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ESTABLISHMENT OF AN ELECTRONIC SERVICE AND TRAINING CENTRE,
RAMNAGAR, U.P.

DP/IND/85/062

INDIA

Technical report: Testing and Quality Control of Electronic Products
and Components in the ESTC at Ramnagar*

Prepared for the Government of India
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of T.P. O'Connor
Expert in Testing, Quality and Reliability

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United Nations Industrial Development Organization
Vienna

32/3

* This document has not been edited.

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Introduction

1.1. General

The establishment of the Electronic Service and Training Centre (ESTC) at Ramnagar, U.P. is an extremely ambitious undertaking. It is a radical idea which requires full support from all interested parties to ensure the success of the project.

This author agrees with and supports the views of W. Bosshart - Expert in PCB Design Technology - as stated in section 1.1. - report of his work in Ramnagar (May 1988) Ref. V88-26887.

1.2 Consultants Mission

The duration of the Consultant's mission is two-and-a-half months in split missions. Duties are -

- (a) Check with and advise project authorities on the work plan for setting up testing and quality control facilities within the project.
- (b) Advise project authorities on the types of equipment required.
- (c) Assist project authorities in selection of candidates for training abroad and advise possible suitable places for the training.
- (d) Prepare training materials and syllabi.
- (e) Train project personnel dealing with testing and quality control.
- (f) Provide advisory services to complex industrialists on methods for Quality Control and testing and set up procedures and methodologies for testing samples received from complex industrialists.
- (g) Prepare a detailed report on each split mission, reflecting the course and results for the field assignments especially in view of specific conclusions and recommendations for follow-up activities.

Comment

Since this was the Consultant's first mission of 15 days, and because of the current status of the project, it was decided to concentrate on items (a), (b), (c), (d) and (g). On subsequent missions, items (e) and (f) will be considered as well as providing more detail for (d).

2. Mission Schedule, Activities and Observations

2.1 Schedule and Activities

Date

25/7/88 Travel Dublin to Vienna.

26/7/88 Briefing at UNIDO Headquarters with the following -

Ms. Sippi Mrs. Phantakul

Mr. A. Hadeiba Briefing Co'ordinator

Mr. Fürkus Mr. Chanana

Copies of all experts reports, who have been on mission to Ramnagar, were provided.

27/7/88 Travel to Delhi - arrived 28/7/88.

28/7/88 Briefing at UNDP, Delhi with the following -

Mrs. Sukuntha Mr. M. Islam

Mr. Ramachandran Dr. P.K. Gupta - Director(Technical) ESTC

29/7/88 Depart UNDP office with Dr. P.K. Gupta for Ramnagar. Attempted to visit Electrical Test Laboratory in Delhi but without success.

30/7/88 ESTC Ramnagar, U.P.

Meeting with Principal Director, Director - Training, Director - Technical and V.K. Gupta.

Visited all Laboratories, Training Room, Workshops etc. at ESTC. Discussions on Equipment, and Training courses to be offered by ESTC.

31/7/88 Sunday - Work in Tourist Bungalow on -

Quality Training Courses, Environmental Test Equipment and additional equipment.

1/8/88 Review of equipment lists with Principal Director, Director - Technical and V.K. Gupta. Considered lay-out of Testing, Quality Control and Reliability Laboratory.

2/8/88 Further consideration of Laboratory lay-out, Furniture details and Facilities.

Discussion with Director - Technical on Services to be offered by ESTC, and Overseas Training for Project staff.

3/8/88 Review of work to date with Principal Director and Director - Technical. Discussion on Laboratory Facilities and Report writing. Brief discussion on Programme plan.

- 4/8/88 Programme plan discussions with Director-Technical.
Report writing.
- 5/8/88 Review with Principal Director and Director-Technical
Depart for Delhi.
- 6/8/88 Work on Report in Hotel, Delhi.
Depart for Airport at 10.30 p.m.
- 7/8/88 Travel Delhi to Frankfurt and Vienna.
- 8/8/88 Debriefing at UNIDO Vienna with -
Ms. M. Sippl Mr. A Hadieba
Mrs. Pinnggera Mr. Seidl
Ms. H. Zeilmayer
Travel Vienna - Dublin.

