

COMMONWEALTH



OF AUSTRALIA

**AUSTRALIAN POST OFFICE
SPECIFICATION**

No. 1071

ISSUE 1

**PABX EQUIPMENT
SUPPLY AND INSTALLATION**

PLEASE NOTE

All references to
"Australian Post
Office" and "APO" in
this Specification
should read
Telecom Australia.

Engineering Works Division Headquarters
Melbourne

COMMONWEALTH OF AUSTRALIA
POSTMASTER - GENERAL'S DEPARTMENT
HEADQUARTERS
ENGINEERING WORKS DIVISION

Specification No. 1071 Issue 1

for

The Supply and Installation of P.A.B.X. Equipment

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1. SCOPE.

- 1.1 This Specification defines the A.P.O. requirements for the supply and installation of P.A.B.X. equipment and associated services for connection to the public telephone system and subsequent maintenance by the A.P.O.
- 1.2 The installation, equipment and activity shall comply with the Telephone Regulations under the Post and Telegraph Act.

2. DEFINITIONS.

2.1 Within the terms of this Specification the following abbreviations and definitions will apply:

- | | | |
|-------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| (i) | A.P.O. | - Australian Post Office. |
| (ii) | Contractor | - A person or organisation approved by the Director-General of Posts and Telegraphs for providing and installing any or all of the P.A.B.X. equipment. |
| (iii) | Customer (including Applicant and Subscriber) | - The person or organisation intending to work or working an exchange line service connected to the A.P.O. network (including P.A.B.X. Services). |
| (iv) | Cutover | - The act of placing the P.A.B.X. into service. |
| (v) | Installation | - The P.A.B.X. equipment (including distribution cabling where called for) being installed or installed. |
| (vi) | Manual Switchboard (including Attendant's Cabinet, Operator's Console, etc.) | - The Manual Switchboard being installed or installed with the particular type of P.A.B.X. |

3. PROCEDURES.

- 3.1 The procedures outlined hereunder in Sub-clauses 3.2 to 3.17 shall be complied with by the various parties for the supply and installation of equipment to each new or existing P.A.B.X. for the work to be accepted by the A.P.O. within the terms of this Specification.
- 3.2 The Customer applying for a service shall have completed an A.P.O. Form Tel. 133 Sheet 1 advising the A.P.O. of the facility and capacity requirements of the P.A.B.X. proposal.
- 3.3 The A.P.O. shall have completed an A.P.O. Form Tel. 133 Sheet 2 advising the engineering detail necessary to satisfy the Customer's requirements.

3.4 A Contractor submitting a tender to the Customer for a P.A.B.X. shall enclose with the tender two copies of A.P.O. Form Tel. 133 Sheet 3 duly completed. Attachments to each copy of the Form must include:

(i) In the case of a small fixed dimension P.A.B.X. covered by Sub-clause 11.2:

- (a) A diagram showing accommodation requirements.
- (b) The cabling diagram upon which the tender is based.
- (c) A statement of any previous usage of equipment, components or apparatus in accordance with Sub-clause 9.6.

(ii) In the case of all other P.A.B.X. installations:

- (a) A trunking diagram in accordance with Sub-clause 11.3.
- (b) A diagram showing accommodation requirements.
- (c) The cabling diagram upon which the tender is based.
- (d) A statement of any previous usage of equipment, components or apparatus in accordance with Sub-clause 9.6.

3.5 The Customer shall have selected a preferred tender and submitted a copy of the completed Form Tel. 133 Sheet 3 and all of the technical papers associated with this tender to the A.P.O. for examination and consideration for approval of the various aspects.

3.6 The Customer shall enter into the necessary agreements with the A.P.O. before any installation activity may be commenced.

3.7 The Contractor shall not commence installation of the P.A.B.X. equipment until he is in possession of a trunking diagram (Sub-clauses 11.2 and 11.3), an accommodation diagram (Sub-clause 8.25) and a power circuit diagram (Sub-clause 15.13) which have been duly approved by the A.P.O. for the particular installation.

3.8 The Contractor shall not commence installation of the distribution cabling until he has possession of a cabling diagram, properly approved by the A.P.O. for the particular installation.

3.9 The Contractor shall make application to the A.P.O. for an acceptance test appointment.

3.10 The A.P.O. will, on receipt of the Contractor's application for an acceptance test appointment, check that the installation has the necessary A.P.O. approvals and schedule the installation for acceptance testing at the next suitable available test period in accordance with a register kept by the A.P.O.

3.11 The A.P.O. will notify the Contractor and the Customer of the P.A.B.X. acceptance test appointment date and estimated period required for acceptance testing of the installation.

3.12 The Contractor shall test the completed installation and advise the A.P.O. when it is ready for acceptance testing, as required in Sub-clause 20.2 (i). If the installation is delayed, the Contractor shall notify the A.P.O. and request rescheduling of the acceptance test appointment.

3.13 By agreement between all parties, the A.P.O. may amend the acceptance test appointment by notifying the Customer and Contractor.

3.14 The cutover date and time shall be agreed between the A.P.O., the Customer and the Contractor and shall be dependent upon a satisfactory acceptance test.

3.15 The Contractor shall be liable to pay the A.P.O. if excessive acceptance testing is required for each new or extended installation in accordance with the provisions of Sub-clause 20.2 (iv).

3.16 The A.P.O. on receipt of suitable advice will arrange to accept at a specified A.P.O. depot, surplus and recovered equipment or apparatus, including dismantled cable, from the Contractor. The acceptance of these items by the A.P.O. shall be recorded by the Contractor for accounting purposes as indicated in Sub-clause 4.21 of this Specification.

3.17 The provision or alteration of P.A.B.X. equipment shall be conducted only in accordance with Telephone Regulations 111 and 112 (see Appendix I). The only authority for activity on P.A.B.X. equipment or associated services shall be an A.P.O. Telephone Order (Tel.1) or a specific letter of request from the A.P.O. to the Contractor.

4. THE CONTRACTOR'S OBLIGATIONS.

4.1 The Contractor shall satisfy the various requirements and perform the various functions described in Clause 3 of this Specification.

4.2 The Contractor shall supply the following items:

- (i) The relevant P.A.B.X. equipment in accordance with Clause 9.
- (ii) An MDF and fittings in accordance with Clause 16.
- (iii) Power Plant in accordance with Clause 15.
- (iv) Frames, racks, ducts and runways in accordance with Clause 17.
- (v) Switchboard and power cables in accordance with Sub-clauses 15.11 to 18.1.
- (vi) Distribution terminal boxes and frames in accordance with Sub-clause 18.2.
- (vii) Distribution cables in accordance with the approved cabling diagram together with the connection of the required telephones and other apparatus in accordance with Sub-clauses 18.1 and 18.2.
- (viii) Jumper wire in accordance with Sub-clause 18.5.
- (ix) Earth wires and connections in accordance with Sub-clauses 15.10 and 17.3.
- (x) Technician's bench and/or cupboard in accordance with Sub-clause 12.10.
- (xi) Technician's stool and/or ladder in accordance with Sub-clauses 12.15 and 12.16.
- (xii) Test sets, equipment routiners, service control equipment and trouble recording equipment in accordance with Sub-clauses 12.2, 12.3 and 12.4.
- (xiii) Extension test equipment in accordance with Sub-clauses 12.5 and 12.6.
- (xiv) Spare parts for the equipment in accordance with Sub-clause 10.1.
- (xv) Tools in accordance with Sub-clauses 12.11 and 12.13.
- (xvi) Instructions and Drawings applying to the Installation in accordance with Clause 22.
- (xvii) Folder for drawings in accordance with Clause 22.
- (xviii) Special cupboard or compartment in accordance with Sub-clause 12.12.

