

(3) Industrial Chemistry Center (ICC)

1) Textile & Paper Unit

Industries in Jordan related to this unit are, in the textile industry, manufacturing of garments (number of enterprises, 2,083; number of employees, 16,671; annual sales, JD128,386,000), spinning (number of enterprises, 20; number of employees, 798; annual sales, JD29,188,000), manufacturing of cloth products (number of enterprises, 351; number of employees, 1,021; annual sales, JD5,013,000), and as the paper industry, manufacturing of paper products (number of enterprises, 28; number of employees, 1,091; annual sales, JD42,905,000), manufacturing of corrugated cardboard (number of enterprises, 53; number of employees, 854; annual sales, JD35,738,000), manufacturing of pulp and paper (number of enterprises, 1; number of employees, 897; annual sales, JD25,767,000; source for all: Department of Statistics).

In terms of sales, among the 81 subsectors of the industrial sector, in the textile industry, manufacturing of garments is in 8th place, spinning is in 31st place, manufacturing of cloth products is in 56th place, and the total of the subsectors is in 7th place, a high rank. And, about 13.4% employees of the industrial sector are working for the subsectors, which are very important as such. In the subsectors, the major manufacturers are large enterprises, but there are many medium and small-sized enterprises too. In addition, the amount of exports to the USA and other countries of the products in this field has been rapidly rising in recent years. Products of the subsectors account for 15% of total exports from Jordan (source: Department of Statistics), hence the subsectors are very important for Jordan for acquisition of foreign currency. In the paper industry, in terms of sales, manufacturing of paper products is in 27th place, manufacturing of corrugated cardboard is in 29th, manufacturing of pulp and paper is in 32nd, and total of the subsectors is in 9th place, a high rank. And, about 2% employees of the industrial sector are working for the subsectors, which are important as such. In the subsectors, large enterprises are few and the others are medium and small-sized enterprises. Products of the subsectors account for 2.2% of total exports from Jordan (source: Department of Statistics), hence subsectors are important for Jordan for acquisition of foreign currency.

Therefore, the fields are considered as target subsectors of the project, and supply of equipment is planned for testing of cloth, paper, and textile. Categories of the tests are testing of cloth, testing of paper, testing of strength of cloth and paper, and testing of yarn count.

Requests from enterprises and others of testing services which could not be provided with the existing equipment are as follows:

Table 2-41. ICC-Textile & Paper Unit - Unsatisfied Requests

Requested Services	Enterprises etc.	No. of request (2002, 2003)	Necessary Equipment
Test of air permeability of paper	Jordan Cement Factory	1	Requested item 1-4
Nu-Martindale test	Jordan Worsted Mills	1	Requested item 1-1

(Source: Answers to questionnaires to the Royal Scientific Society)

In addition, research on requirements was conducted using recovered questionnaires from enterprises during the field survey. Data in the answers to the questionnaires are arranged in the following table.

Table 2-42. ICC-Textile & Paper Unit - Demands on Testing Services
(Answer to the Questionnaire)

Requested Services	Enterprises etc.	Expected Frequency	Necessary Equipment
Testing of air permeability of paper	Jordan Paper and Cardboard Factories Co. Ltd.	100 /year	Requested item 1-4
Testing of brightness of paper	Jordan Paper and Cardboard Factories Co. Ltd.	100 /year	Requested item 1-7
Testing of strength of paper	Jordan Paper and Cardboard Factories Co. Ltd.	100 /year	Requested item 1-8

Moreover, in addition to the questionnaire survey, requirements were confirmed by visiting enterprises during the field survey. Data from the visits are arranged in the following table.

Table 2-43. ICC-Textile & Paper Unit - Demands on Testing Services (Visiting Research)

Enterprises	Requested Services	Expected Frequency	Necessary Equipment
Jordan Paper and Cardboard Factories Co. Ltd.	Testing of air permeability of paper	100 /year	Requested item 1-4
	Testing of brightness of paper	100 /year	Requested item 1-7
	Testing of strength of paper	100 /year	Requested item 1-8

For the paper industry, every item of the testing services is expected to be frequently, hence it is judged that there is sufficient demand in the field to equip the unit. For the textile industry, although demand for testing services was not confirmed directly with enterprises, the industry is prospering as mentioned above. And, it is confirmed that the existing equipment has been used frequently in spite of problems such as superannuating etc. Therefore, it is judged that there is sufficient demand in the field of textiles too.

For the testing of cloth, the necessary equipment is the Nu-Martindale Tester, a Washing Machine, a Steaming Cylinder with Steam Generator, and a Motor driven Water Penetration Tester. The Nu-Martindale Tester is necessary for testing abrasion of the cloth surface in accordance with the applicable standards (ASTM D4966, ISO 3690). An existing abrasion tester which was made in 1977 is too old, and it is not usable for tests with high accuracy and the piling test required by the standard. The Washing Machine is necessary for the washing test in accordance with the applicable standard (ISO 6330). An existing washing machine which was made in 1977 is of an old type, and rotor speed and temperature are not controllable as required by the standard. The Steaming Cylinder with Steam Generator is necessary for the steaming test of cloth in accordance with the applicable standard (ISO 3005). The Motor driven Water Penetration Tester is necessary for testing of water penetration of cloth in accordance with the applicable standard (ISO 811). An existing water penetration tester which was made in 1977 is too old, and pressure increments is not controllable precisely due to manual operation, so it does not fulfill the requirement of the standard.

For the testing of paper, the necessary equipment is the Air Permeability Tester of Paper, and the Reflectometer. The Air Permeability Tester of Paper is testing equipment for air permeability of paper in accordance with the applicable standard (ISO 5636/5). An existing air permeability tester is for cloth and it is not applicable to paper. The Reflectometer is testing equipment for measurement of brightness (bleaching) of paper in accordance with the applicable standard (ISO 2469, 2471).

For the testing of strength of cloth and paper, the necessary equipment is a Tensile Machine. The Tensile Machine is used for tensile tests in accordance with the applicable standards (ISO 13934, 2062, 1924-1), and it is commonly used for cloth as well as for paper. The existing tensile machine which was made in 1977 is too old, and it is not applicable for tests with accuracies required by the standard.

For the testing of yarn count, the necessary equipment is the Driven Precision Yarn Reel Instrument. The Driven Precision Yarn Reel Instrument is for testing of count (thickness) of yarn in accordance with the applicable standard (ISO 2060).

Expected frequency of use is shown on the list below. It is expected that the major equipment will be frequently used.

Table 2-44. ICC-Textile & Paper Unit - Expected Frequency of Use

No.	Major Equipment	Frequency of Use		
		Times/day	Hours/time	Occupancy Rate
ICC- 1-1	Nu-Martindale Tester	1	2	25.0%
ICC- 1-2	Washing Machine	2	2	50.0%
ICC- 1-3	Steaming Cylinder with Steam Generator	1	2	25.0%
ICC- 1-4	Air Permeability Tester of Paper	0.5	2	12.5%
ICC- 1-6	Motor driven Water Penetration Tester	1.25	3	46.9%
ICC- 1-7	Reflectometer	2	2	50.0%
ICC- 1-8	Tensile Machine	2	2	50.0%

For the above-mentioned requirements, the following equipment is planned for the project.

Table 2-45. ICC-Textile & Paper Unit - Planned Equipment

Purpose of Use	Planned Equipment
Testing of cloth	Nu-Martindale Tester 1 unit, Washing Machine 1 unit, Steaming Cylinder with Steam Generator 1 unit, Motor driven Water Penetration Tester 1 unit
Testing of paper	Air Permeability Tester of Paper 1 unit, Reflectometer 1 unit
Testing of strength of cloth and paper	Tensile Machine 1 unit
Testing of yarn count	Driven Precision Yarn Reel Instrument 1 unit

2) Cigarettes Unit

The industry in Jordan related to this unit is cigarette manufacturing (number of enterprises, 6; number of employees, 1,148; annual sales, JD211,744,000; source: Department of Statistics).

In terms of sales, among the 81 subsectors of the industrial sector, production of cigarettes is in 5th place, a high rank. And, about 0.7% employees of the industrial sector are working for the subsector. In this sub-sector, all manufacturers are large enterprises. Products of the sub-sectors account for 1.5% of total exports from Jordan (source: Department of Statistics).

The scale of the industry is large, and it is supposed that there are many requirements for testing services. Considering that the users of these services are all large enterprises, and the products have a special character, testing equipment is planned for third-party testing for export and confirmation of safety of the products.

Requests from enterprises for testing services which could not be met with the existing equipment are as follows:

Table 2-46. ICC-Cigarettes Unit - Unsatisfied Requests

Requested Services	Enterprises etc.	No. of request (2002, 2003)	Necessary Equipment
Upgrading of testing capacity and testing range	All cigarettes production companies in Jordan	always	Requested items 2-1, 2-2
(Source: Answers to questionnaires to the Royal Scientific Society)			

In addition, research on requirements was conducted using questionnaires recovered from enterprises during the field survey. Data in the answers to the questionnaires are arranged in the following table.

Table 2-47. ICC-Cigarettes Unit - Demands on Testing Services (Answer to the Questionnaire)

Requested Services	Enterprises etc.	Expected Frequency	Necessary Equipment
Testing of cigarettes	Union Tobacco & Cigarette Industries Co.	60 /year (12-24/year /brand)	Requested items 2-1, 2-2

Expected frequency of the testing services is about once a month per one brand of cigarettes, but there are many brands, and the testing takes a comparatively long time (2 - 3 hours each time), it is judged that there is sufficient requirement in the subsectors to equip the unit.

For the testing of cigarettes, the necessary equipment is a Smoking Machine, and a Gas Chromatograph.

The Smoking Machine is used for analysis of general ingredients of cigarettes in accordance with the applicable standard (JS 446). The existing smoking machine has eight channels (8 cigarettes can be tested simultaneously), but testing demands are much more larger, and then only about 50% of the demands have been responded. In addition, supply of spare parts and consumables for the existing smoking machine which was made in 1997 will be discontinued in the near future, at which time the equipment can no longer be used.. Therefore, it is necessary to plan for new equipment with 16 channels or more.

The Gas Chromatograph is used for analysis of detailed ingredients of cigarettes and their filters in accordance with the applicable standard (ISO 10362, 10315). An existing gas chromatograph cannot be used for analysis of water in nicotine as required by the standard. According to the standard, a Gas Chromatograph with thermal conductivity detector (TCD) is necessary.

Expected frequency of use is shown on the list below. It is expected that the major equipment will be frequently used.

Table 2-48. ICC-Cigarettes Unit - Expected Frequency of Use

No.	Major Equipment	Frequency of Use		
		Times/day	Hours/time	Occupancy Rate
ICC- 2-1	Smoking Machine	2	3	75.0%
ICC- 2-2	Gas Chromatograph	3	2	75.0%

For the above-mentioned demands, the following equipment is planned for the project.

Table 2-49. ICC-Cigarettes Unit - Planned Equipment

Purpose of Use	Planned Equipment
General (routine) test of cigarette	Smoking Machine 1 unit
Detailed test of cigarette	Gas Chromatograph 1 unit

3) Organic & Food Unit

Industries related to this unit in Jordan are oil and fat processing (number of enterprises, 96; number of employees, 1,273; annual sales, JD98,169,000), production of dairy products (number of enterprises, 582; number of employees, 3,912; annual sales, JD65,694,100), meat processing (number of enterprises, 27; number of employees, 1,727; annual sales, JD70,899,900), fruits and vegetables processing (number of enterprises, 19; number of employees, 853; annual sales, JD12,004,000), production of the other foods (number of enterprises, 383; number of employees, 2,644; annual sales, JD44,078,000), production of pesticide and chemicals for agriculture (number of enterprises, 8; number of employees, 45; annual sales, JD2,259,000; source for all: Department of Statistics).