3. Training Courses at ESTC.

3.1 Review of Training Proposals

The Director - Training, Mr. N.N. Bhargava, had prepared the following course material -

(a) Short Course - Testing and Calibration of Laboratory Equipment - 2 weeks

(b) Three Month Course - Testing and Quality Control

(a) The Short Course was well prepared and thought out. Minor changes were suggested -

- Include operating modes of Cathode Ray Oscilloscope(CRO) for AC and DC measurements.

- Delete section on Common Mode and Differential Y input connections, because of complexity.

- Practical demonstrations are essential to back up theory.

- Concentrate on teaching the Basics as too much detail will cause confusion.

(b) The Three Month Course covers in far more detail the same subject matter as (a) and in addition includes several more advanced topics. However, the subject of Quality is not treated at all.

Following discussions with the Director - Training and Director - Technical, it was decided to -

* Change title of Course to "Testing Maintenance and Repair".

* Add the following topics - Logic Gates and Truth Tables.

Semiconductor characteristics using a Curve Tracer and non-interruptible Power Supplies.

* Reduce Content on Oscillators.

* Delete section on Principles of Communication Systems.

* Add lectures (2 maximum) on Quality and Testing. Details are as follows -

Objective is to show the importance of Testing to Quality and explain why Quality is vital to all functions of an organisation.

Topics/Syllabus

- Quality - Conformance to Standards
- What Quality is NOT?
- Responsibility for Quality
- Concept of Total Quality
- Quality is Free - Non Quality costs!
- Why Testing is vital to Quality

3.2 A third course (Short Course 2/3 weeks) is suggested.
Outline subject matter is as follows -

Objective - To introduce Modern Concepts of Quality to staff whose main work is in the Quality Department.

- What is Quality?
- Who is responsible for Quality?
- Organisation for Quality
- Quality Department Functions
- Cost of Quality
- Quality Improvement Programmes
- Reliability
- Quality Procedures
- Quality Management Systems ISO - 9000 Standard
- Safety Standards

Comment

This course will be applicable to all Industries (Engineering, Electronics, Chemical etc.). Practical work will involve case studies in the industry of the participants.

4. Testing and Calibration Equipment

4.1 UNDP List - Review

Most of the Testing and Calibration equipment on this list has been ordered, received or cancelled. However, specific comments are made on the following items -

- Ref. 2/86-1 200 MHz scope. ESTC staff do not know the status of this item. Order should be cancelled and replaced by suggestion (d) in 4-3 (below).
- Ref. 2/86-7 DVM 4½ Digits. This item was cancelled by Dr. Hadidy but the opinion of this Expert is that it is required and hence should be ordered.
- Ref. 2/86-18 Static Work Benches. An error has occurred in this order as the items received are "Black & Decker Workmates" and not Static Work Benches.

4.2 G.O.I. List Review

All Testing and Calibration equipment items were considered acceptable.

4.3 Additional Equipment

Following discussions with the Director Principal, Director - Training and V.K. Gupta, the following additional equipment items are recommended -

- * (a) Chart Recorder
- * (b) Sets of Power Rheostats
- * (c) Line Interference Generator

4.3 Continued/-

- * (d) Fluke Calibrator
- * (e) Single Phase Watt Meters
- * (f) Curve Tracer
- * (g) Range of Mercury in glass Precision Thermometers
- * (h) Phase Meter

4.4. Environmental Test Laboratory

- (i) Hot/Cold Humidity Chamber - 1 cubic metre capacity
- (j) Vibration Rig with Vertical and Horizontal capability
- (k) Thermal Chamber
- (l) Shock/Bump Test Rig

Comment

Items (i) through (l) above are basic test equipment for the Environmental Test Laboratory. Depending on the Test requirements of Complex Industrialists and the requirements of Indian Standards the following equipment should be considered for future (i.e 2 years) investment -

- (m) Water Spray/Salt Spray Rigs
- (n) Dust/Sand Spray
- (o) Life Test Rigs

Note Appendix 2 gives details of the equipment listed above.

5. Layout of Testing, Calibration and Q.A. Laboratory

Discussions were held with the Director-Technical and V.K. Gupta, on possible layouts of the Laboratory. Two layouts were considered and following this, a third layout has been developed which is shown on the following page.

The overall dimensions of the Laboratory are 11m x 14.4m. Air Conditioning is required and expert opinion should be sought on this matter. It is likely that insulation will be required on all outside walls, and double glazing on windows.