(xix) Drawing display plate in accordance with Sub-clause 12.14.

- 4.3 The Contractor shall take delivery of various items of equipment, as specified in Sub-clause 5.1 (iii) at the specified A.P.O. depot and convey them to the Customer's premises.
- 4.4 The Contractor shall examine upon receipt all items of equipment supplied by the A.P.O. and satisfy himself that all such parts are in good condition. If any parts are found to be defective he should return them to the A.P.O. and request exchange, and he shall satisfy himself that any such replacement parts are in good condition on receipt.
- 4.5 The Contractor shall be responsible for safeguarding from loss or damage all the various items of equipment supplied to him by the A.P.O. and for all equipment in situ at the site prior to the commencement of the installation. The cost of any such items not properly accounted for within one month of acceptance of the completed installation, shall be recoverable from the Contractor by the A.P.O. The A.P.O. may require the Contractor to make good any damage to such equipment or may arrange for repairs to the damaged equipment to be carried out at the Contractor's expense.
- 4.6 The equipment detailed in Sub-clauses 4.2 to 5.1 (iii) shall be installed by the Contractor in accordance with the requirements of this Specification.
- 4.7 The Contractor shall install only apparatus and equipment which is necessary for the correct functioning of the facilities required by the relevant A.P.O. Telephone Order (Tel.1) or A.P.O. approved P.A.B.X. Proposal Form (Tel.133). The Contractor shall not install any other associated equipment or apparatus without prior approval in writing from the A.P.O.
- 4.8 The Contractor shall allow the A.P.O.'s authorised inspecting officers free access to the site at all reasonable times to examine the progress of the work.
- 4.9 During the installation of the equipment, all reasonable precautions shall be taken by the Contractor to avoid the risk of fire. Where possible non-flammable materials shall be used.
- 4.10 The Contractor shall provide all tools, appliances, scaffolding, etc., required for the conveyance of the plant to the installation site and for the performance of all the work, and shall remove them on completion of the work.
- 4.11 The Contractor shall ensure that the installation working areas are, and can be maintained in a fit state of cleanliness before commencing the installation. He shall take, or advise the Customer to take, adequate precautions to prevent dust, or anything liable to cause future service failures from entering the equipment or apparatus.
- 4.12 The Contractor shall run and terminate all cables including those cables which are to be diverted from existing A.P.O. plant in accordance with the approved cabling diagram.
- 4.13 The Contractor shall arrange for the equipment to be satisfactorily designated in accordance with Clause 14.

The Contractor shall ensure that each piece of equipment is appropriately marked with the manufacturer's name or authorized distinguishing symbol, circuit schematic number, issue number and month and year of manufacture.

- 4.14 The Contractor shall design and carry out any approved modifications to the equipment which may be required by the A.P.O. in order to correct defects or to satisfy any special local conditions at the installation. The cost of such modifications shall not be borne by the A.P.O. If the requirement is notified during the guarantee period (see Clause 7), the modification shall be deemed to be part of the installation activity. The cost of a modification required in consequence of a notification received after the expiry of the guarantee shall be the responsibility of the Customer.
- 4.15 When modifications of in situ equipment are carried out, the markings of individual pieces of equipment shall be appropriately amended by the Contractor, to show the new drawing and issue number and the date the modification was made.
- 4.16 The Contractor shall notify the A.P.O. of the completion of any equipment modifications so that the work may be examined and if necessary separately tested. When stipulated by the A.P.O., the modified equipment shall not be permitted to be taken into use by the Customer before the A.P.O. has examined and accepted the work.
- 4.17 The Contractor shall, when requested by the A.P.O. in accordance with Sub-clause 5.14, clear faults from the equipment.
- 4.18 The Contractor, all of the Contractor's employees and all other persons under the Contractor's control who are required to work on in-service equipment or facilities shall, prior to undertaking such work, make a declaration on A.P.O. Form P.275 before a Justice of the Peace or Commissioner for Declarations in accordance with the Post and Telegraph Act 1901 - 1950, Section 9, Second Schedule, Form A which relates to secrecy in respect of A.P.O. services. The Contractor shall hold such declarations and make them available for A.P.O. inspection.
- 4.19 The Contractor shall indemnify and keep indemnified the A.P.O. against all loss, damage or injury which may result by reason of the installation of the P.A.B.X. equipment and associated apparatus in the Customer's premises.
- 4.20 The Contractor shall dismantle all A.P.O. equipment (other than P.A.B.X. equipment), apparatus or cable no longer required at the Customer's premises as a result of placing the P.A.B.X. into service. The Contractor shall suitably advise the A.P.O. and deliver the dismantled equipment, apparatus or cable to the depot nominated by the A.P.O. The Contractor shall deal likewise with any surplus telephones and other items of equipment issued to the Contractor by the A.P.O. for the particular installation. The acceptance of all of the foregoing items by the A.P.O. shall be recorded by the Contractor for accounting purposes as outlined in Sub-clause 4.5 of this Specification.
- 4.21 The Contractor shall prepare a log book of the installation in accordance with Clause 23.
- 4.22 The Contractor shall, when requested by the A.P.O., provide appropriate training courses for A.P.O. technical personnel as required by the Assistant Director, Engineering, for the State. In general, such courses will be required at the time of the first installation of a particular type of P.A.B.X. in the area. Each course shall be of approximately forty (40) hours duration and shall consist of lectures and demonstrations.

5. A.P.O. RESPONSIBILITIES.

5.1 The following equipment and facilities will be provided by the A.P.O.:

- (i) Cable pairs to the exchange, terminated on the P.A.B.X. MDF.
- (ii) A telecommunication earth connected to the P.A.B.X. MDF.
- (iii) Telephones and other items of equipment as stipulated, required to provide services conforming to the A.P.O. standard telephone facilities, in accordance with A.P.O. Engineering Instruction, TELEPHONE, Sub-station A 0010.
- (iv) Where appropriate, alarm circuit and extension test equipment at the parent or other exchange.

5.2 In general the A.P.O. shall not be responsible for any work at the P.A.B.X. site other than that specified in this Clause 5, except that in the case of a magneto type parent exchange the A.P.O. may elect to provide, at A.P.O. expense, the necessary conversion equipment for the exchange lines at the P.A.B.X.

5.3 The A.P.O. is responsible for estimating traffic requirements for each proposed P.A.B.X. which would have an initial requirement of more than 50 extension circuits. This information will normally be made available to Contractors on Sheet 2 of Form Tel. 133.

5.4 In the case of P.A.B.X. installations covered by Sub-clauses 3.4 (ii) and 11.3, the A.P.O. will check the trunking diagram prepared by the preferred Contractor, for accuracy and validity against the information supplied by the Customer and the traffic estimate. Satisfactory trunking diagrams will be approved and signed by the A.P.O. authorized officer.

5.5 The A.P.O. may advise the Customer of the P.A.B.X. accommodation requirements in accordance with Clause 8, and will conduct negotiations with the Customer and the Contractor in accordance with Sub-clause 8.13.

5.6 The A.P.O. will check the accommodation diagram prepared by the preferred Contractor in accordance with Sub-clause 8.25 and if it is satisfactory will approve and sign it in accordance with Sub-clause 8.26.

5.7 The A.P.O. will indicate on Sheet 2 of Form Tel. 133 the type of power supply required for the P.A.B.X.

5.8 The A.P.O. will check the power circuit diagram prepared by the preferred Contractor. If the details shown on the diagram are satisfactory the A.P.O. will approve and sign the diagram.

5.9 The A.P.O. will indicate the size of the MDF to be provided and the extent of the distribution cabling required to be provided by the preferred Contractor. This will normally be available on Sheet 2 of Form Tel. 133. The A.P.O. will check the cabling diagram submitted by the preferred Contractor. If details shown on the cabling diagram are satisfactory then the diagram will be approved and signed.