In terms of sales, among the 81 subsectors of the industrial sector, oil and fat processing is in 12th place, production of dairy products is in 20th place, meat processing is in 18th place, fruits and vegetables processing is in 43rd place, production of the other foods (including feed for livestock) is in 25th place, production of pesticide and chemicals for agriculture is in 67th place, and total of the sub-sectors is in 4th place, a high rank. And, about 7.8% employees of the industrial sector are working for the subsectors, which are thus important fields. In the subsectors, most manufacturers are medium- and small-sized enterprises. Products of the sub-sectors account for 3.5% (oil and fat), 1.7% (dairy products, processed meat, processed fruits and vegetables, and other processed foods), and 0.2% (pesticide and chemicals for agriculture), and 5.4% (total of the sub-sectors) of total exports from Jordan (source: Department of Statistics). Thus, the subsectors are important for Jordan as a means of acquiring foreign currency.

Therefore, the fields are considered as target subsectors of the project, and testing equipment is

planned mainly for testing of processed foods (including feed for livestock). The scale of production of pesticide and chemicals for agriculture is not large, so equipment is not planned for this category alone. In case planned equipment can be jointly used for this category, it should be considered. Categories of the tests are analysis of ingredients, and testing of properties of processed foods etc.

Requests from enterprises and others of testing services which could not be provided with the existing equipment are as follows.

Table 2-50. ICC-Organic & Food Unit - Unsatisfied Requests

Requested Services	Enterprises etc.	No. of request (2002, 2003)	Necessary Equipment
Amino acid analysis in feed	Sonokrot Co. Amman	10	Requested item 3-9
Analysis of pesticide	Ministry of Agriculture	4	Requested items 3-1, 3-3
Analysis of pesticide	Agricultural Materials Co. Amman	5	
Analysis of pesticide	Mobedcom Co. Amman	3	
Unknown organic analysis	Other companies	50	Requested item 3-1
Analysis of vitamin	JISM	always	Requested item 3-3
Analysis of food additives	JISM	always	Requested items 3-1, 3-3
Amino acid analysis in feed	JISM	always	Requested item 3-9

(Source: Answers to questionnaires to the Royal Scientific Society)

In addition, research on requirements was conducted using questionnaires recovered from enterprises during the field survey. Data in the answers to the questionnaires are arranged in the following table.

Table 2-51. ICC-Organic & Food Unit - Demands on Testing Services
(Answer to the Questionnaire)

Requested Services	Enterprises etc.	Expected Frequency	Necessary Equipment
Analysis of food additives	VAPCO	6 /year	Requested item 3-1
Separation and analysis of analysis of food additives	Jordan Vegetable Oils Industries Co. Ltd.	20 /year	Requested items 3-2, 3-3
Kjeldahl Analysis	VAPCO	4 /year	Requested item 3-4
Analysis of meat products	Quality Food Co. Ltd.	50 /year	Requested item 3-6
Analysis of sugar content	VAPCO	4 /year	Requested item 3-7
Analysis of amino acid	VAPCO	6 /year	Requested item 3-9
Measurement of melting point of fat	Jordan Vegetable Oils Industries Co. Ltd.	20 /year	Requested item 3-10

Measurement of moisture	VAPCO	6 /year	Requested item 3-11
Measurement of density	VAPCO	4 /year	Requested item 3-12
Measurement of ash content	VAPCO	4 /year	Requested item 3-13

Though there are differences of expected frequency of testing among the enterprises, there are many enterprises in the subsectors, so it is judged that there is sufficient demand in the subsectors to equip the unit.

For analysis of ingredients of processed foods etc., in accordance with regulations of AOAC International (Washington DC), a Gas Chromatography/Mass Spectrometer (GC/MS), a High Performance Liquid Chromatography (HPLC), a Kjeldahl Nitrogen Analyzer, an Amino Acid Analyzer, a Muffle Furnace, and a Moisture Meter are used. A Gas Chromatography/Mass Spectrometer is necessary for measurement of unknown ingredients, i.e., food additives etc., and analysis of ingredients of chemicals for agriculture, i.e., pesticide. High Performance Liquid Chromatography is necessary for separation of ingredients of foods and chemicals for agriculture, detection and measuring of concentration of separate ingredients. In addition, it is possible to measure very small amounts of ingredients through further analysis with another piece of equipment, i.e., a gas chromatograph etc. There are two unit of high performance liquid chromatography at the RSS, but both are too old to use, and replacement is required. A Kjeldahl Nitrogen Analyzer is necessary for measurement of nitrogen content, i.e., protein etc., in foods etc. by the Kjeldahl method. The existing Kjeldahl nitrogen analyzer is a manual operation type and has one channel only. The Kjeldahl analysis takes a long period for a single test so at present it is not possible at all to respond to demand, and replacement is required due to superannuating. An Amino Acid Analyzer is necessary for analysis of amino acid contained in foods, feeds etc.

For the testing of properties of processed foods, in accordance with regulations of AOAC International, a Polarimeter, an Automatic Melting Point Apparatus, and a Density Meter are used. The Polarimeter is necessary for testing of sugar content in beverages etc. The Automatic Melting Point Apparatus is necessary for measurement of melting points of oils and fats. The Density Meter is necessary for measurement of density of beverages, alcohol, vinegar etc.

In addition, for olive oils, milks, and meats which are typical foods produced in Jordan and for which there is great need for testing of those products, testing equipment used is exclusively used for those products respectively. For the testing of olive oils, in accordance with the applicable standard (JS 3) and regulations of the International Olive Oil Council (IOOC), a Gas Chromatograph with Flame Ionization Detector (GC/FID) is necessary. This equipment is required by IOOC to be used

exclusively for olive oil, and, for the same reason a Gas Chromatography with Flame Ionization Detector only for olive oil is necessary. For the testing of milk, in accordance with the applicable standard (JS 837, 121), a Milk Analyzer is necessary. It is used for analysis of fat, protein, lactose etc. in the milk. For the testing of meat, in accordance with the applicable standard (JS 232), a Meat Analyzer is necessary. It is used for analysis of moisture, fat etc. in the meat.

Expected frequency of use is shown on the list below. It is expected that the major equipment will be frequently used.

Table 2-52. ICC-Organic & Food Unit - Expected Frequency of Use

No.	Major Equipment	Frequency of Use		
		Times/day	Hours/time	Occupancy Rate
ICC- 3-1	Gas Chromatography/Mass Spectrometer (GC/MS)	3	0.75	28.1%
ICC- 3-2	Gas Chromatography/Flame Ionization Detector (GC/FID)	9	0.33	37.1%
ICC- 3-3	High Performance Liquid Chromatography (HPLC) (Semi-Preparative)	12.5	0.25	39.1%
ICC- 3-4	Automatic Kjeldahl Nitrogen Analyzer	1	7	87.5%
ICC- 3-5	Milk Analyzer	7.5	2	187.5%
ICC- 3-6	Meat Analyzer	3	2	75.0%
ICC- 3-9	Amino Acid Analyzer	1	2	25.0%
ICC- 3-10	Automatic Melting Point Apparatus	4	2	100.0%

For the above-mentioned requirements, the following equipment is planned for the project.

Table 2-53. ICC-Organic & Food Unit - Planned Equipment

Purpose of Use	Planned Equipment
Analysis of ingredients of processed foods etc.	Gas Chromatography/Mass Spectrometer (GC/MS) 1 unit, High Performance Liquid Chromatography (HPLC) (Semi-Preparative) 1 unit, Automatic Kjeldahl Nitrogen Analyzer 1 unit, Amino Acid Analyzer 1 unit, Muffle Furnace 1 unit, Moisture Meter 1 unit
Testing of properties of processed foods etc.	Polarimeter 1 unit, Automatic Melting Point Apparatus 1 unit, Density Meter 1 unit
Testing of olive oil	Gas Chromatography/Flame Ionization Detector (GC/FID) 1 unit
Testing of milk	Milk Analyzer 1 unit
Testing of meat	Meat Analyzer 1 unit
General use for testing	Titration Apparatus 1 unit, pH/Ion Meter 1 unit

The Kjeldahl Nitrogen Analyzer mainly consists of a digestion apparatus and a distillation/titration apparatus. The digestion process takes 1 - 2 hours, so it is planned that the digestion apparatus to be supplied has 20 or more tubes for sample digestion. And, as it is supposed that the process is repeated 5 times a day, a total of 100 samples a day are digested. Distillation and titration processes take three minutes per sample. For the 100 samples, the processes take 5 hours respectively, and hence a total of

10 hours are necessary for distillation and titration process. In case of manual operation of the processes, personnel are always necessary during the operation for each apparatus. Therefore, it is planned that the distillation and titration processes be automatic, and the titration/titration apparatus have an auto-sampler for 20 samples or more considering the coordination with the digestion apparatus, and this can save personnel expenses.

4) Petrol & Lubricants Laboratory

The industry in Jordan related to this unit is oil refining (number of enterprises, 1; number of employees, 3,463; annual sales, JD595,248,400; source: Department of Statistics). There is only one refining company in Jordan, but its sales amount and number of employees, are both large. As to sales, among the 81 subsectors of the industrial sector, the subsector is in 1st place. And, about 2.4% of employees of the industrial sector are working for this subsector. The company's products are used in various related industries, and exported too; therefore, this field is very much important for the Jordanian industry and economy.

Therefore, the field is considered as a target subsector of the project, and testing equipment is planned for testing of petroleum products, i.e., lubricants, hydraulic oils etc. Categories of the tests are testing of properties and characteristics of oils, and ingredients (additives) test.

Requests from enterprises and others for testing services which could not be provided with the existing equipment are as follows.

Table 2-54. ICC-Petrol & Lubricants Laboratory - Unsatisfied Requests

Requested Services	Enterprises etc.	No. of request (2002, 2003)	Necessary Equipment
Analysis of S, Ni, V, Na, Pb in fuel	Jordan Petroleum Refinery	50	Requested item 4-10
Measurement of calorie of fuel	ACTS Lebanon	10	Requested item 4-9
Analysis ob Pb in gasoline	Tawfeeq Gharghor Co.	4	Requested item 4-10
Insulation test	JISM	always	Requested item 4-2
Lubricant load test	JISM	always	Requested item 4-1
Noack test	JISM	always	Requested item 4-3
Air release test, demulsibility test	JISM	always	Requested items 4-6, 4-7

(Source: Answers to questionnaires to the Royal Scientific Society)

In addition, research on requirements was conducted using questionnaires recovered from enterprises during the field survey. Data in the answers to the questionnaires are arranged in the following table.

Table 2-55. ICC-Petrol & Lubricants Laboratory - Demands on Testing Services
(Answer to the Questionnaire)

Requested Services	Enterprises etc.	Expected Frequency	Necessary Equipment
Measurement of vapor pressure	Jordan Industrial Petrochemical Co. Ltd.	120 /year	Requested item 4-5
Measurement of flash point	Jordan Industrial Petrochemical Co. Ltd.	120 /year	Requested item 4-8

Moreover, in addition to the questionnaire survey, requirements were confirmed by visiting enterprises during the field survey. Data from the visits are arranged in the following table.

Table 2-56. ICC-Petrol & Lubricants Laboratory - Demands on Testing Services (Visiting Research)

Enterprises	Requested Services	Expected Frequency	Necessary Equipment
Jordan Petroleum Refinery Co. Ltd.	Measurement of vapor pressure	120 /year	Requested item 4-5
	Measurement of flash point	120 /year	Requested item 4-8

Every item of the testing services is expected to be required frequently, and thus it is judged that there is sufficient demand in the subsectors to equip the laboratory.

For the testing of properties and characteristics of oils, the necessary equipment is a Lubricant Test Machine, a Dielectric Breakdown Voltage of Insulating Liquids, Evaporating Loss of Lubricating Oils (Noack Test), Determination of Vapor Pressure, Determination of Air Release Value, Demulsibility Characteristics, Rapid Flash Point Tester, and Automatic Oxygen Bomb Calorimeter. The Lubricant Test Machine is necessary for the measurement of load of lubricants between friction metals in accordance with the applicable standards (ASTM S2509, D2782). Dielectric Breakdown Voltage of Insulating Liquids is necessary for the testing of electrical insulation of insulating oil in accordance with the applicable standards (ASTM D877, D18186). Evaporating Loss of Lubricating Oils (Noack Test) is necessary for the measurement of evaporating loss of lubricants in accordance with the applicable standard (ASTM D5800). Determination of Vapor Pressure is necessary for the measurement of vapor pressure of lubricants in accordance with the applicable standard (ASTM D323). Determination of Air Release Value is necessary for the measurement of the air release value of

hydraulic oils in accordance with the applicable standard (ASTM D3427). Demulsibility Characteristics is necessary for the measurement of demulsibility of lubricants in accordance with the applicable standard (ASTM D1401). Rapid Flash Point Tester is necessary for the testing of flash points of petroleum products in accordance with the applicable standard (ASTM D3828). Automatic Oxygen Bomb Calorimeter is necessary for the measurement of the calories of petroleum products in accordance with the applicable standard (ASTM D240). An existing automatic oxygen bomb calorimeter which was made in 1984 is too old to respond to the demands for testing.