Comments on Layout

- The Benches can be made up in 2m and 1m modules
- Bench details are given in Appendix 1
- At the end of each Bench ("X" on Layout Diagram) there is an Emergency Isolation Switch which interrupts all power sockets on that Bench. In addition, Earth Leakage Circuit Breakers(ELCB) are installed on both Stabilised and non-Stabilised power sockets.
- Three Phase Electrical Supply should be available at one point on each row of benches.
- Separation between Benches is 3m or 2m. The 3m separation allows testing of physically large pieces of equipment.
- The Bench allocated for Calibration purposes should have a Ground Strap on its entire length.
- The maximum load for the entire Laboratory is 20kVA. This gives adequate provision for future expansion.
- Adequate space is provided for filing cabinets and storage cabinets.
- The main entrance is 2m wide. It is advisable to consider increasing this to 2.5m or 3m.

6. Training of Project Personnel

There are three distinct requirements -

- Training in Electrical, Electronic and Environmental Testing.
- Training in Calibration
- Training in Quality

Training abroad is recommended, but this is expensive and consequently the project authorities must ensure that the best results possible are obtained from training abroad. It is suggested therefore, that before a trainee goes abroad he should be familiar with the subject matter of training. Consequently the trainee is recommended to do some study - as given below and attend an Indian Test and/or Calibration Lab for some weeks, before going abroad for training.

Note: The mention of an Organisation in Ireland as being suitable for training does not commit that Organisation in any way. Agreement will have to be reached between any training organisation in Ireland and UNIDO/ESTC before training can take place.

6.1 Electronic, Electrical and Environmental Testing

Prerequisites for training abroad are as follows -

- (a) Familiarity with Testing of Power Supplies or Modules to IEC Standard.
- (b) Knowledge of at least three IEC Standards and their application.
- (c) Training period in an Electrical Test Laboratory in India.
- (d) Degree in Electrical Engineering, Electronic Engineering or Physics (with Electronics speciality).

A suitable place for training abroad is -

The National Electrical Test House(NETH)
Irish Science and Technology Agency - EOLAS
Glasnevin, Dublin 9.

Telephone - 353-1-370101 Telex - 32501 OLAS EI FAX 353-1-379620

The NETH is the nationally approved Electrical Test House for the Irish Government. It is also recognised internationally as the equivalent of other European Test Houses such as BSI - U.K., KEMA - N.L., VDE - F.R.G. etc. etc.

The period of training in NETH should not be greater than one month.

6.2. Calibration Training

Prerequisites for training abroad are -

- (a) Familiarity with the principles of Metrology - the Science of Precision Measurement.
- (b) Degree in Physics or as an alternative, a degree in Electrical or Electronic Engineering.

6.2. Continued/-

(c) Knowledge of the Fluke Calibrator is desirable.

Training in Calibration for ESTC Personnel will be basic because of the calibration needs of ESTC. It will involve Voltage, Current, Resistance, Time, Frequency and Temperature.

A suitable place for training abroad is -

The Metrology Laboratory of EOLAS(as in 6.1).

A period of 2 to 3 weeks should be sufficient. The training course will be laboratory based but one or two lectures will be given on Measurements and Reference Standards.

6.3. Quality Training

Prerequisite is a degree in a scientific subject. Training in Quality could be accomplished in a number of different organisations in Ireland. (Details to follow)

However practical training in the implementation of Quality Management Systems in companies is not possible because of reasons of confidentiality and of time.

6.4. Timing of Training

The completion of the Testing, Calibration and Quality Laboratory is key to the scheduling of the courses discussed above. It is strongly recommended that training abroad should only be undertaken when the Laboratory is completed and all the equipment installed.

As the Environmental Test Laboratory has to be designed and built, this will delay any training until mid 1989 at the earliest.

7 . Work Programme

The Work Programme(attachment to K. Popov's Report) was reviewed as it related to Testing Calibration and Quality Control with the Director - Technical, Dr. P.K. Gupta.