5.10 The A.P.O. will supply standard MDF and cable terminal box record cards, books and proforma sheets together with the log book to the Contractor.

5.11 The A.P.O. will keep a register for the scheduling of acceptance test appointment dates and record entries in it in accordance with Sub-clauses 3.10 and 3.13.

5.12 The A.P.O. will inspect the accommodation in accordance with Sub-clause 8.28.

5.13 The A.P.O. will connect the required exchange lines, tie-lines and out-door extensions to the P.A.B.X. after the satisfactory acceptance by the Customer of the terms of this Specification and payment of the appropriate fees.

5.14 The A.P.O. will be responsible for the maintenance of the P.A.B.X. and any additions carried out by the Contractor from the date of cutover but the Contractor shall clear all faults as required by the A.P.O. during the first week after cutover or until an acceptance certificate is issued. The A.P.O. will charge the Customer an annual fee for this service and may elect not to maintain certain approved attachment apparatus which may be connected to the P.A.B.X.

5.15 The A.P.O. will not be responsible for the correction of any defect in the equipment covered by the guarantee in accordance with Clause 7. If corrective maintenance work, attributable to any such defect, is undertaken by the A.P.O., the A.P.O. will debit the Contractor with the cost of the work.

5.16 The maintenance work to be carried out by the A.P.O. is restricted to:

- (i) The maintenance and testing of the P.A.B.X. equipment in accordance with Department procedures.
- (ii) The clearance of faults at all times subject to Sub-clause 5.13.
- (iii) The replacement of small components and batteries.
- (iv) The keeping of records and designations.

5.17 The A.P.O. will not be responsible for the replacement of such major items as switches, racks, cabling, major wiring, bank multiples, dynamotors, power rectifier units and components for power rectifier units. The A.P.O. will also not be responsible for re-arrangement of trunking or for the renovation, including repainting or repolishing, of any of the equipment. All such work shall be carried out by a Contractor to a standard satisfactory to the A.P.O.

5.18 The A.P.O. will supply replacement batteries, maintenance spares for A.P.O. supplied equipment and apparatus and other minor switching circuit components that are currently an A.P.O. stock item. The A.P.O. will not be liable for the supply or cost of proprietary components or equipment supplied to the Customer in respect of this P.A.B.X.

5.19 The A.P.O. will maintain the installation until in the opinion of the A.P.O. the equipment or cabling is no longer capable of giving reliable service without excessive maintenance attention. Thereafter it will be the responsibility of the Customer to arrange, at his expense, for the replacement of the installation in whole or part, as recommended by the A.P.O.

6. THE CUSTOMER'S RESPONSIBILITIES.

6.1 When applying for the P.A.B.X. service, the Customer should act as follows:

- (i) Nominate a person for negotiations with the A.P.O. and the various Contractors direct.
- (ii) Complete A.P.O. Form Tel.133 Sheet 1 advising the requirements of the proposed P.A.B.X.

- (iii) Provide to the A.P.O. all details of current or proposed future internal organisational operations that may affect the number or usage of telephones, so that the planning of the P.A.B.X. will be more accurate and the installation will consequently be provided more economically. Such detailed information will be deemed confidential and will not be divulged by the A.P.O.
- (iv) Select locations for the P.A.B.X. equipment and associated apparatus as advised by the A.P.O.
- (v) Examine the various Contractors' tenders and select a tender.
- (vi) Forward all technical papers associated with the preferred tender to the A.P.O. for consideration and advice prior to committing himself with any Contractor.

6.2 When requested by the A.P.O. the Customer should complete the appropriate agreement forms and forward the necessary fees to the A.P.O. for the required exchange lines, tie-lines and out-door extension lines. The appropriate agreements between the Customer and the A.P.O. must be completed and the fees paid before the installation may be commenced.

6.3 The Customer shall undertake to provide the following facilities:

- (i) Equipment accommodation in accordance with that agreed to in the approved accommodation diagram.
- (ii) Cabling access (riser shafts, ducts, conduits, etc.) in accordance with that agreed to in the approved cabling diagram.
- (iii) Public power supply and electrical fittings in accordance with Sub-clauses 8.21, 8.22 and 15.14.
- (iv) Exclusive use of the P.A.B.X. equipment room for A.P.O. maintenance activities. It must not be used for storage of material or for any purpose other than accommodation of the P.A.B.X.
- (v) Provision of satisfactory locks and keys for all equipment room doors and adequate fasteners for equipment room windows. The Customer has an obligation under Telephone Regulation 112 (see Appendix I) to maintain security of the P.A.B.X. equipment and should therefore exercise strict control of any key to the equipment and equipment room.
- (vi) Provision of a regular (at least once per month) adequate and satisfactory cleaning service for inside the P.A.B.X. room but not within the P.A.B.X. switching equipment itself. In particular, floors, shelves, tables, window ledges and other surface areas should be kept free of dust, dirt and refuse. The use of liquids in the cleaning operations should be kept to a minimum and care should be taken to ensure that the liquids do not enter the P.A.B.X. equipment, thus avoiding damage which could interrupt service and be costly to repair. The advice of the A.P.O. should be sought in the selection of cleaning materials, as most detergents and polishes are harmful to telephone switching equipment. If the cleaning operations are impeded by A.P.O. activities, the matter should be reported to the A.P.O. Engineering Division for investigation and necessary action.

6.4 The Customer should consider the provision and maintenance of adequate fire protection equipment. Fire extinguishers should be of the carbon dioxide gas type, mounted inside the P.A.B.X. room adjacent to the main door. Soda acid and carbon tetrachloride type extinguishers must not be brought inside the P.A.B.X. room as they may be dangerous if used for electrical fires in confined spaces. Smoke detectors may be fitted. Sprinkler equipment should not be installed, but if the fitting of sprinklers is unavoidable in the vicinity of the P.A.B.X. equipment, special safeguards should be adopted to ensure that operation of the sprinklers does not lead to wetting of the P.A.B.X. equipment.

7. GUARANTEE.

7.1 The Contractor shall be required to guarantee the installation against faulty materials, workmanship and finish for a guarantee period of twelve calendar months from the date of issue of the acceptance certificate by the A.P.O. The Contractor shall also guarantee that the installed equipment is in satisfactory working order, provides the required facilities, is free from hum, noise, crosstalk, etc., and is in correct adjustment, and that it will function reliably and satisfactorily for the same guarantee period of twelve calendar months. The A.P.O. reserves the right to raise an appropriate debit on the Contractor for expenses incurred by the A.P.O. in rectifying any defects attributable to default by the Contractor, his equipment and material suppliers and his agents in respect of this guarantee.

8. LOCATION, ACCOMMODATION AND LAYOUT.

8.1 The P.A.B.X. will be installed in the Customer's premises in a location approved by the A.P.O. in accordance with the provisions of Sub-clause 8.26.

8.2 The P.A.B.X. equipment should be located in the area of the building occupied by the Customer. In multi-storey buildings a lower floor (but not a basement) location is preferred. Locations in dusty, damp or humid situations will not be accepted by the A.P.O.

8.3 In order to cater for the most efficient and convenient service to the Customer and expeditious maintenance by the A.P.O., and provide for the satisfactory performance, protection and longevity of the equipment, a separate room shall normally be provided for the P.A.B.X. For the installation of certain types of equipment, and where a battery is not to be provided, equivalent alternative accommodation may be acceptable to the A.P.O.

8.4 The A.P.O. will not approve and will not accept P.A.B.X. equipment installed in any of the following locations:

- (i) A passage way or entrance hall.
- (ii) A boiler room.
- (iii) A storage room.
- (iv) A lift control room or other electrical plant control room.
- (v) A garage.
- (vi) A workshop.
- (vii) A bathroom or toilet.
- (viii) A kitchen.
- (ix) A factory production room.
- (x) A riser shaft.