For the ingredients test, the necessary equipment is the Bench top XRF. It is used for the analysis of sulphur in petroleum products in accordance with the applicable standards (ASTM D1266, 2622, 3341, 3116). For that purpose, a simple type of bench top type sulphur analyzing equipment is planned.

Expected frequency of use is shown on the list below. It is expected that the major equipment will be frequently used.

Table 2-57. ICC-Petrol & Lubricants Laboratory - Expected Frequency of Use

No.	Major Equipment	Frequency of Use		
		Times/day	Hours/time	Occupancy Rate
ICC- 4-1	Lubricant Test Machine	4	1	50.0%
ICC- 4-2	Dielectric Breakdown Voltage of Insulating Liquids	10	0.5	62.5%
ICC- 4-3	Evaporating Loss of Lubricating Oils (Noack Test)	0.8	3	30.0%
ICC- 4-5	Determination of Vapor Pressure	2	3	75.0%
ICC- 4-6	Determination of Air Release Value	0.42	3	15.8%
ICC- 4-7	Demulsibility Characteristics	0.8	3	30.0%
ICC- 4-9	Automatic Oxygen Bomb Calorimeter	0.63	5	39.4%
ICC- 4-10	Bench top XRF	2.5	2	62.5%

For the above-mentioned requirements, the following equipment is planned for the project.

Table 2-58. ICC-Petrol & Lubricants Laboratory - Planned Equipment

Purpose of Use	Planned Equipment
Testing properties and characteristics of oils	Lubricant Test Machine 1 unit, Dielectric Breakdown Voltage of Insulating Liquids 1 unit, Evaporating Loss of Lubricating Oils (Noack Test) 1 unit, Determination of Vapor Pressure 1 unit, Determination of Air Release Value 1 unit, Demulsibility Characteristics 1 unit, Rapid Flash Point Tester 1 unit, Automatic Oxygen Bomb Calorimeter 1 unit
Ingredients test	Bench top XRF 1 unit

5) Paints, Lacquers & Solvents Laboratory

The industry in Jordan related to this unit is production of paints and inks (number of enterprises, 55; number of employees, 1,204; annual sales, JD48,993,000; source: Department of Statistics).

In terms of sales, among the 81 sub-sectors of industrial sector, production of paints and inks is in 24th place, a medium to high rank, making it comparatively important field. And, about 0.9% of the employees of the industrial sector are working for this subsector. In this subsector, the major manufacturers are medium and small-sized enterprises. Products of the subsector accounts for 0.6% of total exports from Jordan (source: Department of Statistics). Therefore, the field is considered as a target subsector of the project, and testing equipment is planned for the products, i.e., paints and solvents, provided that the scale of the planned equipment corresponds to the size of the subsector. Categories of the tests are testing of properties and characteristics of paints, solvents etc., and color test of paints.

Requests from enterprises and others for testing services which could not be provided with the existing equipment are as follows.

Table 2-59. ICC-Paints, Lacquers & Solvents Laboratory - Unsatisfied Requests

Requested Services	Enterprises etc.	No. of request (2002, 2003)	Necessary Equipment
Measurement of viscosity	Companies in the West Bank	300	Requested items 5-1, 5-2, 5-3
Measurement of drying time	Ministry of Public	300	Requested items 5-1, 5-4
Accurate color test of paint	Private companies	150	Requested item 5-6
Measurement of viscosity	JISM	always	Requested items 5-1, 5-2, 5-3
Measurement of drying time	JISM	always	Requested items 5-1, 5-4
Accurate color test of paint	JISM	always	Requested item 5-6

(Source: Answers to questionnaires to the Royal Scientific Society)

In addition, research on requirements was conducted using questionnaires recovered from enterprises during the field survey. Data from the answers to the questionnaires are arranged in the following table.

Table 2-60. ICC-Paints, Lacquers & Solvents Laboratory - Demands on Testing Services
(Answer to the Questionnaire)

Requested Services	Enterprises etc.	Expected Frequency	Necessary Equipment
Measurement of viscosity	Kalani Paints Ind. Com. Est., International Coating & Specialties, Modern Paints & Chemical Ind.	50 /year 60 /year 100 /year	Requested item 5-1, 5-2, 5-3
Measurement of drying time	Kalani Paints Ind. Com. Est., International Coating & Specialties, Modern Paints & Chemical Ind.	50 /year 60 /year 100 /year	Requested item 5-1, 5-4
Accurate color test of paint	Kalani Paints Ind. Com. Est., International Coating & Specialties, Modern Paints & Chemical Ind.	50 /year 60 /year 100 /year	Requested item 5-6

Every item of the testing services is expected to be frequently required; hence it is judged that there are sufficient demand in the subsector to equip the laboratory.

For the testing of properties and characteristics of paints, solvents etc., the necessary equipment is a Constant Climate Chamber, a Cone and Plate Viscometer, a Digital Constant Temperature Bath/Circulator & Cooler, and a Drying Time Recorder & Film Applicator. The Constant Climate Chamber is necessary for the testing of paints under conditions of constant temperature and humidity in accordance with the applicable standard (ISO 3270). The Cone and Plate Viscometer is necessary for the measurement of viscosity of paints and solvents in accordance with the applicable standard (ASTM D4287). The Digital Constant Temperature Bath/Circulator & Cooler is necessary to keep the temperature of the sample being tested constant for the measurement of viscosity. The Drying Time Recorder & Film Applicator is necessary for the measurement of drying time of paints in accordance with the applicable standard (ASTM D5895).

For the color test of paints, the necessary equipment is a Superchroma Spectro-colorimeter. It is used for the measurement of color of paints in accordance with the applicable standard (ISO 7724).

Expected frequency of use is shown on the list below. It is expected that the major equipment will be frequently used.

Table 2-61. ICC-Paints, Lacquers & Solvents Laboratory - Expected Frequency of Use

No.	Major Equipment	Frequency of Use		
		Times/day	Hours/time	Occupancy Rate
ICC- 5-1	Constant Climate Chamber	6	1	75.0%
ICC- 5-6	Superchroma Spectro-colorimeter	4	1	50.0%

For the above-mentioned requirements, the following equipment is planned for the project.

Table 2-62. ICC-Paints, Lacquers & Solvents Laboratory - Planned Equipment

Purpose of Use	Planned Equipment
Testing of properties and characteristics of paints, solvents etc.	Constant Climate Chamber 1 unit, Cone and Plate Viscometer 1 unit, Digital Constant Temperature Bath/Circulator & Cooler 1 unit, Drying Time Recorder & Film Applicator 1 unit
Color test of paints	Superchroma Spectro-colorimeter 1 unit

6) Inorganic Material Division

Industries in Jordan related to this unit are: the mining industry (number of enterprises, 6; number of employees, 6,514; annual sales, JD339,034,600), production of fertilizer (number of enterprises, 10; number of employees, 1,426; annual sales, JD224,951,400), production of basic inorganic chemicals (number of enterprises, 14; number of employees, 1,042, annual sales, JD92,145,900), production of non-alcohol beverages (number of enterprises, 31; number of employees, 2,884; annual sales, JD76,598,800; source for all: Department of Statistics).

In terms of sales, among the 81 subsectors of industrial sector, mining industry is in 2nd place, production of fertilizer is in 5th place, production of basic inorganic chemicals is in 14th place, production of non-alcohol beverages is in 13th place, and the total of the subsectors is in 1st place. And, about 8.6% of employees of the industrial sector are working for these subsectors, which are important fields. In the subsectors, the major manufacturers are large, national enterprises. Products of the subsectors account for 10.4% of total exports from Jordan (source: Department of Statistics), the subsectors are very important for Jordan for acquisition of foreign currency.

Therefore, the fields are considered as target subsectors of the project, and testing equipment is planned for the products, i.e., minerals, fertilizers, basic inorganic chemicals, etc.

Requests from enterprises and others for testing services which could not be provided with the existing equipment are as follows.

Table 2-63. ICC-Inorganic Material Division - Unsatisfied Requests

Requested Services	Enterprises etc.	No. of request (2002, 2003)	Necessary Equipment
Analysis of basalt	Arabil Center for Optic, Amman	2	Requested item 6-2
Analysis of heavy metals in foods	Al-Riad Co., Amman	5	Requested item 6-1
Analysis of U in mineral phosphate	Phosphate Co.	5	Requested item 6-3
Analysis of kaolin	JISM	always	Requested items 6-2, 6-4
Analysis of talc	JISM	always	Requested item 6-2, 6-4
Analysis of nitrogen in KNO ₃ fertilizer	JISM	always	Requested item 6-4
Analysis of heavy metals in toys	JISM	always	Requested item 6-3
Analysis of As, Hg, Se in inorganic solvents	JISM	always	Requested items 6-1, 6-3

(Source: Answers to questionnaires to the Royal Scientific Society)

Requirements were confirmed when visiting enterprises during the field survey. Data from the visits are arranged in the following table.

Table 2-64. ICC-Inorganic Material Division - Demands on Testing Services (Visiting Research)

Enterprises	Requested Services	Expected Frequency	Necessary Equipment
Jordan Phosphate Mines Co. Ltd.	Testing with X-ray diffractometer	100 /year	Requested item 6-2
	Testing with XRF	100 /year	Requested item 6-4

Every item of the testing services is expected to be required frequently, and hence it is judged that there is sufficient demand in the subsectors to equip the division.

For the above-mentioned requirements, the necessary equipment is an Atomic Absorption Spectrophotometer, an X-Ray Diffractometer (XRD), a Sequential Plasma Emission Spectrometer (ICP), and a XRF- Sequential Spectrometer.

The Atomic Absorption Spectrophotometer is used for the detection of heavy metals in samples. The existing atomic absorption spectrophotometer which was made in 1975 is too old to use. In addition, supply of spare parts of the existing equipment will be discontinued in the near future, making it necessary to replace the existing equipment. This item is used for analysis of samples in many fields of industry, and this is one of basic items needed to obtain international accreditation of a testing institution, and therefore, urgent replacement is necessary.

The X-Ray Diffractometer is used for chemical analysis of potassium salt, orthophosphate,

magnesium minerals etc. It can determine the crystalline structures of minerals, and can be utilized for development of mining area for potassium salt, orthophosphate too, then there is great demand in the industrial sector for this equipment.

The Sequential Plasma Emission Spectrometer is used for analysis of molybdenum, arsenic, lead, etc. in drinking water etc. It has high sensitivity, and can detect such elements at the ppb level. It is used for measurement of very small amounts of elements contained in drinking water, etc. The existing sequential plasma emission spectrometer which was made in 1986 is too old, the supply system for vaporized samples is out of order, and analysis of vaporized samples cannot be performed. In addition, detection accuracy is too low to comply with the international standards. Furthermore, data analysis software cannot be used with the existing equipment, so it is very hard to analyze measurement data.

The XRF- Sequential Spectrometer is used for analysis of elements in stones, metals etc. The existing XRF- sequential spectrometer which was made in 1988 is too old, and has frequently broken down. In addition, supply of spare parts of the existing equipment has been discontinued already, and it will become unusable in the near future.

Expected frequency of use is shown on the list below. It is expected that the major equipment will be frequently used.

Table 2-65. ICC-Inorganic Material Division - Expected Frequency of Use

No.	Major Equipment	Frequency of Use		
		Times/day	Hours/time	Occupancy Rate
ICC- 6-1	Atomic Absorption Spectrophotometer	40	0.25	125.0%
ICC- 6-2	X-Ray Diffractometer	10	1	125.0%
ICC- 6-3	Sequential Plasma Emission Spectrometer (ICP)	10	0.5	62.6%
ICC- 6-4	XRF- Sequential Spectrometer	40	0.5	250.0%

For the above-mentioned requirements, the following equipment is planned for the project.