The following main points were made -

- * Need for reliable electricity supply
- * Air Conditioning for laboratories
- * Electrical requirements in Laboratory for Testing Reliability and Quality Control
- * Timing of Environmental Test Laboratory

7.1 Reliable Electricity Supply

This subject is discussed elsewhere in this Report. It is repeated in this section because the point must be made that the Quality Testing and Reliability, and the Environmental Testing Laboratories, will not be able to function without a reliable electricity supply. Therefore standby generators should be acquired as a matter of the highest priority, and a small building constructed with the necessary switching and synchronising equipment. These actions must be completed in a short time frame - say within a three month period or by end November 1988.

7.2 Air Conditioning for Laboratories

The opinion of an Air Conditioning Consultant should be sought for all ESTC Laboratories. The reasons for this are energy conservation, air conditioning effectiveness and reliability.

Thermal insulation may be required on all outside walls. This will cost more but will reduce running costs. A Central Air Conditioning Unit for each major grouping of Laboratories should be considered as opposed to many window mounted Air Conditioning Units.

7.3. Electrical Requirements - Laboratories

Dr. P.K. Gupta has agreed to co-ordinate the electrical requirements for the Testing Quality Control and Reliability Laboratory, Environmental Laboratory and all other laboratories to ensure that adequate circuits, electrical outlets and earth points are available, and safety requirements are met.

7.4. Timing of Environmental Test Laboratory

The planned completion date of the Environmental Test Laboratory is end 1990, whereas the Testing Quality Control and Reliability Laboratory will be completed by the first quarter of 1990. However, the Environmental Equipment specified in 4.3 can be purchased, received and commissioned at ESTC, Ramnagar within the next six months.

7.4. Continued/ -

This equipment can be temporarily located in the Electrical Winding Laboratory where it will take up at most 70 sq.m. of floor space.

On completion of the Environmental Test Laboratory, the equipment can be easily transferred to the new location. It is therefore strongly recommended that the Environmental Test Equipment be procured as soon as possible.

8. General Conclusions and Recommendations

Specific recommendations have already been given.

- 8.1 The ESTC building is large - 2,400 sq. m. and is more than adequate size for the purposes intended.
- 8.2 None of the Laboratories, Offices, Training Rooms or Workshops have been completed at the time of writing. The completion of any of the major laboratories (excluding Training Labs) is at least 6 to 9 months away.
- 8.3. Electricity supply to ESTC is a major problem, which must be solved as a matter of the highest priority (see 7.1).

There are many power cuts, some lasting more than 2 hours. A continuous 24 hour supply is required for Electrical Testing, since some tests last for several days.

The solution proposed by ESTC of two 100kVA stand-by generators is practical. However, automatic control will eventually be required to enable automatic switching startup and synchronising of generators.

- 8.4 There is no telephone line to ESTC - this should be provided as a priority.
- 8.5 A continuous water supply is also a priority requirement.
- 8.6 Staffing at ESTC has been reduced from 10 to 8 with the departure of the Director - Training, N.N. Shargava and S.V.Singh. Extra staff both technical and administrative must be recruited as a priority.
- 8.7 Transport to and from ESTC is difficult since the only means of transport is the Principal Director's car. There is a need for a Van/Minibus.
- 8.8 The location of ESTC at Kaniya, 5 Km. from Ramnagar, presents several problems in addition to those already mentioned, such as -
 - (a) Lack of Entrepreneurs (at present)
 - (b) Living conditions are not the best
 - (c) Poor roads/access to Complex
 - (d) The Market for ESTC Services is not fully known.

These problems and those already mentioned in 8.1 to 8.7 are impeding progress in the development of ESTC and are therefore acting against the success of the project. All of these problems can be solved and every assistance should be given to ensure that these problems are resolved.

- 8.9 The creation of an Electronics Complex and the ESTC at Kaniya, Ramnagar, is an idea which has both vision and imagination. It is a bold venture which can be successful and have a beneficial

8.9. Continued/

effect on the surrounding area. It deserves to succeed if all interested and involved parties work hard to make it succeed.