8.5 Basement locations for P.A.B.X. equipment are undesirable and will not be accepted by the A.P.O. unless each of the following special conditions is met to the satisfaction of the A.P.O.:

- (i) If the location is the lowest basement of the building, the equipment room floor surface shall be at least six inches clear above the general basement floor level.
- (ii) The equipment room shall be adequately ventilated in accordance with Sub-clause 8.10 and the temperature and humidity are to be controlled to meet the conditions in Sub-clause 8.11, desirably within the best service conditions.
- (iii) Sumps and sump pumps shall not be located in, or near the entrance to, the equipment room.
- (iv) External building walls forming part of the equipment room shall be adequately waterproofed on the outside.
- (v) The room shall be free of perceptible vibration.
- (vi) Access to the equipment room shall be such that the path from street level for equipment and apparatus does not involve hazardous manhandling. The access door to the equipment room should be from public space (e.g. a corridor).

8.6 The location and design of the equipment room shall be such that the largest required unit of equipment may be readily moved to and from, and assembled within, the room. The room shall also provide reasonable access for staff. Access by trapdoors, ladders, catwalks, etc., will not be acceptable to the A.P.O.

8.7 The equipment shall be located in a position that will remain free from perceptible vibration and noise. Equipment locations situated over girders that may transmit vibration will not be acceptable to the A.P.O.

8.8 The equipment shall not be located in close proximity to gas mains, water mains or sewerage pipes or to main electricity routes. Equipment installed in a room having meters or inspection points for such services will not be acceptable to the A.P.O.

8.9 The equipment shall not be located in positions in the vicinity of machinery, pipes or other outlets that may discharge into the atmosphere steam, fumes, gases or small particles of matter. Special sealing and air-conditioning shall be provided by the Customer for the equipment room to counteract the effects of such environments when they cannot otherwise be avoided.

8.10 The equipment room shall provide a situation from which dust entry is adequately impeded, yet allows a free flow of clean dry air to dissipate heat from equipment and to minimize hydrogen concentration in the room atmosphere when batteries are on overcharge. To achieve these conditions the room shall be pressurised with filtered air and vented to the outside atmosphere. The filtered air pressure source shall be an air-conditioning outlet or an induction fan. The air filtration for both air-conditioning and mechanical ventilation shall comprise fixed, dry fabric type air filters of 15%, 95% and 85% efficiency with test ducts Nos. 1, 2 and 3 to B.S.2831, respectively. Access to such filters for servicing shall be external to the equipment room. The ventilation shall be in accord with local building authority regulations, and shall supply a minimum of 8 air changes per hour whilst the equipment is attended.

- 8.11 The equipment will provide best service when it operates in an environment with an ambient temperature 10°-25°C at 50-65% relative humidity. Equipment locations that may have an ambient temperature in excess of 35°C or where the relative humidity may exceed 70% shall not be acceptable unless they are adequately treated. The upper limit humidity control may be effected by electric strip heaters. Such strip heaters shall be actuated by a humidistat and be thermostatically controlled to cut out at an ambient room temperature of 35°C. For coincident ambient temperature and relative humidity that may respectively be in excess of 35°C and 70% R.H., appropriate air-conditioning shall be provided.
- 8.12 The manual switchboard shall be located in a separate room from the P.A.B.X. equipment with the exception of the installation of certain types of equipment as indicated in Sub-clause 8.3. The preferred arrangement is for a large room, divided by a partition wall into an equipment room and telephonist's operating room. In order to improve the natural lighting or display the equipment, the upper half of the partition wall may be a window of clear glass. Main access to the telephonist's operating room through the equipment room will not be acceptable, but access to the equipment room through the telephonist's operating room may be acceptable. In rooms which are divided, cord type manual switchboard shall be so placed that their backs protrude through a partition wall into the equipment room. The construction of the partition wall shall cater for the ultimate required number of switchboard positions. Cordless type manual switchboards shall be installed entirely within the telephonist's operating room. Where provision of adjacent operating and equipment rooms is not feasible, they should be located on the same floor area with reasonable access for staff between them. Remote segregation of the two rooms shall be avoided. The maximum permissible distance between the rooms shall be determined by the A.P.O. taking into consideration the characteristics of the particular equipment to be installed.
- 8.13 The floor area of the equipment room will depend on the ultimate size and type of P.A.B.X. desired, and the Customer will be advised by the A.P.O., in accordance with the standard layouts for the particular types of equipment under consideration, with a reasonable allowance for unforeseen requirements. Following the selection by the Customer of a particular type of P.A.B.X., the Customer and the Contractor shall jointly consult with the A.P.O. to determine the dimensions of the equipment room. The Contractor shall thereafter be responsible to the A.P.O. for the design and submission of the accommodation and layout diagram in accordance with A.P.O. requirements.
- 8.14 The equipment room area may be reduced to cater for the initially required equipment, provided that a satisfactory ceiling height partition wall is installed to contain the equipment room. The responsibility for eventually shifting such a partition to make way to extend the equipment room shall rest with the Customer. The Customer shall be responsible for adequately shrouding and protecting the equipment from dust and damage during any building operations involving the equipment room.
- 8.15 The clear ceiling height under beams in the equipment room shall not be less than 9 feet, except that for small unit type P.A.B.X.'s a lower ceiling height of not less than 7 feet may be acceptable to the A.P.O. For large installations employing 10 ft.-6½ in. racks and overhead cabling, a clear ceiling height of 12 feet shall be provided.
- 8.16 The equipment room ceiling shall be lined, dustproof and watertight. The preferred ceiling material is Asbestolux (or equivalent) backed with insulation, fixed with dust sealed joints and left finished in its natural state (off white). If a ceiling is painted, only light coloured full gloss paint or enamel shall be used.

- 8.17 The equipment room walls, including partition walls, shall have an impervious smooth glossy finish, to minimize the settling of dust and to facilitate its removal. Untreated or painted brick walls will not be acceptable. Such brick walls shall be rendered smooth, and finished with a light coloured full gloss paint or enamel. Panelling or other features involving irregular surfaces, or Caneite type materials, will not be acceptable. All internal and salient angles should be radiused as a security against chipping and to offset the harbouring of dust. All surfaces such as window sills should be sloped at an angle of 60° to the horizontal.
- 8.18 Windows in the equipment room shall be fitted accurately to exclude dust and damp. They should be of the fixed type, but may be of a type capable of being opened in an emergency, provided that they are fitted with adequate securing fasteners and are normally kept closed. Windows shall not be located in positions that will permit direct sunlight to fall on the equipment to be installed unless such windows are satisfactorily treated or provided with suitable blinds. External windows should, and in hazardous locations shall, be fitted with reinforced glass. Metal window frames and fittings should be treated against oxidation, corrosion, etc.
- 8.19 The Customer shall be responsible for the design and construction of the equipment room floor to withstand the superimposed loading of the equipment, etc. This loading may vary throughout the range of 90-200 pounds per square foot depending on the type of equipment. The Customer should seek the advice of the A.P.O. for typical floor loadings for the particular types of equipment being considered, in accordance with standard equipment layouts. Following the selection by the Customer of a particular type of equipment, the Contractor shall advise the Customer of the maximum superimposed load of the equipment, including power supply, in accordance with the proposed layout. The Contractor shall confirm or vary this advice to the Customer when the A.P.O. approves the accommodation and layout diagram in accordance with Sub-clause 8.26.
- 8.20 The floor covering of the equipment room shall be high quality linoleum, vinyl, P.V.C. or other approved material coved at junctions of walls, partitions, etc. After construction, but before any equipment is introduced to the room, the floor shall be scrupulously cleaned, using a detergent if necessary, and the floor allowed to dry thoroughly. The floor covering shall then be fitted in accordance with the manufacturer's recommendation, and its surface shall again be scrupulously cleaned, dried and treated with an appropriate sealing material. The sealed floor covering shall then be further treated by two coats of a suitable polish applied undiluted, allowed to dry and then buffed. The sealing material and polish shall not contain solvents, silicones or ammonia. The polish shall have a solid content of not less than 15% and shall give a hard surface film and be non-flaking and non-slip. Subsequent to the introduction of any equipment to the room, mild detergents, not containing solvent or ammonia vapours, and suitable floor polishes as described above, only shall be used for cleaning in the equipment room. Maintenance attention should be as required in accordance with Sub-clause 6.3, a suitable polish being applied to worn areas with a plastic mop in the manner prescribed by the manufacturer of the polish, and then lightly buffed. The A.P.O. will give advice on the suitability of floor polishes for equipment rooms as most types are very detrimental to the performance of telephone switching equipment.
- 8.21 The lighting of the equipment room shall be sufficient to enable all parts of the equipment to be examined by day or night. The required illumination level shall be at least 10 lumens per square foot in the vertical plane on all rack and frame faces in accordance with Australian Standard CA.30.