Table 2-66. ICC-Inorganic Material Division - Planned Equipment

Purpose of Use	Planned Equipment
Detection and measurement of heavy metals	Atomic Absorption Spectrophotometer 1 unit
Chemical analysis of minerals	X-Ray Diffractometer 1 unit
Analysis of molybdenum, arsenic, lead, etc. in drinking water etc.	Sequential Plasma Emission Spectrometer (ICP) 1 unit
Analysis of elements in stones, metals etc.	XRF- Sequential Spectrometer 1 unit

(4) Building Research Center (BRC)

1) Cement and Concrete Unit

The industry in Jordan related to this unit is manufacturing of concrete products (number of enterprises 1,581; number of employees, 6,470; annual sales, JD 85,080,000)(source: Department of Statistics).

In terms of sales, among the 81 subsectors of industrial sector, manufacturing of concrete products is in 15th place as a comparatively higher rank. And, about 4.4% employees of the industrial sector are working for the subsector. In the subsector, major manufacturers are medium and small-sized enterprises. Products of the subsectors account for 0.4% of total exports from Jordan (source: Department of Statistics).

Therefore, the field is considered as a target subsector of the project, and testing equipment is planned for the products, i.e. precast concrete, provided that the scale of the planned equipment corresponds to the size of the subsector. Categories of the tests are compression/flexural test, non-destructive test, and water permeability test.

Requests from enterprises and others for testing services which could not be provided with the existing equipment are as follows.

Table 2-67. BRC-Cement and Concrete Unit - Unsatisfied Requests

Requested Services	Enterprises etc.	No. of request (2002, 2003)	Necessary Equipment
Heating test of concrete	NPA- Palestine	4	Calorimeter, oven

(Source: Answers to questionnaires to the Royal Scientific Society)

In addition, research on requirements was conducted using questionnaires recovered from enterprises during the field survey. Data from the answers to the questionnaires are arranged in the following table.

Table 2-68. BRC-Cement and Concrete Unit - Demands on Testing Services

(Answer to the Questionnaire)

Requested Services	Enterprises etc.	Expected Frequency	Necessary Equipment
Compression/flexural test	Jordan Cement Factories (JCF)	28 /year	Requested item 2
Water permeability test	Jordan Cement Factories (JCF)	12 /year	Requested item 9

For the compression/flexural test, the necessary equipment is an Auto Test Compression/Flexural

Machine. In accordance with the applicable standards (ASTM C39, BS1881-116), concrete products are compressed and flexed with this equipment to measure their strength. The existing auto test compression/flexural machine which was made in 1980 is too old to use.

For non-destructive testing, the necessary equipment is a Non-Destructive Ultrasonic testing device. In accordance with the applicable standard (ASTM C597), it is used for the inspection of products for internal defects and cracks.

For the water permeability test, the necessary equipment is Water Permeability of Concrete. In accordance with the applicable standard (DIN 1048), it is used for the testing of water permeability of concrete products. The existing water permeability tester which was made in 1983 is too old to use.

Expected frequency of use is shown in the list below. It is expected that the major equipment will be frequently used.

Table 2-69. BRC-Cement and Concrete Unit - Expected Frequency of Use

No.	Major Equipment	Frequency of Use		
		Times/day	Hours/time	Occupancy Rate
BRC- 2	Auto Test Compression/Flexural Machine	1	3	37.5%
BRC- 9	Water Permeability of Concrete	0.2	48	120.0%

For the above-mentioned requirements, the following equipment is planned for the project.

Table 2-70. BRC-Cement and Concrete Unit - Planned Equipment

Purpose of Use	Planned Equipment
Compression/flexural test	Auto Test Compression/Flexural Machine 1 unit
Non-destructive test	Non-Destructive Ultrasonic testing device 1 unit
Water permeability test	Water Permeability of Concrete 1 unit

2) Ceramic Unit

The industry in Jordan related to this unit is manufacturing of non-structural and non-fireproof bricks and ceramics (number of enterprises, 7; number of employees, 327; annual sales, JD5,802,000; source: Department of Statistics).

In terms of sales, among the 81 subsectors of the industrial sector, manufacturing of non-structural and non-fireproof bricks and ceramics is in 55th place, a middle-to-low rank. About 0.2% of employees of the industrial sector are working for the subsector. In the subsector, the major manufacturers are medium and small-sized enterprises. Products of the subsectors account for 0.3% of

total exports from Jordan (source: Department of Statistics).

Therefore, the field is considered as a target subsector of the project, and testing equipment is planned for ceramics products, provided that the scale of the planned equipment corresponds to the size of the subsector. Categories of the tests are testing of quality of ceramics products.

Requests from enterprises and others for testing services which could not be provided with the existing equipment are as follows.

Table 2-71. BRC-Ceramic Unit - Unsatisfied Requests

Requested Services	Enterprises etc.	No. of request (2002, 2003)	Necessary Equipment
Heating test of ceramic tiles and fittings	JCC/ Jordan Ceramic Company	1	Requested item 5
Testing of imported ceramic products	JISM	always	Requested item 5

(Source: Answers to questionnaires to the Royal Scientific Society)

In addition, research of demands is conducted with questionnaires to enterprises during the field survey. Data in the answers to the questionnaires are arranged in the following table.

Table 2-72. BRC-Ceramic Unit - Demands on Testing Services (Answer to the Questionnaire)

Requested Services	Enterprises etc.	Expected Frequency	Necessary Equipment
Testing of sanitary ware	Jordan Ceramic Industries Co. Ltd.	5 /year	Requested item 5

Moreover, in addition to the questionnaire survey, requirements were confirmed when visiting enterprises during the field survey. Data from the visits are arranged in the following table.

Table 2-73. BRC-Ceramic Unit - Demands on Testing Services (Visiting Research)

Enterprises	Requested Services	Expected Frequency	Necessary Equipment
Jordan Ceramic Industries Co. Ltd.	Testing of sanitary ware, ceramic tiles, etc.	15 /year	Requested item 5

Expected frequency of the testing services is not many. However, each single test takes a long period of time, hence it is judged that there is sufficient demand in the subsector to equip the unit.

For the testing of sanitary ware, the necessary equipment is the Equipment and Accessories to Test Sanitary Ware. The tests performed are scratch test, heating test, surface test, etc., in accordance with the applicable standard (JS 1222).

Expected frequency of use is shown on the list below. It is expected that the major equipment will be frequently used.

Table 2-74. BRC-Ceramic Unit - Expected Frequency of Use

No.	Major Equipment	Frequency of Use		
		Times/day	Hours/time	Occupancy Rate
BRC- 5	Equipment and Accessories to Test Sanitary Ware	1	3	37.5%

For the above-mentioned requirements, the following equipment is planned for the project.

Table 2-75. BRC-Ceramic Unit - Planned Equipment

Purpose of Use	Planned Equipment
Testing of sanitary ware	Equipment and Accessories to Test Sanitary Ware 1 set

3) Building Components & Insulation Materials Unit

Industries in Jordan related to this unit are manufacturing of stone products (number of enterprises, 615; number of employees, 4,121; annual sales, JD36,048,000), manufacturing of concrete products (number of enterprises, 1,581; number of employees, 6,470; annual sales, JD 85,080,000; source for both, Department of Statistics).

In terms of sales, among the 81 subsectors of the industrial sector, manufacturing of stone products is in 30th place, manufacturing of concrete products is in 15th place, and total of the subsectors is in 8th place as a higher rank, which make them comparatively important fields. About 7.4% of employees of the industrial sector are working for the subsectors. In the subsectors, major manufacturers are medium and small-sized enterprises. Products of the subsectors account for 0.4% of total exports from Jordan (source: Department of Statistics).

Therefore, the fields are considered as target subsectors of the project, and testing equipment is planned for testing of stones and concrete building materials, and insulation materials, provided that the scale of the planned equipment corresponds to the size of the subsectors. Category of the test is insulation test.

Requests from enterprises and others for testing services which could not be provided with the existing equipment are as follows.

Table 2-76. BRC-Building Components & Insulation Materials Unit - Unsatisfied Requests

Requested Services	Enterprises etc.	No. of request (2002, 2003)	Necessary Equipment
Heat conductivity test of stones and concrete	SBE TEX Damascus, Syria	2	Requested item 3
Heat conductivity test of heavy and light materials	JISM	always	Requested item 3

(Source: Answers to questionnaires to the Royal Scientific Society)

In addition, research on requirements was conducted using questionnaires recovered from enterprises during the field survey. Data from the answers to the questionnaires are arranged in the following table.

Table 2-77. BRC-Building Components & Insulation Materials Unit - Demands on Testing Services
(Answer to the Questionnaire)

Requested Services	Enterprises etc.	Expected Frequency	Necessary Equipment
Insulation test of panels	Jordan Rock Wool Ind.	50 /year	Requested item 3

The item of the testing services is expected to be frequently required, and then it is judged that there are sufficient demands in the subsectors to equip the division.

For the insulation test, the necessary equipment is the Guarded Hot Plate Apparatus. It is used for the measurement of heat conductivity in accordance with the applicable standard (ASTM C177). This equipment can be utilized not only for testing of insulation materials but also but also for technology development and technical assistance to the enterprises.

Expected frequency of use is shown on the list below. It is expected that the major equipment will be frequently used.

Table 2-78. BRC-Building Components & Insulation Materials Unit - Expected Frequency of Use

No.	Major Equipment	Frequency of Use		
		Times/day	Hours/time	Occupancy Rate
BRC- 3	Guarded Hot Plate Apparatus	0.2	36	90.0%

For the abovementioned requirements, the following equipment is planned for the project.

Table 2-79. BRC-Building Components & Insulation Materials Unit - Planned Equipment

Purpose of Use	Planned Equipment
Insulation test	Guarded Hot Plate Apparatus 1 unit

(5) Environmental Research Center (ERC)

1) Chemical Testing Unit

Industries in Jordan related to this unit are production of non-alcoholic beverages (number of enterprises, 31; number of employees, 2,884; annual sales, JD76,598,800), oil and fat processing (number of enterprises, 96; number of employees, 1,273; annual sales, JD98,169,000), fruit and vegetable processing (number of enterprises, 19; number of employees, 853; annual sales, JD12,004,000; source for all: Department of Statistics).

In terms of sales, among the 81 subsectors of the industrial sector, production of non-alcoholic beverages is in 17th place, oil and fat processing is in 12th place, fruits and vegetables processing is in 43rd place, and total of the subsectors is in 6th place, a high rank. And, about 4.2% of employees, of the industrial sector are working for the subsectors. In the subsectors, most manufacturers are medium and small-sized enterprises. Products of the subsectors account for 3.9% of total exports from Jordan (source: Department of Statistics), hence the subsectors are important for Jordan for acquisition of foreign currency.

Therefore, the fields are considered as target subsectors of the project, and testing equipment is planned for testing (mainly detection of additives and residual agricultural chemicals) of beverages, oils and fats, processed fruits and vegetables. Categories of the tests are detection of cyanides, additives, PCB dioxin, etc. in foods.

Requests from enterprises and others for testing services which could not be provided with the existing equipment are as follows.

Table 2-80. ERC-Chemical Testing Unit - Unsatisfied Requests

Requested Services	Enterprises etc.	No. of request (2002, 2003)	Necessary Equipment
Detection of BrO ₃	Ghadeer, Ma'an	1	Requested item 2
Detection of Siouxen and PCB in foods	Ministries concerned	1	Requested items 3, 6, 7

(Source: Answers to questionnaires to the Royal Scientific Society)

In addition, research on requirements was conducted using questionnaires recovered from enterprises during the field survey. Data from the answers to the questionnaires are arranged in the following table.

Table 2-81. ERC-Chemical Testing Unit - Demands on Testing Services (Answer to the Questionnaire)

Requested Services	Enterprises etc.	Expected Frequency	Necessary Equipment
Detection of cyanides	Middle East Can Co.	12 /year	Requested item 1
Detection of food additives	Jordan Vegetable Oils Industries Co. Ltd.	20 /year	Requested items 3, 6, 7

For the detection of cyanides, food additives, PCB dioxin, etc., the necessary equipment is Multi stage Cyanide Distillation System. It is used for detection of cyanides in water and other beverages in accordance with the applicable standards (JS200, 286, 1214).

