NO- 04, ROAD NO-02, SECTOR-03, UTTARA MODEL TOWN DHAKA-1230, BANGLADESH Telephone: +88-02-7913217 Fax: +88-02-7913203 web: www.meterbd.net	20	**Mr. SHEERAZ KHAN** Telephone: 91-98189002-47 Mobile Phone: 9212324964 Address: C-305, SECTOR-10 Zip: 201301 City: NOIDA Province/State: Uttar Pradesh Country/Region: India
8	**LEADER TECHNOLOGY SCIENTIFIC (M) SDN BHD (587430-P)Wisma T-machine** No. 47, Jalan Taming Permai 1, Kawasan Perniagaan Taming Permai, 43300 Jalan Balakong, Selangor Darul Ehsan, Malaysia. Tel: 03-8941 9393 Fax: 03-8941 9696 E-mail: leadertech@pd.jaring.my / sales@LT-scientific.com Website: www.leadertech.com.my	21	**GESTER INTERNATIONAL CO.,LTD** 12-112 ShuiAnjiaRi,JiangBin Road, Fengze Region, Quanzhou of Fujian. PR.362000. China Ph: 86 (595) 22515230 Fax: 86 (595) 22515221 E-mail: sales@gester-instruments.com
9	**Reza Khandaker** MAKS TRADKING INTERNATIONAL 3/4 Block G 1207 Lalmatia, Dhaka Bangladesh Phone +88 02 9130973 Fax +88 02 9122420 maks@bangla.net	22	**M.C. TEC B.V.** Distributiestraat 27 4283 JN Giessen The Netherlands Phone: +31 (0)183-445050 Fax: +31 (0)183-445059 Email: info@mctec.nl
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11	**RHOPOINT INSTRUMENTS** Rhopoint House, Enviro 21 Park, Queensway Avenue South, Queensway, St. Leonards-on-Sea, East Sussex, TN38 9AG, UK Phone: +44 (0)1424 739623 Web: www.hanatekintruments.com	24	**Labthink Instruments Co., Ltd.** 144 Wuyingshan Road, Tianqiao District, Jinan, Shandong, China Telephone: 86-531-85068566 Fax: 86-531-85062108
12	**James Heal** Richmond Works Halifax HX3 6EP England t: +44 (0)1422 366355 f: +44 (0)1422 352440 e: hello@james-heal.co.uk	25	**James heal UK supplier in Bangladesh** **Overseas Marketing Corp (Pvt) Ltd.** Contact: Maruf Atker Mannan Phone: +880 (2) 8154510 Email: maruf@omcbd.com
13	Mountain States Consulting, LLC 970 West Broadway #471 PO Box 30000 Jackson, WY 83002 U.S.A. Phone:+1 307-733-1442 Fax:+1 303-379-6850 Email:info@msc-lims.com		