Fluorescent lighting is preferred, and ceiling switches may be fitted.

- 8.22 Power outlets for portable tools and other electrical appliances shall be provided in the same room as the equipment. Sufficient power outlets shall be provided to ensure that no point on the equipment, or its associated apparatus in the equipment room, is more than nine feet from a power outlet. The power outlets shall be readily accessible. Such power outlets shall be supplied from final sub-circuits fused separately from the power plant supply for the equipment. Outlets shall be provided with an earth connection, and installed in accordance with the rules of the local Electricity Supply Authority.
- 8.23 The telephonist's operating room shall adequately cater for the ultimate number of manual switchboards, supervisor's desks and display boards as appropriate to the installation requirements. The switchboards and furnishings shall be arranged for efficient operation. The cubic capacity of the operating room shall allow for 400 cubic feet per occupant for the maximum ultimate number of operating and supervisory staff to be accommodated, provided that any ceiling height in excess of 13 feet is disregarded in the calculation. The ceiling, and the walls where appropriate, shall be acoustically treated. Acoustic Perforated Limpet hardboard backed with 2" insulation in polythene bags adequately supported clear of the hardboard, or other equivalent treatments, shall be used. In noisy locations, or for multi-position installations, the telephonist's operating room shall be provided with suitable soft furnishings such as carpet. Lighting in the room shall be sufficient to allow telephonists to work efficiently, but arrangements shall be made to prevent bright artificial light or glare from falling on the face of the manual switchboards. Switchboard equipment shall not be exposed to direct sunlight. Arrangements shall be made to facilitate the preparation and dispensing of food and drinks, and for the use of cosmetic materials, to be carried out remote from the switchboard equipment, preferably in a separate telephonist's rest room. Adequate power outlets shall be provided for portable tools and other electrical appliances. A clock shall be provided and mounted in a position which is readily visible to the telephonists.
- 8.24. The layout of the equipment shall normally conform to standards accepted by the A.P.O. relative to the type of equipment. The grouping of the equipment racks and frames, etc., in the layout shall be such as to facilitate subsequent maintenance operations. The layout shall provide for addition or replacement of equipment to cater for the five year requirements, and shall allow adequate space for installation, testing and maintenance activities. In particular, working area aisles shall not be less in each case than 3 feet 4 inches in width between equipment faces, 2 feet 6 inches in width between an equipment face and a wall or wiring face. Non-working area aisles, i.e., between wiring faces or a wiring face and a wall, and passageways for personnel only shall not be less than 2 feet in width. Main passageways that lead from the doorway to each equipment face shall not be less than 2 feet 6 inches in width. A clear floor space at least 4 feet wide shall be provided in front of the M.D.F. except that if the uppermost termination on the M.D.F. does not exceed 5 feet 6 inches from the floor, the minimum clear space in front of the M.D.F. shall be 3 feet. For the installation of certain types of equipment other than in a separate equipment room (see Sub-clause 8.3), the equipment shall be fitted to or along a wall, and the layout shall provide at least 2 feet clear wall space on each side of the equipment. The equipment shall not be within 3 feet of a doorway, adjacent wall buttress,

column or protruding cupboard. For such installations at least 3 feet clear floor space measured from the most prominent point of the equipment when opened to its fullest extent, shall be provided and maintained directly in front of the equipment.

8.25 A diagram of the proposed accommodation and layout of the equipment shall be prepared by the Contractor for each installation, and shall be submitted to, and approved by the A.P.O., before the installation work may commence. The plan shall be to a suitable scale, and shall show the proposed location for all of the required P.A.B.X. switching equipment, its associated apparatus and the manual switchboards. The proposed initial installation shall be shown by full lines, the two-year requirement by broken lines and the five-year requirement by dotted lines. The accommodation diagram shall also show the following details:

- (i) The clearance height of beams and ceiling adjacent to the equipment and apparatus.
- (ii) The location, size and type of all windows adjacent to the equipment.
- (iii) The location, size and type of all partitions, buttresses, fixed cupboards, etc.
- (iv) The location and types of cables, conduits, pipes, etc., belonging to other services in the P.A.B.X. equipment room.
- (v) The position and swing of all doors.
- (vi) The location and type of light fittings.
- (vii) The location and type of power outlets.
- (viii) The type of floor treatment.
- (ix) The type of room finish.
- (x) The location and type of ventilation.
- (xi) The location and type of the fire protection equipment.
- (xii) The maximum superimposed load, expressed as pounds per square foot, of equipment, including power supply, to all floors and walls.
- (xiii) The type, size and location of cable runs and ducts.
- (xiv) The north-south orientation of the plan.

8.26 If satisfactory, the accommodation diagram will be approved and signed. The installed P.A.B.X. equipment shall conform to the approved accommodation plan without variation.

8.27 Telephone switching equipment shall not be introduced to the site until the areas where it will be unpacked, moved and erected, have been finished, and are dry, free from dust and vapours, and in a condition which will enable the equipment to be safeguarded from damage and interference by unauthorised persons.

8.28 Before the installation may be commenced, an A.P.O. authorised officer shall inspect the accommodation to ensure that it satisfies the requirements of this Specification. If the accommodation does not meet requirements, the Contractor shall not be given A.P.O. permission to commence the work of installation until the deficiencies are corrected to the satisfaction of the A.P.O. An installation that is commenced without A.P.O. permission may not be acceptable to the A.P.O. for the connection of exchange lines, and for the subsequent maintenance of the equipment.

9. P.A.B.X. EQUIPMENT.

9.1 The P.A.B.X. shall be of the type and capacity approved by the Director-General of Posts and Telegraphs for connection to the A.P.O. telephone network.

9.2 Essential and Desirable Facilities.

(i) The P.A.B.X. shall provide all of the essential facilities listed in Appendix II to this Specification.

(ii) The P.A.B.X. shall be capable of readily providing at any time without replacement of any part of the P.A.B.X. equipment, the desirable facilities which are listed in Appendix II to this Specification and which have the prior approval of the Director-General of Posts and Telegraphs.

9.3 Optional Facilities. The P.A.B.X. may provide the optional facilities which are listed in Appendix II to this Specification, which have the specific prior approval of the Director-General of Posts and Telegraphs, and which are listed by the Customer on A.P.O. Form Tel. 133 Sheet 1 for the particular P.A.B.X.