For the detection of additives, PCB dioxin, etc. in foods, the necessary equipment is the Gas Chromatograph. For microgram level detection, samples are concentrated by use of the Purge & Trap Concentrator and Rotary Evaporator System first, after that the Gas Chromatograph is used. In addition, for the detection of very small amounts of materials, an Electron Capture Detector (ECD) is necessary for the Gas Chromatograph. The existing Gas Chromatograph with ECD which was made in 1987 is too old and not usable.

Expected frequency of use is shown on the list below. It is expected that the major equipment will be frequently used.

Table 2-82. ERC-Chemical Testing Unit - Expected Frequency of Use

No.	Major Equipment	Frequency of Use		
		Times/day	Hours/time	Occupancy Rate
ERC- 6	Gas Chromatograph	3	1	37.5%

For the above-mentioned requirements, the following equipment is planned for the project.

Table 2-83. ERC-Chemical Testing Unit - Planned Equipment

Purpose of Use	Planned Equipment
Detection of cyanides	Multi stage Cyanide Distillation System 1 unit
Detection of additives, PCB dioxin, etc. in foods	Gas Chromatograph (with Purge & Trap Concentrator, and ECD) 1 unit, Rotary Evaporator System 1 unit

2) Microbiological Testing Unit

An industry related to this unit in Jordan is, the same as for the Paints, Lacquers & Solvents Laboratory of ICC, production of paints and inks (number of enterprises, 55; number of employees, 1,204; annual sales, JD48,993,000; source: Department of Statistics).

Therefore, the field is considered as a target subsector of the project, as same as the Paints, Lacquers & Solvents Laboratory, and testing equipment is planned for the products, i.e., paints and solvents, provided that the scale of the planned equipment corresponds to the size of the subsector. Categories of the tests in the Paints, Lacquers & Solvents Laboratory are physical and chemical testing of properties and characteristics of paints, solvents etc. On the other hand, testing field in this unit is antifungal test for paints.

Requests from enterprises and others for testing services which could not be provided with the existing equipment are as follows.

Table 2-84. ERC - Microbiological Testing Unit - Unsatisfied Requests

Requested Services	Enterprises etc.	No. of request (2002, 2003)	Necessary Equipment
Antifungal test of interior	Paint companies	2	Requested item 5
Antifungal test of interior	JISM	always	Requested item 5

(Source: Answers to questionnaires to the Royal Scientific Society)

Necessary equipment for the antifungal test is the Environmental Cabinet Assembly. The testing is conducted with a small test pieces, therefore, tabletop size equipment has been requested.

Expected frequency of use is shown on the list below. It is expected that the major equipment will be frequently used.

Table 2-85. ERC-Microbiological Testing Unit - Expected Frequency of Use

No.	Major Equipment	Frequency of Use		
		Times/day	Hours/time	Occupancy Rate
ERC- 5	Environmental Cabinet Assembly	1	24	300%

For the above-mentioned requirements, the following equipment is planned for the project.

Table 2-86. ERC-Microbiological Testing Unit - Planned Equipment

Purpose of Use	Planned Equipment
Antifungal test of paints	Environmental Cabinet Assembly 1 unit

3) Air Quality Measurements Unit

Industries in Jordan related to this unit are production of pharmaceuticals (number of enterprises, 25; number of employees, 3,922; annual sales, JD165,032,200), mining industry (number of enterprises, 6; number of employees, 6,514; annual sales, JD339,034,600), production of cement (number of enterprises, 4; number of employees, 1,889; annual sales, JD156,571,900)(source: Department of Statistics), and others.

In terms of sales, among the 81 subsectors of the industrial sector, production of pharmaceuticals is in 6th place, mining industry is in 2nd place, and production of cement is in 7th place, which are all high ranks. And, about 9.4% employees of the industrial sector are working for the subsectors, which are important fields.

Requests from enterprises and others for testing services which could not be provided with the existing equipment are as follows.

Table 2-87. ERC-Air Quality Measurements Unit - Unsatisfied Requests

Requested Services	Enterprises etc.	No. of request (2002, 2003)	Necessary Equipment
Analysis of heavy metals	Enterprises of cement and mining industries	Many	Requested item 16
VOC analysis of working environment	Enterprises of production of paints, oil refinery, etc.	Many	Requested item 11
Air pollution of working environment	Enterprises concerned	Many	Requested item 10
VOC and air pollution of working environment	JISM	always	Requested items 10, 11
Calibration of dust test	JISM	always	Requested item 15
Calibration of air pollution test	JISM	always	Requested item 14

(Source: Answers to questionnaires to the Royal Scientific Society)

To comply with the abovementioned requirements, a Precision Integrated Sound Level Meter/Noise Dosimeter, an Occupational Air Quality Portable Analyzer, an Occupational Volatile Organic Compounds (VOC's) Portable Analyzer, provision of up-to-date Windows Operation Software, a Continuous Fine Dust Monitor, a Dynamic Gas Calibration System, a Primary Roots Meter Calibrator, and a Fluorescent EDX have been requested.

In the above tables, it is found that the demands made of this unit are measurement of air quality of working environment and surrounding area of companies. The companies in Jordan are concerned about preservation of environment of work areas and surrounding areas of the companies. However, they have not been requested to conduct environmental measures by purchasers in domestic and export markets, therefore, it is not directly related to competitiveness of their products. In this project,

equipment which is related to the overall goal "increasing quality of Jordanian industrial products and increasing their competitiveness in export market and domestic market" is prioritized, and equipment for preservation of environment is not included in the planned equipment.

(6) Major Equipment

No.	Description	Major Specifications	Q'ty	Purpose of Use
NCL- A-1	Direct Voltage Reference Standard	10V/ 1.018V, accuracy 2 ppm	1	primary standard of DC voltage
NCL- A-2	Resistance Standards (complete set, all range)	1 Ω ~ 19 M Ω (1 Ω, 1.9 Ω, 10 Ω, 100 Ω, 1 kΩ, 10 kΩx4, 19 kΩ, 100 kΩ, 1 MΩ, 10 MΩ, 19 MΩ), Hamon resistor 1k, 100k, accuracy 1-4 ppm	1	primary standard of DC voltage, transfer standard (10 kΩ)
NCL- A-3	Direct Voltage Standard	10V/ 1.018V, accuracy 2 ppm	1	primary standard of DC, transfer standard
NCL- A-4	Oscilloscope Calibrator	DC: ~ 200 V,Sq. Wave: ~ 200 V, pk-pk timing marker:900.91ns, Levelled sine function: ~ 1.1 GHz, accuracy 0.05% to 0.25%	1	calibration of A-6,7,11,13, 18 and outside items
NCL- A-6	Digital Multimeter	DC 1000V/ 20A/20GΩ, AC 1000V/20A	1	working standard
NCL- A-11	1000A DC Current Source	1000A, accuracy 0.1% to 1%	1	testing of welding machine, circuit breaker, etc.
NCL- A-15	Microwave Frequency Counter	DC ~ 18GHz	1	RF system
NCL- A-19	Standard Capacitances (1pF - 1000pF, 4 kinds)	1pF, 10pF, 100pF, 1000pF each 1, accuracy ±0.03%	1	primary standard of capacitance
NCL- A-20	Decade Capacitor	100pF ~ 1000 μF	1	primary standard of capacitance
NCL- A-21	Standard Inductance (6 kinds)	100μ, 1m, 10m, 100m,1, 10H, accuracy 0.1-0.25%	1	primary standard of inductance
NCL- A-22	Global Positioning System with Time Interval Counter	1, 5, 10 MHz, 1pps	1	primary standard of frequency
NCL- A-24	Calibration Asset Track/Management Software	for calculating uncertainty, tracking, management	1	precise calibration and uncertainty evaluation
NCL- A-25	Multifunction Calibrator	DC 1000V/ 2,2 A/ 1 00 MΩ, AC 1100V/2.2 A, accuracy 3.5/35/8.5 ppm 45/120ppm	1	calibration of A-6 and outside items
NCL- B-1	Water Bath	~ 100 °C, dept. > 30cm, accuracy 0.1%	1	calibration of thermocouples
NCL- B-2	Fluid Bath	-35 ~ 150 °C, dept. > 30cm, accuracy 0.1%	1	
NCL- B-3	Fluid Bath	Ambient ~ 250 °C, dept. > 30cm, accuracy 0.1%	1	
NCL- B-4	Salt Bath	200°C ~ 500°C, dept. > 30cm,accuracy 0.1%	1	
NCL- B-7	Triple Point of Water Cell	0.01 °C, accuracy 0.0001°C	1	primary standard of temperature
NCL- B-9	Freezing Point of Indium Cell	156.5985 °C, accuracy: 0.5-1.0 mK	1	
NCL- B-11	Freezing Point of Aluminum Cell	660.323 °C, accuracy: 2.5-5.0 mK	1	
NCL- B-12	Freezing Point of Tin Cell	231.928 °C, accuracy: 0.7-1.4 mK	1	
NCL- B-14	Freezing Point of Copper Cell	1084.62 °C, accuracy: 7.0-15 mK	1	
NCL- B-15	Bath for Maintaining Triple Point of Water and Gallium Cells	-10°C ~ 110°C	1	for B-7
NCL- B-16	Bath for Maintaining Indium, Tin , Zinc and Aluminum Cells	100°C ~ 680°C	1	for B-9,11,12
NCL- B-17	Bath for Maintaining Silver and Copper Cells	400°C ~ 1100°C	1	for B-14
NCL- B-18a	Dry Block Calibrator	-25 ~ 140 °C depth > 30 cm, accuracy: 0.1/1 °C	1	calibration of dry block of pharmaceutical companies etc.
NCL- B-18b	Dry Block Calibrator	150 ~ 1200 °C depth > 30 cm, accuracy: 0.1/1 °C	1	
NCL- B-19	Spherical Furnace	~ 1200 °C, accuracy: 0.1/1°C	1	calibration of thermocouples of food, pharmaceutical, cosmetic companies
NCL- B-21	Humidity/Temperature Chamber	~ 200°C/ RH 100%, accuracy: 0.1%	1	calibration of humidity meter, recorder etc.
NCL- B-22b	Reference Standard Thermocouples and Resistance Thermometers	~ 420°C, accuracy: 0.001°C	1	calibration of B-23