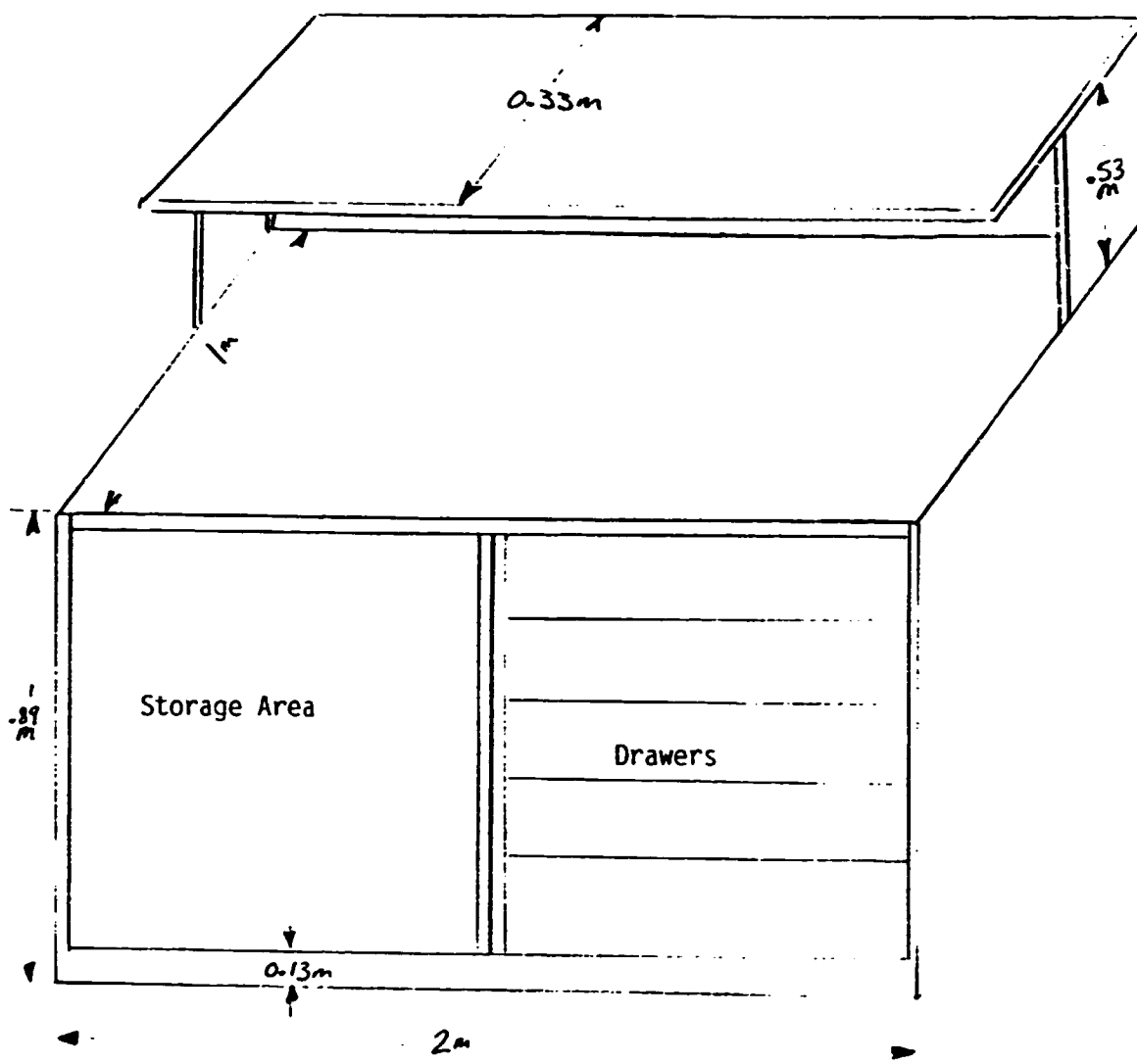
8.10 Co-operation with all ESTC staff was good. Special thanks are expressed to Mr.L.J. Jeyaraj, Principal Director and to Dr. P.K. Gupta, Director-Technical.

APPENDIX 1 - LABORATORY FURNITURE

Benches, Stools, Trolleys

Details

- * Dimensions - Length 2m; Depth 1m; Height 0.89m (see diagram)
- * 6 Stabilised Power Sockets - 220 volts
- * 6 Non-Stabilised Power Sockets
- * Earth Point
- * Flourescent lighting under entire length of top shelf
- * Drawers should not be less than 0.12m in depth
- * Storage Area beside drawers should be approximately 0.13m above floor level
- * Top surfaces should be a white, hard-wearing surface, such as "Formica"
- * Stools for Benches should be 0.74m height and have both back and foot rests
- * Trolleys should have a top surface at 0.89m height (same as Bench height) and dimensions 1.1m by 0.7m. Lower surface should be at least 0.25m above ground level.