9.4 The equipment shall be completely safeguarded against the possibility, intentionally, accidentally or by misoperation, that exchange lines are switched together or that exchange lines are switched to non-exchange access tie-lines or private lines.

9.5 The installed equipment shall be identical in mounting arrangements and dimensions, circuits, facilities and performance to that of the prototype or model which was submitted to the Director-General for test and examination and for which type approval had been granted. Separate additional approvals in writing shall be required for changes to, or variation of, the equipment. The electrical performance and termination conditions of the telephone lines connected to the A.P.O. telephone network shall be in accordance with the conditions of type approval. All exchange line circuits shall be identical to those individually approved and registered by the A.P.O. and no other circuit for inter-connecting with the network will be permitted without prior A.P.O. approval.

9.6 All equipment installed in accordance with this Specification shall be new and unused, except that if previously used items have been offered a statement to this effect shall be clearly stated on the A.P.O. Form Tel. 133 Sheet 3 prepared by the Contractor and submitted to the Customer. Such a statement referring to previously used items shall contain a full history of the location and period of usage, reason for removal and extent of reconditioning and modification carried out subsequent to the usage. The installation of previously used items shall not commence until the statement of usage has been verified, approved and signed by the A.P.O.

9.7 The P.A.B.X. installation shall comprise a complete and efficient system of communication between the P.A.B.X. extensions and between extensions and the subscribers connected to all exchanges in the network, so that intercommunication may be effected with ease, expedition, efficiency and economy of operation.

9.8 Unless the P.A.B.X. equipment and the technician's cupboard are located in a separate lockable room, they shall each be guarded from unauthorized interference by universal locks which have a key that is common to the type of P.A.B.X. Such keys shall be distributed only to the A.P.O. (two for each installation) and the Customer (one).

10. SPARE PARTS.

10.1 The Contractor shall, at the time of cutover, provide with each new P.A.B.X. installation at no charge to the A.P.O., a supply of spare parts equivalent to a normal two (2) years usage for the particular size of installation. The spare parts shall be in accordance with the currently approved spare parts list

appropriate to the type of P.A.B.X. The Contractor shall act similarly when placing into service an extension to an existing P.A.B.X. installation. In this case, the supply of spare parts shall be determined according to the size of the extension.

- 10.2 The Contractor shall at no charge to the A.P.O. and within one month of being requested, supply such replacement and supplementary items to the spare parts stock as may be requested by the A.P.O. The replacement and supplementary items shall be in accordance with the currently approved spare parts list appropriate to the type and size of installation.
- 10.3 The Contractor shall, within twenty-four (24) hours of a telephoned request from an A.P.O. authorised officer, supply to the P.A.B.X. in the Customer's premises, a replacement for any component part of the P.A.B.X. equipment becoming defective and failing in service. The Contractor shall nominate persons in his employ for liaison with the A.P.O. to ensure continuous service, and shall enter the names, addresses and telephone numbers of such persons on the first page of the log book for the particular installation.
- 10.4 The cost of the spare parts supplied in accordance with Sub-clause 10.1 shall be included in the Contractor's tender for the particular installation or extension. The Contractor may charge the Customer in accordance with Clause 7 for spare parts supplied after expiry of the guarantee, but the A.P.O., in the event of a disputed charge, reserves the right to act as sole arbitrator and fix an equitable amount.
- 10.5 The Contractor shall be responsible for the obligations and liability under Sub-clauses 10.2, 10.3 and 10.4 from the date of A.P.O. acceptance of the P.A.B.X. installation for a period, whichever is the longer, of twenty (20) years, or equal to the estimated life of the type of P.A.B.X. as may be published by the manufacturer, the Contractor or the Contractor's agent if any.

11. TRAFFIC AND CIRCUIT CAPACITY.

- 11.1 The installed P.A.B.X. equipment shall be in accordance with the trunking diagram submitted by the Contractor and approved by the A.P.O.
- 11.2 Small fixed dimension P.A.B.X.'s shall be installed fully equipped in accordance with the trunking diagram submitted to and approved by the Director-General of Posts and Telegraphs in respect to the type approval.
- 11.3 For installations other than those applicable to Sub-clause 11.2, the trunking diagram and associated charts shall show all relevant equipment quantities to be installed, and traffic values carried by the various circuit groups, for the initial two year and five year development requirements to meet the A.P.O. estimate of traffic. It shall show the dispersal of the total traffic, at the required grade of service, into each traffic classification as required by the Customer. It shall give full details of the gradings, interconnections and traffic route patterns. It shall also show the mean holding times as given on the Form Tel.133 Sheet 2.
- 11.4 At each P.A.B.X. installation the installed equipment shall provide a facility in each traffic carrying circuit for the individual measurement of each traffic classification on each traffic route. The occupied circuit condition shall be indicated by a direct earth connection and the unoccupied condition by an open circuit applied to the traffic measuring lead for that traffic path. The traffic measuring leads for each suite of the P.A.B.X. equipment shall be connected to a 200 point knife jack or jacks, mounted at a convenient location within the suite. The type of knife jack used shall be in accordance with A.P.O. Drawing CE.64001 Sheet 1. A chart shall be provided at each such location showing the tag position of each traffic carrying

circuit in the knife jack.

12. MAINTENANCE FACILITIES.

12.1 The equipment shall provide adequate access and connection facilities for the individual testing of all relay sets and integral circuits without the need to remove covers from the equipment. Each exchange circuit shall have a break type jack in the exchange line path for testing back into the P.A.B.X. equipment. Each traffic carrying circuit shall be provided with the following facilities:

- (i) Access jack.
- (ii) Occupation lamp.
- (iii) A make busy key or control.

12.2 Test Sets for the functional testing of all of the P.A.B.X. equipment, and as approved by the A.P.O., shall be provided on the following basis:

- (i) For installations having an installed capacity of 50 extension lines or less, a test set as approved for the P.A.B.X. type, shall be provided with the "first-in" installation of the particular type of equipment installed by the Contractor in each area as defined by the A.P.O.
- (ii) For installations having an installed capacity of more than 50 lines, one of each different type of test set, as approved for the P.A.B.X. type, shall be provided at each installation.

12.3 Service control meter facilities shall be provided for each P.A.B.X. installation having an installed capacity of more than 200 extension lines or more than one common control marker or its equivalent device. The leads from each marker are to be wired to a service control centre within the P.A.B.X. The meters shall be four or five digit types of approved design. The following facilities shall be provided:

- (i) For each marker, a meter permanently connected to count the total number of calls offered to that marker.
- (ii) For each marker, a meter permanently connected to count the total number of lost calls (faults plus congestion).
- (iii) For each marker, separate circuit leads for each internal and external traffic route classification for each of the categories (i) and (ii) above.
- (iv) For the installation, control circuitry for the connection of any of the marker leads to a meter set which shall make a count of offered and lost calls to the traffic route classifications. Both of the following facilities shall be provided for use one at a time:
 - (a) Each and every classification simultaneously within any one marker.
 - (b) Each individual classification simultaneously within every marker.