No.	Description	Major Specifications	Q'ty	Purpose of Use
NCL- B-22c	Reference Standard Thermocouples and Resistance Thermometers	~ 1000°C, accuracy: 0.001°C	1	calibration of B-23
NCL- B-22d	Reference Standard Thermocouples and Resistance Thermometers	~ 1450°C, accuracy: 0.001°C	1	
NCL- B-24	Digital Precision Thermometers	-80°C to 1600°C, accuracy 0.001°C	1	calibration of furnace, oven, etc.
NCL- B-28	Cold Junction Comparison	0	1	comparison of thermocouples
NCL- C-1	Gauge Block Set (1-100mm)	1- 100 mm, Grade 00	1	primary standard
NCL- C-2	Gauge Block Set (125-500mm)	125mm- 500mm, Grade 00	1	
NCL- C-20	Dial Gauge Tester	100 mm, digital	1	calibration of dial gauge
NCL- C-27	Automatic Gauge Block Comparator	0.1 ~ 500 mm, accuracy: 0.1 µm	1	calibration with C-1 -4
NCL- C-29	Machine for calibration of length standards, steel rulers, etc.	1 ~ 2 m, accuracy: 1 µm	1	calibration of length standards, etc.
NCL- C-31	Special Gauge Block Set for vernier caliper with control ring for inner diameter and height calibration	ring gauge 23 kinds	1	calibration of inner and depth caliper
NCL- D-1	Weight Sets E1 Class with accessory kits	1mg ~ 10 kg, accuracy: E1	2	primary standard
NCL- D-2	Weight Sets E2 Class with accessory kits	1mg ~ 20 kg, accuracy: E2	2	working standard of mass for pharmaceutical production etc.
NCL- D-3	Weight Sets F1 Class with accessory kits	1mg ~ 60 kg, accuracy: F1	1	
NCL- D-6	Electronic Digital Balance (25kg) with table	25 kg, accuracy: 1mg	1	calibration of lower accurate weights
NCL- D-8	Digital Balance Comparator (5g) with table	5 g, accuracy: 0.1 µg	1	calibration of higher accurate weights
NCL- D-9	Digital Balance Comparator (300g) with table	300 g, accuracy: 10 µg	1	
NCL- D-10	Digital Balance Comparator (1200g) with table	1200 g, accuracy: 100 µg	1	
NCL- D-11	Digital Balance Comparator (10000g) with table	10000 g, accuracy: 100 µg	1	
NCL- D-12	Apparatus for Measuring Density of Weights with table	100g-2kg, 2kg-50kg each 1	1	calibration of weights
NCL- D-13	Apparatus for Measuring Magnetic Susceptibility of Weights with table	BIPM type, permanent magnet, PC, software	1	calibration of weights
NCL- E-1	Dead Weight Tester Complete with	Vacuum (-0.7bar) ~ 700 bar, accuracy: 0.001%	1	primary pressure system
NCL- F-2	Digital Force Read Out	2mv/v	2	reading of F-4 -9
NCL- F-3	Reference Standard Machine for Calibration of Load Cells	2000kN, hydraulic type	1	calibration of load cells
NCL- F-4	Load Cell / Compression & Tension	1kN	2	primary standard transfer standard
NCL- F-5	Load Cell / Compression & Tension	10kN	2	
NCL- F-6	Load Cell / Compression & Tension	50kN	2	
NCL- F-7	Load Cell / Compression & Tension	100kN	2	
NCL- F-8	Load Cell / Compression & Tension	500kN	2	
NCL- F-9	Load Cell / Compression	1000kN	2	
NCL- G-7	Standard Hydrometer	accuracy 0.1%	1	calibration of equipment for pharmaceutical, cosmetic companies etc.
ESTC- 1-8	Proof tracking test apparatus	100V, 175V, 400V or 600V	1	proof tracking test
ESTC- 1-9	IP Rating Test equipment	IPX1-8, with drip box, dust chamber etc.	1	IP rating test
ESTC- 1-14	Door endurance tester for microwave ovens	door open/close: 100,000 times or more, angle 135 deg. or more	1	door endurance test for microwave oven
ESTC- 1-15	Hot winding ohmmeter	0-450V ±1%, 0-20kΩ ±0.5%, 0-150	1	hot test
ESTC- 1-19	Torque tester for lamps	Lamp holder: variable, torque 0-400Ncm	1	Torque test for lamp
ESTC- 1-20	Life cycling tester for lamps	voltage:0-300V ±1%, with lamp sockets	1	Life cycling test for lamp
ESTC- 1-29	Test corner	board: 600×800mm or more	1	thermal test of electric appliances
ESTC- 3-1	Tumbling barrel	drum dia. : 500 mm, speed: 5rpm	1	mechanical test of plug
ESTC- 3-5	Apparatus for cord retention testing	load: 10N ~ 100N, with motor	1	cord retention testing
ESTC- 3-12	Apparatus for socket-outlets breaking capacity and normal operation test	50-60cm, pre-set: 100-10000, interval: 30-15 min.	1	socket-outlets breaking capacity

No.	Description	Major Specifications	Q'ty	Purpose of Use
ESTC- 3-13	Apparatus for flexing test	45°, cycle: 0.3 ~ 1Hz	1	flexing test of plug
ESTC- 3-24	Test apparatus for making and breaking capacity for switches	load amp.: within 16A, repeat: times x hour, roomtemp., with case	1	breaking capacity for switch
ESTC- 3-25	Conductor damage test set	disk: within 15mm, rotation: 10±2rpm	1	Conductor damage test
ESTC- 3-33	AC current source	AC230V50Hz,40A or more	1	AC current source for switch test
ESTC- 3-34	Inductive Loads:	core: 100mH,25A	1	power test of switch
ESTC- 4-3	50/60 Hz Frequency Converter	power: 220V60Hz, variable: 0.0005Hz	1	general testing
ESTC- 4-5	Temperature and Humidity Chamber	temp.: 10 ~ 60°, humidity: 10 ~ 95%, size: approx. 2x1.8x2m	1	high humidity, high temperature test
ESTC- 5-1	Temperature Chamber	capacity: 64L, -40 °C ~ +130 °C	1	thermal test for battery
ESTC- 5-2	Vibration Tester	vertical: 30 or 50m/s ² , load: 50kg, table: 500×500mm	1	vibration test for battery
ESTC- 5-3	High Rate Discharge Tester	discharge: 5-15V, current: variable, with timer	1	discharge test
ESTC- 5-4	Universal Battery Tester	3-channel, current: 50A, accuracy: 0.5%	1	performance test
ESTC- 5-5	Water Bath	temp.: 50, accuracy: ±1, size: 700x1500x180mm	1	keeping temperature
ESTC- 6-7	Oscilloscope	analog 1GHz, channel: 4	1	measuring signals
ESTC- 6-8	Softening temperature-testing equipment	pressure: 10N-0.1mm	1	high temperature test
ESTC- 6-19	Surge test generator	surge: 10kV, capacitance: 1nF	1	surge test
ESTC- 6-28	Full draught oven	120x100x100 cm	1	thermal test of TV sets
ESTC- 6-37	Video test signal generator	PAL,NTSC,SECAM	2	video test
ESTC- 6-38	Audio test signal generator	output: 0.5 V r.m.s/ 47 kΩ	1	audio test
ESTC- 6-41	Spectrum analyzer with digital frequency counting function	9kHz ~ 6GHz, with counter	1	frequency analysis
ESTC- 6-43	Video noise meter	PAL, NTSC, noise: luminance	1	video noise test
ESTC- 6-47	Television test modulator	1Vpp-75Ω, TV: B/G,D/K,L/L',I,M,N,K1	1	testing TV modulation
ESTC- 7-1	Short circuit current test set with all standard accessories	capacity: 15kA, 2kV	1	short circuit test
ESTC- 7-3	Glow wire test apparatus	750/650/550 - current (insulation)	1	flammable test
MDTC- 1-1	Universal testing machine	load cell 2 pcs (5000N, 15000N), rubber grip, plastic grip 12mm ~ 30 mm thickness	1	extending test of plastic
MDTC- 1-2	Melt flow indexer	range 80-300 manual and automatic	1	testing viscosity of materials
MDTC- 1-6	Computerized tensile film tester	~ 500 N, 900-1000 mm grip	1	Agricultural films, engineering films, etc.
MDTC- 1-7	Sample preparation machine	10,000-25,000 rpm	1	preparation of samples
MDTC- 2-1	Automated Universal tension/compression testing machine	1000 kN, grip interval 1000 mm	1	tensile and compression testing of pipes, bars, plates etc.
MDTC- 2-4	Impact testing machine	- 100 ~ 100 °C	1	impact testing of materials
MDTC- 4-1-1	Scanning Electron Microscope with X-ray Analyzer	x8-x300,000 AI qualitative analysis, resolution 6nm	1	elemental analysis, micro analysis of metal
MDTC- 4-1-2	CS Analyzer	accuracy 0.01ppm, time 30 - 60 sec.	1	CS analysis
MDTC- 4-2	Cutting Machine	cutting up to 90mm	1	sample preparation
MDTC- 4-3	Grinding and polishing machines	double wheel 1 unit, single wheel 1 unit	1	sample preparation

No.	Description	Major Specifications	Q'ty	Purpose of Use
MDTC- 4-4-1	Digital Universal Hardness Tester (Brinel, Vickers, and Rockwell)	29.42, 98.07N, sample size:205mmH x 150mmD	1	testing hardness
MDTC- 4-4-2	Mini-load hardness (Micro-hardness) tester (Vickers)	10,25,50,100,200,300,500,1000gf, 10x,40x	1	testing hardness
MDTC- 4-9	Electric Furnace	capacity 250L, temp. 100-1500	1	heat treatment
MDTC- 4-10	Salt Spray Cabinet	capacity 400L, temp. ~ 55	1	salt spray test
MDTC- 4-13	Automatic Mounting Press Machine for Sample preparation	pressure : 1200-4400psi, temp.: 150-180	1	molding metal parts
MDTC- 6-1	Directional X-Ray Machine for industrial radiography	200kv 8 mAMP, portable, with stand, PC data exchangeable	1	checking welding results for pressure vessels, tanks, checking casting products, etc.
MDTC- 6-3	Digital Ultrasonic Flow Detectors with probes	10 5000mm, 2000-999m/s	2	checking welding results for pressure vessels, tanks etc.
MDTC- 7-2	Gamma-Ray Spectroscopy Analysis Software	energy calibration, peak calibration, etc.	1	testing radioactive contamination of food, potash, salt, fertilizer, animal feed
MDTC- 7-3	Portable Gamma Spectroscopy System	efficiency:50, resolution: 0.85keV(122keV)	1	
MDTC- 7-5	Gross Alpha / Beta Counter	sensitivity: 1 cpm, range :2-2,000,000Bq/m3	1	testing water, juice
MDTC- 9-2	Induction Furnace	1600°C, 200 kg, crucible 2	1	development and consultation for casting
MDTC- 9-3	Mobile Sand Testing Laboratory for foundry industry	sieves, particle test, moisture test, soil test, with mobile	1	testing of sand
ICC- 1-1	Nu-Martindale Tester	sample: 1 ~ 6, pressure: 9 ~ 12kPa, rotation : 47.5±2.5rpm	1	Martindale abrasion test of textile
ICC- 1-2	Washing Machine	ISO 6330/1984, washing test	1	washing test of textile
ICC- 1-3	Steaming Cylinder with Steam Generator	ISO 3005, steaming test	1	steaming test of textile
ICC- 1-4	Air Permeability Tester of Paper	inner pressure : 567g±0.5g, air permeability: 25, 50, 75, 100, 150, 200, 250, 300, 350ml	1	testing of air permeability of paper
ICC- 1-6	Motor driven Water Penetration Tester	ISO 811, water penetration test	1	water penetration test of textile
ICC- 1-7	Reflectometer	150mm dia., Xe flash lamp	1	Determination of brightness etc. of paper
ICC- 1-8	Tensile Machine	0-100N load cell, accuracy 0.1 N, 0-5000N load cell, accuracy 1 N	1	tensile test of textile and paper
ICC- 2-1	Smoking Machine	16 channel, gas sampler, CO analyser	1	testing of quality of cigarettes
ICC- 2-2	Gas Chromatograph	with TCD, auto-sampler	1	analyzing water of filter of cigarettes
ICC- 3-1	Gas Chromatography/Mass Spectrometer (GC/MS)	resolution 5000, mass range M/2 1 ~ 1000 amu, EI, PCI, NCI	1	chemical analysis of food especially for unknown components
ICC- 3-2	Gas Chromatography/Flame Ionization Detector (GC/FID)	EPC: ~ 100psi temp.: 120 /min, detector: FID(200Hz)	1	testing of olive oil
ICC- 3-3	High Performance Liquid Chromatography (HPLC) (Semi-Preparative)	flow rate: 0.001 ~ 5ml/min (1.0 ~ 39.2Mpa), wave length: 190 ~ 900nm	1	analysis of organic compounds
ICC- 3-4	Automatic Kjeldahl Nitrogen Analyzer	with auto-sampler for 20 samples, automatic distillation and titration	1	Nitrogen analysis of food
ICC- 3-5	Milk Analyzer	speed: about 40 samples/h, range: fat: 0-40%, protein: 0 ~ 8%, lactose: 0-7%	1	analysis of milk
ICC- 3-6	Meat Analyzer	wave length: 850 ~ 1050nm, data: 100 points, absorption: 1 ~ 5AU	1	analysis of meet
ICC- 3-9	Amino Acid Analyzer	wave length: 0.5 ~ 5ml/min, pressure: 0 ~ 40MPa	1	Amino acid analysis
ICC- 3-10	Automatic Melting Point Apparatus	temp. range: room ~ 400 , control: PID	1	measuring melting point of fat