BENCH DIMENSIONS

Appendix 2: Equipment - Additions

A. Sets of Power Rheostats

- 16 Amps 6 Ohms Quantity 10
- 10 Amps 6 Ohms x 6 Ohms Quantity 5

Supplier : Local.

B. Chart Recorder

Manufacturer : Leeds and Northrup
Model : Speedomax Recorder 1650
Approximate Cost : US \$3000

C. Humidity Chamber

Specifications

Capacity : One Cubic Metre
Temperature : +10°C to +100°C
Rh. : Ambient to 97% Approx.
 Programmable

Suggested Suppliers:

1. Fisons Scientific Apparatus,
 Bishops Meadow Road,
 Loughborough LE110 0RG,
 U.K.
2. Headinair Ltd.,
 Beaver Centre,
 Selinas Lane,
 Dagenham RM8 1QH,
 U.K.
3. Gallenkamp,
 Belton Road West,
 Loughborough LE11 0TR.
 U.K.
4. Montford Instruments Ltd.,
 24-26 Gorst Road,
 London NW10 6LE.
 U.K.

D. Thermal Chamber

Specifications : Capacity : 1 Cubic Metre
Temperature
Range : -70°C to +200°C
Programmable
Suggested Suppliers : As in C above

E. Wattmeter

Manufacturer : YEW Japan
Model Number : 250D
Digital Wattmeter
Approximate Cost : \$3,000 US

F. Curve Tracer

Manufacturer : Tekronix US
Model Number : 576 Curve Tracer
Option 01. Option A1.
Approximate Cost : \$23,000 US

Note: This is an expensive item, that can only be justified by the training requirements. Locally manufactured curve tracers, or adaptors to oscilloscopes should be considered as alternatives.

G. Mercury in Glass Thermometers

Range : -70°C to +300°C
Set of 4 Approx. Instruments

Suggested Suppliers

G.H. Zeal Ltd.,
Lombard Road,
Morden Road,
Merton,
London, SW19.
U.K.

H. Stout & Co. Ltd.,
Holmethorpe,
Redhill,
Surrey.
U.K.

Corning Ltd.,
Stone,
Staffordshire.
U.K.

H. Vibration Rig

Specification Maximum Load Unsupported : 22.7 Kg
 Maximum Load Supported : 54 Kg
 Frequency Range : 20 Hz to 20 kHz
 Programmable

Suggested Suppliers

1. Derritron Group Ltd.,
Sedlescombe Road North,
Hastings TN34 1XB,
U.K.
2. Environmental Equipments Ltd.,
Fleming Road,
London Road Industrial Estate,
Newbury RG13 2DE,
U.K.
3. Carl Schenk (UK) Ltd.,
Howerd House,
The Runway,
Ruislip HA4 6TH, U.K.

J. Calibrator

Manufacturer : Fluke, U.S.

Model : 515A
DC & AC Voltage, Resistance.

**Approximate
Cost** : \$8,500

Appendix 3 - Standards

Note: Copies of all International Electrotechnical Commission (IEC) and International Standard Organisation (ISO) Standards and other Publications can be obtained from the Indian Standards Institution.

Addresses and recommended Publications and Standards are as follows.

A. International Electrotechnical Commission,
Central Office,
P.O. Box 131,
3 Rue de Varembe,
1211 GENEVA 20,
Switzerland.

B. Indian Standards Institution,
Sales Service,
Manak Bhavan,
9, Bahadur Shah Zafar Marg,
New Delhi, 110002.

Tel. (11) 3317991

Telex 031-3970 ISI/nd

Telegrams MANAKSANSTHA.

C. Suggested Publications/Standards

- Catalogue of IEC Publications 1988 .
World Standards for Electrical and
Electronic Engineering.
- IEC 65 (1985)* Radio and TV
- IEC 335* Household Appliances
- IEC 380 (1985) Office Machines
- IEC 435 (1983) Data Processing Equipment
- IEC 950 (1986) IT and Business Equipment
- ISO 9000 Quality Management Systems

* Issued in a Number of Parts/Amendments.



*Photographs of the control room of the
USSR submarine "K-19" in 1961.*