- 12.4 An automatic circuit routiner or trouble recording unit of a type approved for the P.A.B.X. shall be provided for each common control register P.A.B.X. installation having a five year development requirement of more than 600 extension lines. When provided, this equipment may replace the requirement for the appropriate test sets as outlined in Sub-clause 12.2. This type of equipment may be stipulated by the A.P.O. for smaller systems.
- 12.5 Dial test facility (i.e., extension test) equipment shall provide for the individual testing, from the parent or other exchange as stipulated by the A.P.O., of any dial provided in the P.A.B.X. installation. For these tests the dials shall remain in the instruments of which they are part and at the locations in which they are connected, and the test circuit shall be free of all electrical bridges and other circuit elements across the line or connected to earth potential.
- 12.6 Installations of 600 extension lines or more, or as otherwise stipulated by the A.P.O., shall be provided with a test rack of approved design having facilities and circuitry generally equivalent to A.P.O. Drawing No. CE.462.
- 12.7 A Technician's telephone circuit, connected exclusively as an extension line, shall be provided for equipment having an installed capacity of 20 extension lines or more.
- 12.8 Multiple jacks and associated wiring shall be provided in appropriate positions on all racks and frames, including the MDF, for extending the technician's telephone, any line circuit, or service tones, to these points, for maintenance purposes.
- 12.9 A battery jack, protected by a 3 ampere fuse, shall be provided on each rack and frame, and adjacent to the technician's bench. Where two or more suites of racks are installed, a lamp shall be provided in a prominent position within the P.A.B.X. room to glow when a plug is inserted in any of the battery jacks.
- 12.10 For installations in separate lockable rooms, a technician's bench generally in accordance with A.P.O. Drawing CE.40076 shall be provided. For all other installations having a capacity of 20 or more extension lines, a technician's lockable cupboard having a bench top working area equivalent to Drawing CE.40076 shall be provided.
- 12.11 An equipment tool kit shall be provided for each P.A.B.X. installation. The tool kit shall be housed in a specially fitted box and shall contain all special maintenance tools, other than those listed in Appendix III, which may be required to service the installed equipment.
- 12.12 A special cupboard, or compartment in, or associated with, the P.A.B.X. equipment shall be provided to house the stipulated spare parts, equipment tool kit and documents of the installation.
- 12.13 The Contractor shall provide the following battery tool kit together with a suitable container located adjacent to the battery to house the various items:
- (i) A voltmeter of an approved A.P.O. type, for cell testing.
 - (ii) A hydrometer with suction bulb, of an approved type generally in accordance with A.P.O. Drawing No. CZ.2008.
 - (iii) A thermometer of an approved type generally in accordance with A.P.O. Drawing No. CZ.2026, for measuring the temperature of the electrolyte.

(iv) A battery filler, "Lucas" or similar A.P.O. approved type.

(v) A jug made of rubber, polythene or glass as approved by the A.P.O.

12.14 A mild steel plate of suitable thickness, with a smooth surface painted in a colour to match the equipment in accordance with Sub-clause 19.2, and having dimensions not less than those of the largest drawing supplied with the equipment, shall be supplied and fitted at a convenient height on a wall of the P.A.B.X. room for the display of circuit drawings during maintenance operations. The plate shall be complete with at least four (4) permanent magnets capable of attaching the largest drawing to the plate.

12.15 A Technician's stool equivalent to A.P.O. Drawing CE.939 shall be provided for each installation of 20 extension lines or more.

12.16 A Technician's step ladder generally in accordance with A.P.O. Drawing CE.40075 shall be provided for each installation of equipment where the height of the top of the equipment is more than 6 ft. 6 in. from the floor.

13. ALARM FACILITIES.

13.1 The alarm facility shall provide a warning of selected malfunctioning of the P.A.B.X. equipment and shall also readily indicate the location of the source of trouble.

13.2 P.A.B.X. alarms shall be classified as urgent, non-urgent and supervisory.

13.3 A P.A.B.X. urgent alarm shall be operated when an equipment fault or other defect causes a complete failure of route, stage, group of extensions or traffic facility. The following equipment conditions shall operate an alarm which shall be classified as urgent:

(i) Operation of any fuse, circuit breaker, heat coil or any other electrical protective device.

(ii) Failure of the ring and tone supply to any part of the equipment when no further alternative supply is available.

(iii) Low voltage or failure of a battery supply to the equipment.

(iv) Low voltage or failure of a battery eliminator supply to the equipment except where the cause of the condition is due only to an interruption to the electricity supply mains.

(v) A switching magnet continuously energised, with the exception of those magnets which are guaranteed by the manufacturer to be self-protecting against electrical overload.

(vi) Failure of a subsidiary power supply to the equipment.

(vii) Failure of a total stage register or marker.

(viii) Failure of the alarm circuitry.

13.4 A P.A.B.X. non-urgent alarm shall be operated when failure of the equipment is of such a nature as to cause little or no disruption to any traffic facility. The following equipment conditions shall operate an alarm which shall be classified as non-urgent:

- (i) Interruption to the electricity supply mains feeding to the equipment.
- (ii) Failure of a battery rectifier output except where the cause of the condition is due to a fuse or circuit breaker.
- (iii) Failure of the ring and tone source automatic change-over to alternative supply.
- (iv) Failure of marker or register when a duplicate continues to function correctly.

13.5 A P.A.B.X. supervisory alarm shall be operated when any abnormal condition of an extension line, exchange line or tie-line causes the P.A.B.X. equipment to be held for a period of from one to three minutes or when line lock-out occurs.

13.6 The alarm circuitry shall be such that no alarm is given unless a genuine failure or non-standard condition has occurred. In general, failure conditions shall give an immediate alarm response and non-standard conditions shall initiate a delay period before giving an alarm. The minimum and maximum periods for such delayed alarms shall be specified by the A.P.O. for each P.A.B.X. type and may depend on the characteristics of the equipment components as well as on the trunking arrangements. Alarm conditions shall not be produced by cumulative applications of conditions of shorter duration than the specified delay period. The delay period of an alarm shall not be affected by applications of an alarm condition from another source.

13.7 Urgent alarms shall be reset to normal only by the manual operation of the control at the P.A.B.X. equipment. Non-urgent and supervisory alarms shall be self-restoring.

13.8 Alarms shall be adequately displayed in such a manner that the source of the equipment failure may be readily determined and located. The main alarm displays for the P.A.B.X. shall be in the P.A.B.X. room and on the manual switchboard. An urgent alarm shall, except when a complete power failure occurs, light a red lamp and operate a bell or buzzer in the P.A.B.X. room whilst it is attended. The bell or buzzer shall be provided with a control mounted on the equipment such that when the control is operated, the bell or buzzer is inoperative during an alarm condition but operates when the condition which caused the alarm restores. A non-urgent alarm shall light a blue lamp except that an interruption to the electricity supply mains shall be indicated by the absence of glow from a neon lamp mounted on, or adjacent to, the battery eliminator or rectifier. A supervisory alarm shall light white lamps.

13.9 The power supply for the alarm circuit shall be separately wired and fused on the primary P.A.B.X. power source in such a way that it is protected from an electrical over-load and provides an independent alarm indication in the event of a failure of the supply. Separate power supplies for alarm circuits will not normally be required.

13.10 For P.A.B.X.'s having an ultimate capacity of four or more exchange lines, the P.A.B.X. shall be capable of extending the urgent and non-urgent alarm classifications to the parent exchange or service testing centre. The extended alarm circuit shall connect to a conductor allocated by the A.P.O. and shall normally provide the following circuit conditions:

- (i) For no alarm, 6,800 ohm ($\pm 10\%$) to earth.
- (ii) For an urgent alarm, an open circuit.
- (iii) For a non-urgent alarm, a short circuit to earth.
- (iv) The circuit should be so wired that restoration to normal after connection of a non-urgent alarm will allow a momentary open circuit condition.

13.11 An urgent alarm classification shall take precedence over a non-urgent alarm classification in the determination of the effective alarm condition.