No.	Description	Major Specifications	Q'ty	Purpose of Use
ICC- 4-1	Lubricant Test Machine	according to ASTM D 2509 for Lubricating Greases, ASTM D 2782 for Lubricating fluids.	1	measurement of performance of lubricant
ICC- 4-2	Dielectric Breakdown Voltage of Insulating Liquids	Automatic high-voltage insulating oil test Appts, with arrange 0-100 Kv.	1	measurement of voltage of insulation
ICC- 4-3	Evaporating Loss of Lubricating Oils (Noack Test)	temp.: 150 ~ 350 , accuracy:±0.1	1	measurement of evaporating loss
ICC- 4-5	Determination of Vapor Pressure	1.8 bar, bath	1	measurement of vapor pressure
ICC- 4-6	Determination of Air Release Value	capacity: 14 L, flow: 10L/min	1	determination of air release value
ICC- 4-7	Demulsibility Characteristics	samples: 5, temp. range: 25 ~ 150	1	demulsibility characteristics
ICC- 4-9	Automatic Oxygen Bomb Calorimeter	range: 4000 ~ 32,000J, accuracy: ±80J, minimum: 10J	1	measurement of calorie
ICC- 4-10	Bench top XRF	method: fluorescent X-ray, range: 0 ~ 9.999%	1	determination of sulphur in oils
ICC- 5-1	Constant Climate Chamber	temp. 0° to 100C°, humidity 10 to 90 % R.H, capacity 720 L	1	testing of paints
ICC- 5-6	Superchroma Spectro-colorimeter	portable, range: 380nm x 780nm	1	measurement of color in factories
ICC- 6-1	Atomic Absorption Spectrophotometer	wave range: 190 ~ 900nm, slit: 0.1, 0.2, 0.5, 1.0, 2.0, 5.0nm (6 steps)	1	analysis of metal contents
ICC- 6-2	XRD – (X-Ray Diffractometer)	scanning dia. : 185mm, scanning angle: -6° ~ 163°(2θ), -180° ~ 180°(θ)	1	Analysis of potash, phosphate, magnesium
ICC- 6-3	Sequential Plasma Emission Spectrometer (ICP)	method: pulse, analog, pulse frequency: 10 ⁸ cps	1	chemical analysis of water elements, i.e. Mo, B, Pd etc.
ICC- 6-4	XRF- Sequential Spectrometer	250µm mapping capabilities, elements to be determined (Be to U), X-ray tube 4KW, Stability +/- 0.005%, Continuous-scanning speed: 0.1° to 300°/min., step scanning 0.002° to 1.0°, stopping position repeatability +/- 0.0004° Max. Counting linearity 1000Kcps for SC; 2000 Kcps for PC	1	elemental analysis of rocks metals alloys etc.
BRC- 2	Auto Test Compression/Flexural Machine	2000kN	1	compression and flexural test in cement & concrete unit
BRC- 3	Guarded Hot Plate Apparatus	46 x 46cm, 10cm thickness	1	testing of insulation, stone, bricks etc. in building components & insulation materials unit
BRC- 5	Equipment and Accessories to Test Sanitary Ware	autoclave pressure: 1000kPa	1	testing of sanitary ware in ceramics unit
BRC- 9	Water Permeability of Concrete	measurement of air and water permeability, air permeability: vacuum rate, water permeability	1	concrete impermeability of concrete in cement & concrete unit
ERC- 5	Environmental Cabinet Assembly	temp.: -40.0 ~ 180 , memory: 500	1	testing resistance to growth of mold on the surface of interior coatings
ERC- 6	Gas Chromatograph/Electron Capture Detector (GC/ECD)	detector: ECD, 2-channel (PTV and SP litless)	1	analysis of additives in foods micro g level in env. and organic lab.

(7) Procurement of equipment of the third-country origin

There is a possibility of the third-country origin for the equipment marked with " " in the column of "Reasons".

The reason for procurement of equipment of the third-country origin:

It is not produced in Japan.

It is produced in Japan, but it is necessary to consider products of third-country origin too in the interests of assuring competitive bidding.

It is produced in Japan, but there is no service agent in Jordan, for which reason sufficient maintenance would be difficult.

No.	Description	Quantity	Reasons		
NCL- A-1	Direct Voltage Reference Standard	1			
NCL- A-2	Resistance Standards (complete set, all range)	1			
NCL- A-3	Direct Voltage Standard	1			
NCL- A-4	Oscilloscope Calibrator	1			
NCL- A-5	DC Null Detector/ Ohm Meter	1			
NCL- A-6	Digital Multimeter	1			
NCL- A-8	Power Meter Calibrator	1			
(A-23)	Power sensor	1			
NCL- A-9	Power Supply	1			
NCL- A-10	High Voltage Digital Voltmeter	1			
(A-17)	High Voltage Probe	1			
NCL- A-11	1000A DC Current Source	1			
NCL- (A-12)	Current Probe	1			
NCL- A-14	High Voltage Source	1			
NCL- A-15	Microwave Frequency Counter	1			
NCL- A-18	Voltage Reference Divider (Scope Meter)	1			
NCL- A-19	Standard Capacitances (1pF - 1000pF, 4 kinds)	1			
NCL- A-20	Decade Capacitor	1			
NCL- A-21	Standard Inductance (6 kinds)	1			
NCL- A-22	Global Positioning System with Time Interval Counter	1			
NCL- A-24	Calibration Asset Track/Management Software	1			
NCL- A-25	Multifunction Calibrator	1			
NCL- B-1	Water Bath	1			
NCL- B-2	Fluid Bath	1			
NCL- B-3	Fluid Bath	1			
NCL- B-4	Salt Bath	1			
NCL- B-5	Ice Point Reference	1			
NCL- B-6	Ice Machine with Crusher	1	-	-	-
NCL- B-7	Triple Point of Water Cell	1			
NCL- B-9	Freezing Point of Indium Cell	1			
NCL- B-11	Freezing Point of Aluminum Cell	1			
NCL- B-12	Freezing Point of Tin Cell	1			
NCL- B-14	Freezing Point of Copper Cell	1			
NCL- B-15	Bath for Maintaining Triple Point of Water and Gallium Cells	1			
NCL- B-16	Bath for Maintaining Indium, Tin , Zinc and Aluminum Cells	1			
NCL- B-17	Bath for Maintaining Silver and Copper Cells	1			
NCL- B-18	Dry Block Calibrator	1			
NCL- B-19	Spherical Furnace	1			
NCL- B-20	Humidity/Temperature Recorder	1			
NCL- B-21	Humidity/Temperature Chamber	1			
NCL- B-22	Reference Standard Thermocouples and Resistance Thermometers	1			
NCL- B-23	Working Standard Thermocouples and Resistance Thermometers	1			
NCL- B-24	Digital Precision Thermometers	1			
NCL- B-25	Liquid In Glass Thermometers	10			
NCL- B-27	Clamps for holding thermometers and thermocouples	10			
NCL- B-28	Cold Junction Comparison	1			
NCL- B-29	Multiplexer Selector Switch	1			
NCL- C-1	Gauge Block Set (1-100mm)	1			
NCL- C-2	Gauge Block Set (125-500mm)	1			
NCL- C-3	Gauge Block Set (0-5 inch)	1			
NCL- C-4	Gauge Block Set (5-20 inch)	1			
NCL- C-5	Angle Block Set (0-360°)	2			
NCL- C-6	Gauge Block Accessory Kit	1			
(C-25)	Maintenance Kit for gauge blocks	1			
NCL- C-7	Caliper checker	2			
NCL- C-8	Inside Micro Checker	2			
NCL- C-9	Depth Micro Checker	2			
NCL- C-12	Black Granite Surface Plate and Tables	1			

No.	Description	Quantity	Reasons		
NCL- C-16	Bore Gauges	2			
NCL- C-20	Dial Gauge Tester	1			
NCL- C-21	Precision Level	1			
NCL- C-22	Granite Comparator Stand	2			
NCL- C-24	Edge Scale for measurement of parallelism of vernier calipers	2			
NCL- C-26	Linear Scale (up to one meter steel)	2			
NCL- C-27	Automatic Gauge Block Comparator	1			
NCL- C-29	Machine for calibration of length standards, steel rulers, etc.	1			
NCL- C-31	Special Gauge Block Set for vernier caliper with control ring for inner diameter and height calibration	1			
NCL- C-32	Plate for tempering gauge blocks	2			
NCL- D-1	Weight Sets E1 Class with accessory kits	2			
NCL- D-2	Weight Sets E2 Class with accessory kits	2			
NCL- D-3	Weight Sets F1 Class with accessory kits	1			
NCL- D-4	Weight Sets M1 Class with accessory kits	1			
NCL- D-5	Electronic Digital Balance (200g) with table	1			
NCL- D-6	Electronic Digital Balance (25kg) with table	1			
NCL- D-7	Electronic Digital Balance (60kg) with table	1			
NCL- D-8	Digital Balance Comparator (5g) with table	1			
NCL- D-9	Digital Balance Comparator (300g) with table	1			
NCL- D-10	Digital Balance Comparator (1200g) with table	1			
NCL- D-11	Digital Balance Comparator (10000g) with table	1			
NCL- D-12	Apparatus for Measuring Density of Weights with table	1			
NCL- D-13	Apparatus for Measuring Magnetic Susceptibility of Weights with table	1			
NCL- D-14	Desiccator	1	-	-	-
NCL- D-16	Humidity Controlled Cabinets	1	-	-	-
NCL- E-1	Dead Weight Tester Complete with	1			
NCL- E-2	Low and High Range Pressure Piston and				
NCL- E-3	Weight Set high range 20-700 bar	1			
NCL- E-4	Precision Pressure Gauge	2	-	-	-
NCL- E-5	Hydraulic Digital Pressure Calibrators (Fluid and Air)	1			
NCL- E-6	Vacuum Pump	1	-	-	-
NCL- E-7	Vacuum Meter	1	-	-	-
NCL- E-9	Barometer	1	-	-	-
NCL- F-2	Digital Force Read Out	2			
NCL- F-3	Reference Standard Machine for Calibration of Load Cells	1			
NCL- F-4	Load Cell / Compression & Tension	2			
NCL- F-5	Load Cell / Compression & Tension	2			
NCL- F-6	Load Cell / Compression & Tension	2			
NCL- F-7	Load Cell / Compression & Tension	2			
NCL- F-8	Load Cell / Compression & Tension	2			
NCL- F-9	Load Cell / Compression	2			
NCL- F-11-A	Torque Calibration System	1	-	-	-
NCL- F-11-B	Torque Transducer Calibration System	1	-	-	-
NCL- G-1	Weighing Machine	1			
NCL- G-2	Balance	1			
NCL- G-3	Standard Flask	1	-	-	-
NCL- G-4	Standard Pipette	1	-	-	-
NCL- G-5	Standard Burette	1	-	-	-
NCL- G-7	Standard Hydrometer	1	-	-	-
NCL- G-8	Specific Gravity Meter	1	-	-	-
NCL- G-9	Temperature Bath	1			
NCL- G-10	Water Distillation Apparatus	1	-	-	-
NCL- G-13	Dry Oven	1	-	-	-
NCL- G-14	Pycnometer	1	-	-	-
NCL- G-16	Hydrometer	1	-	-	-
NCL- G-17	Desiccator	1	-	-	-
NCL- H-1a	Reference Standard and Working Flow Meters (Fluid)	2			
NCL- H-1b	Reference Standard and Working Flow Meters (Fluid)	2			
NCL- H-1c	Reference Standard and Working Flow Meters (Fluid)	2			
NCL- H-2a	Reference Standard and Working Flow Meters (Air)	2			
NCL- H-2b	Reference Standard and Working Flow Meters (Air)	2			
NCL- J-1	Reference Standard and Working Luxmeters	2	-	-	-
NCL- J-2b	Reference Standard and working UV-meter	2			
ESTC- 1-1	Insulation and breakdown tester	1	-	-	-
ESTC- 1-2	Leakage current meter	2			
ESTC- 1-3	Ball pressure test set	1			

No.	Description	Quantity	Reasons		
ESTC- 1-4	Spring operated impact hammer	2			
ESTC- 1-5	Needle flame test apparatus	1			
ESTC- 1-6	Water pressure apparatus	1	-	-	-
ESTC- 1-7	Heating cabinet	1	-	-	-
ESTC- 1-8	Proof tracking test apparatus	1			
ESTC- 1-9	IP Rating Test equipment	1			
ESTC- 1-10	Creepage Gauge set	1			
ESTC- 1-13	High frequency power supply	1	-	-	-
ESTC- 1-14	Door endurance tester for microwave ovens	1			
ESTC- 1-15	Hot winding ohmmeter	1	-	-	-
ESTC- 1-17	Digital Power Meter	1			
ESTC- 1-19	Torque tester for lamps	1			
ESTC- 1-20	Life cycling tester for lamps	1			
ESTC- 1-21	- Rigid Test finger with Force meter	1			
	- Test Pin	1			
	- Test Nail	1			
	- Test probe	1			
	- Jointed Test Finger with Guard	1			
ESTC- 1-22	Variable transformers	1	-	-	-
ESTC- 1-23	Resistance Battery	1			
ESTC- 1-24	Surface resistivity meter	1	-	-	-
ESTC- 1-27	RCL Meter	1			
ESTC- 1-29	Test corner	1			
ESTC- 2-2	Circular blade crosscut tester	1			
ESTC- 2-3	Steam pressure measuring apparatus	1	-	-	-
ESTC- 2-4	Apparatus for measuring temperature drop under load	1			
ESTC- 2-5	Test apparatus for total steaming time	1			
ESTC- 2-6	Digital Thermometer with recording option	2	-	-	-
ESTC- 3-1	Tumbling barrel	1			
ESTC- 3-2 (3-3) (3-9)	Pendulum impact test apparatus-mechanism	1			
	Mounting device for impact test	1			
	Pendulum impact test apparatus-polyamide hammer	1			
ESTC- 3-4	Apparatus for checking the withdrawal force	1			
ESTC- 3-5	Apparatus for cord retention testing	1			
ESTC- 3-6	Impact Weight Apparatus with:	1			
	- Intermediate Piece for Low Temperature Test	1			
	- Intermediate piece for Pin Insulating Sleeves	1			
	- Falling Weight 1000g	1			
	- Falling Weight 100 g	1			
ESTC- 3-12	Apparatus for socket-outlets breaking capacity and normal operation test	1			
ESTC- 3-13	Apparatus for flexing test	1			
ESTC- 3-14	Device for testing non-solid pins	1			
ESTC- 3-16	Apparatus for plug pin abrasion test	1			
ESTC- 3-20	Device for checking the resistance to lateral strain	1			
ESTC- 3-21	4-step double programmable timer	1			
ESTC- 3-22	Programmable off switching counter	1			
ESTC- 3-23	Pneumatic drive unit	2			
ESTC- 3-24	Test apparatus for making and breaking capacity for switches	1			
ESTC- 3-25	Conductor damage test set	1			
ESTC- 3-32	Apparatus for compression test for verification of resistance to heat	1			
ESTC- 3-33	AC current source	1	-	-	-
ESTC- 3-34	Inductive Loads:				
	- Air core inductor 100 mH, 25 A	1			
	- Air core inductor I _{max} 63 A, cos ϕ max 0.6	1			
	Resistive Loads:				
	- Resistance Battery 10 kW	1			
ESTC- 4-1	Multi-Channel Temperature Logger (PC Based Data Acquisition) with PC and software.	2	-	-	-
ESTC- 4-3	50/60 Hz Frequency Converter	1			
ESTC- 4-4	Digital kWh Meter	2	-	-	-
ESTC- 4-5	Temperature and Humidity Chamber	1			
ESTC- 4-6	Water Evaporation Apparatus	1			
ESTC- 5-1	Temperature Chamber	1			
ESTC- 5-2	Vibration Tester	1	-	-	-
ESTC- 5-3	High Rate Discharge Tester	1			
ESTC- 5-4	Universal Battery Tester	1			
ESTC- 5-5	Water Bath	1			

No.	Description	Quantity	Reasons		
ESTC- 6-2	Several special equipment for laser classification	1	-	-	-
ESTC- 6-3	Temperature recorder (multi-channel) with thermocouples	2	-	-	-
ESTC- 6-7	Oscilloscope	1			
ESTC- 6-8	Softening temperature-testing equipment	1	-	-	-
ESTC- 6-9	Discharge meter	1	-	-	-
ESTC- 6-10	Test finger (Test probe B of IEC 61032)	1			
ESTC- 6-11	Test pin (Test probe 13 of IEC 61032)	1			
ESTC- 6-12	Test pin (Diameter 4 mm , length 100 mm)	1			
ESTC- 6-13	Test pin (Test probe 16 of IEC 61032)	1			
ESTC- 6-14	Straight test probe (Test probe D of IEC 61032)	1			
ESTC- 6-15 (6-36)	Test probe C of IEC 61032	1			
	Test probe	1			
ESTC- 6-16	Test hook (Fig 4 , 180 mm by 5 mm by 8 mm)	1			
ESTC- 6-17	Rigid test finger (Test probe 11 of IEC 61032)	1			
ESTC- 6-18	Test tool	1			
ESTC- 6-19	Surge test generator	1			
ESTC- 6-20	Dielectric strength tester	1	-	-	-
ESTC- 6-21	Dielectric strength for sheet material test instrument	1			
ESTC- 6-27	Microscope	1			
ESTC- 6-28	Full draught oven	1			
ESTC- 6-37	Video test signal generator	2			
ESTC- 6-38	Audio test signal generator	1			
ESTC- 6-40	RF signal generator	1			
ESTC- 6-41	Spectrum analyzer with digital frequency counting function	1			
ESTC- 6-43	Video noise meter	1	-	-	-
ESTC- 6-44	Vectorscope	1			
ESTC- 6-45	Audio level / distortion meter	1			
ESTC- 6-46	Passive devices	1			
ESTC- 6-47	Television test modulator	1			
ESTC- 6-50	Luminance meter and colorimeter with telescopic lens	1	-	-	-
ESTC- 7-1	Short circuit current test set with all standard accessories	1			
ESTC- 7-2	Mechanical shock test apparatus	1			
ESTC- 7-3	Glow wire test apparatus	1			
MDTC- 1-1	Universal testing machine	1	-	-	-
MDTC- 1-2	Melt flow indexer	1			
MDTC- 1-3	Analytical balance	1			
MDTC- 1-6	Computerized tensile film tester	1	-	-	-
MDTC- 1-7	Sample preparation machine	1	-	-	-
MDTC- 1-9	Punch dies for plastic tensile samples	3			
MDTC- 2-1	Automated Universal tension/compression testing machine	1	-	-	-
MDTC- 2-2	Analytical balance	1			
MDTC- 2-3	Thermocouple	1	-	-	-
MDTC- 2-4	Impact testing machine	1	-	-	-
MDTC- 3-1	Digital height master	1			
MDTC- 3-5	Calibrated steel balls	1			
MDTC- 3-9	Digital balance	1			
MDTC- 3-10	Digital balance	1			
MDTC- 3-11	Digital balance	1			
MDTC- 3-12	Ultrasonic thickness gauge (10mm)	1			
MDTC- 3-14	Coating and oxidation thickness gauge	1			
MDTC- 4-1-1	Scanning Electron Microscope with X-ray Analyzer	1			
MDTC- 4-1-2	CS Analyzer	1	-	-	-
MDTC- 4-2	Cutting Machine	1			
MDTC- 4-3	Grinding and polishing machines				
4-3-1	- Grinding: using twin wheel machine	1			
4-3-2	- Polishing: single wheel machine.	1			
MDTC- 4-4-1	Digital Universal Hardness Tester (Brinel, Vickers, and Rockwell)	1			
MDTC- 4-4-2	Mini-load hardness (Micro-hardness) tester (Vickers)	1			
MDTC- 4-5	Portable Spectrometer	1	-	-	-
MDTC- 4-7	Universal Hardness Tester References Blocks	1			
MDTC- 4-8	Electronic Balance	1			
MDTC- 4-9	Electric Furnace	1	-	-	-
MDTC- 4-10	Salt Spray Cabinet	1			
MDTC- 4-13	Automatic Mounting Press Machine for Sample preparation	1			
MDTC- 4-14	Lacquer Thickness Measurement	1			
MDTC- 6-1	Directional X-Ray Machine for industrial radiography	1			
MDTC- 6-3	Digital Ultrasonic Flow Detectors with probes	2			

No.	Description	Quantity	Reasons		
MDTC- 6-4	Digital Ultrasonic Thickness Gauge	1	-	-	-
MDTC- 7-2	Gamma-Ray Spectroscopy Analysis Software	1			
MDTC- 7-3	Portable Gamma Spectroscopy System	1			
MDTC- 7-5	Gross Alpha / Beta Counter	1			
MDTC- 9-1	Portable Hardness Tester	1	-	-	-
MDTC- 9-2	Induction Furnace	1			
MDTC- 9-3	Mobile Sand Testing Laboratory for foundry industry	1			
ICC- 1-1	Nu-Martindale Tester	1			
ICC- 1-2	Washing Machine	1			
ICC- 1-3	Steaming Cylinder with Steam Generator	1			
ICC- 1-4	Air Permeability Tester of Paper	1	-	-	-
ICC- 1-5	Driven Precision Yarn Reel Instrument	1			
ICC- 1-6	Motor driven Water Penetration Tester	1			
ICC- 1-7	Reflectometer	1	-	-	-
ICC- 1-8	Tensile Machine	1	-	-	-
ICC- 2-1	Smoking Machine	1			
ICC- 2-2	Gas Chromatograph	1			
ICC- 3-1	Gas Chromatography/Mass Spectrometer (GC/MS)	1			
ICC- 3-2	Gas Chromatography/Flame Ionization Detector (GC/FID)	1			
ICC- 3-3	High Performance Liquid Chromatography (HPLC) (Semi-Preparative)	1			
ICC- 3-4	Automatic Kjeldahl Nitrogen Analyzer	1			
ICC- 3-5	Milk Analyzer	1			
ICC- 3-6	Meat Analyzer	1			
ICC- 3-7	Polarimeter	1	-	-	-
ICC- 3-8	Titration Apparatus	1			
ICC- 3-9	Amino Acid Analyzer	1			
ICC- 3-10	Automatic Melting Point Apparatus	1			
ICC- 3-11	Moisture Meter	1	-	-	-
ICC- 3-12	Density Meter	1	-	-	-
ICC- 3-13	Muffle Furnace	1	-	-	-
ICC- 3-14	pH/Ion Meter	1	-	-	-
ICC- 4-1	Lubricant Test Machine	1			
ICC- 4-2	Dielectric Breakdown Voltage of Insulating Liquids	1			
ICC- 4-3	Evaporating Loss of Lubricating Oils (Noack Test)	1			
ICC- 4-5	Determination of Vapor Pressure	1			
ICC- 4-6	Determination of Air Release Value	1			
ICC- 4-7	Demulsibility Characteristics	1			
ICC- 4-8	Rapid Flash Point Tester	1			
ICC- 4-9	Automatic Oxygen Bomb Calorimeter	1			
ICC- 4-10	Bench top XRF	1			
ICC- 5-1	Constant Climate Chamber	1			
ICC- 5-2	Cone and Plate Viscometer	1			
ICC- 5-3	Digital Constant Temperature Bath/Circulator & Cooler	1			
ICC- 5-4	Drying Time Recorder & Film Applicator	1			
ICC- 5-6	Superchroma Spectro-colorimeter	1			
ICC- 6-1	Atomic Absorption Spectrophotometer	1	-	-	-
ICC- 6-2	XRD – (X-Ray Diffractometer)	1	-	-	-
ICC- 6-3	Sequential Plasma Emission Spectrometer (ICP)	1	-	-	-
ICC- 6-4	XRF- Sequential Spectrometer	1	-	-	-
BRC- 2	Auto Test Compression/Flexural Machine	1			
BRC- 3	Guarded Hot Plate Apparatus	1			
BRC- 5	Equipment and Accessories to Test Sanitary Ware	1			
BRC- 8	Non-Destructive Ultrasonic testing device	1			
BRC- 9	Water Permeability of Concrete	1			
ERC- 1	Multi stage Cyanide Distillation System	1	-	-	-
ERC- 5	Environmental Cabinet Assembly	1	-	-	-
ERC- 6	Gas Chromatograph/Electron Capture Detector (GC/ECD)	1			
ERC- 7	Rotary Evaporator System	1			