14. DESIGNATIONS.

- 14.1 All equipment shall be adequately designated to permit ease of operation and guidance for service activities. The designations shall provide contrast with the equipment surface and be of sufficient size to be legible.
- 14.2 Sign writing shall be clean edged, neat and free of brush marks with the characters well formed. Only good quality synthetic enamel paints shall be used.
- 14.3 Transfers, stickers, allocation charts or any other form of designation material shall be submitted to the A.P.O. for approval before use.
- 14.4 Exposed designations on the manual switchboard shall be engraved and filled with material of a contrasting colour.
- 14.5 Operational designations shall be provided for:
 - (i) The calling code numbers for all lines terminating on the manual switchboards and telephones.
 - (ii) The function names, or their approved standard abbreviations, for control keys and lamps on the manual switchboards and special telephones.
 - (iii) The function names, or their approved standard abbreviations for all controls and indicating devices on other installed apparatus used by the Customer and telephonist.
- 14.6 Service designations shall be provided for:
 - (i) The MDF verticals.
 - (ii) MDF terminal numbers.
 - (iii) Extension line MDF and IDF appearances.
 - (iv) Exchange line MDF and IDF appearances.
 - (v) Tie-line MDF and IDF appearances.
 - (vi) Cable appropriation and tag identification of the IDF.
 - (vii) Racks, where three or more are installed.
 - (viii) All relays (if deemed necessary, relay positions as seen from the rear) and switch magnets.
 - (ix) Relay sets.
 - (x) Relay set positions.
 - (xi) Switch circuit allocations.

- (xii) Fuse block allocation and ratings.
- (xiii) Power supply including the battery installation.
- (xiv) All service jacks, keys, switches and lamps.
- (xv) Tool identification.

14.7 The Contractor's name and date of the installation shall be designated in a prominent position on the equipment installed.

15. POWER PLANT AND COMMON SERVICES.

15.1 General. A complete power plant suitable for the operation of the P.A.B.X. shall be supplied by the Contractor. The power plant shall conform to the undermentioned details except that, when stipulated by the Customer, an approved type of battery eliminator as specified in Sub-clause 15.5 may be used in lieu of the items specified in Sub-clauses 15.2, 15.3 and 15.4. This alternative will be permitted only when the equipment provides facilities which enable the exchange lines to be connected to individual telephones during power failure and prevents exchange calls established during power failure from being disconnected as a result of restoration of the power.

15.2 Battery.

- (i) Single Battery. Normally, a single battery of 48 volts (or other voltage compatible with the approved P.A.B.X.) shall be provided.
- (ii) Duplicate Batteries. When specified by the A.P.O., duplicate batteries shall be provided with the approved switching facility to connect to the P.A.B.X. load without interruption, either battery or both batteries in parallel.
- (iii) Capacity. Each battery shall have a discharge capacity at least equivalent to four times the five year "busy hour" load.
- (iv) Type of Cells. The cells of the battery shall have a designed float service life of fifteen (15) years and shall be in accordance with A.P.O. Specification No. 662 and of a type currently being supplied to the A.P.O.
- (v) The water and acid used as constituents of the electrolyte with which the cells have been filled shall be certified by the battery manufacturer or other qualified testing authority to comply with Australian Standards Nos. C.59 and C.60.
- (vi) Battery Cabinets and Stands. Generally, the battery shall be accommodated within an approved type of battery cabinet in accordance with the relevant sheet of A.P.O. Drawing No. CZ.2000. When the battery is required to be installed in a separate battery room or power plant room, the battery may, as an alternative, be mounted on an approved type of battery stand in accordance with A.P.O. Drawing No. CZ.2002.

15.3 Battery Installation and Testing.

- (i) Installation. The battery shall be installed in accordance with the relevant provisions in A.P.O. Engineering Instruction POWER PLANT, Batteries I.0010, particular attention being paid to Paragraphs 4.2, 4.3, 4.4, 5.2, 5.3, 5.4 and 5.8.
- (ii) Initial Charge. The initial charge of the battery shall be carried out in accordance with Section 6 of the aforementioned A.P.O. Instruction, particular attention being paid to Paragraphs

- (iii) Test Discharge. The battery shall have a recorded test discharge in accordance with Sub-clause 21.14 of this Specification. The battery shall be recharged and over-charged immediately on completion of the test discharge.

15.4 Rectifier.

- (i) A regulated, smoothed, power supply rectifier or rectifier suite to be used for battery charging and float duty shall be supplied and installed by the Contractor.
- (ii) The rectifier plant shall have an output capacity at least equivalent to the average current consumption for the estimated five year traffic figure "busy hour" load of the proposed P.A.B.X.
- (iii) The rectifier shall be an approved type in accordance with the requirements of A.P.O. Specification No. 876 (maximum 50 amperes) or No. 849, and shall be fitted with automatic and manual voltage controls.
- (iv) The rectifier shall be installed to A.P.O. requirements, generally in accordance with the manufacturer's recommendations and with particular attention being paid to the aspects of ventilation.
- (v) The output meters shall be adjusted for zero and checked for accuracy in accordance with British Standard No. 89. The rectifier shall then be adjusted for correct operation of the automatic voltage control on the light and heavy load conditions as required by the installed P.A.B.X. equipment.

15.5 Battery Eliminator.

- (i) For certain installations of P.A.B.X. equipment as stipulated in Sub-clause 15.1, a battery eliminator power plant shall be supplied and installed by the Contractor.
- (ii) The battery eliminator shall be of a type approved by the A.P.O. for the P.A.B.X. equipment, regulated in accordance with the performance requirements of the installed equipment, and generally complying with A.P.O. Specification No. 906.
- (iii) The eliminator shall have adequate output capacity to cater for the peak load of the installed P.A.B.X. equipment.
- (iv) The eliminator shall be installed in an approved manner with particular attention being paid to adequate ventilation, mounting and securing, and electrical connections. The input voltage tapping shall be adjusted in accordance with the mean public power supply voltage which shall have been determined and recorded over a period of at least 24 hours.

15.6 Ring and Tone Equipment. All ring and tone supply equipment shall be of a type approved by the A.P.O. and shall have the same reliability of operation as the main D.C. supply. The ring and tone supply shall have an output capacity adequate for the full loading of the P.A.B.X. equipment to be installed to satisfy the five year development requirement, except that in the case of a non-extensible P.A.B.X., the output capacity of the ring and tone supply shall be as approved by the A.P.O. for the particular P.A.B.X. type. The normal provision of ring and tones for the P.A.B.X. installation shall be as follows:

- (i) Ringing Current. The frequency of any alternating current required by the P.A.B.X. installation for the ringing of bells or for the operation of signalling circuits via telephone lines, shall be between 15 and 27.5 cycles per second. For the operation of telephone bells the alternating current shall be interrupted with the periodicity of 360 to 440 milliseconds on, 180 to 220 milliseconds off, 360 to 440 milliseconds on and 1.8 to 2.2 seconds off. For all P.A.B.X. installations the full load output voltage at the terminals of the P.A.B.X. equipment shall not be less than 75 volts, and the no load voltage shall not rise above 100 volts.
- (ii) Ring Tone shall be a 360 c/s to 440 c/s voltage modulated approximately 100 per cent at the ring current frequency and interrupted in accordance with the ringing current supply as specified in Sub-clause 15.6 (i) above. The level of the ring tone measured across a 600 ohm non-reactive termination on any telephone circuit feeding the tone from the equipment shall be within the limits of -9 dbm minimum and -6 dbm maximum.
- (iii) Dial Tone shall be generated from a 145 c/s to 165 c/s source and shall comprise one cycle every 27 to 33 milliseconds to produce a complex voltage with each of the harmonics of the fundamental frequency (approximately 33 c/s), up to at least 1300 c/s, having values of not more than 40 db less than the fundamental. The level of dial tone measured across a 600 ohm non-reactive termination on any telephone circuit feeding the tone from the equipment shall be within the limits of -9 dbm minimum and -6dbm maximum.
- (iv) Busy Tone shall be a 360 c/s to 440 c/s voltage interrupted 335 milliseconds to 415 milliseconds on and 335 milliseconds to 415 milliseconds off. The level of busy tone measured across a 600 ohm non-reactive termination on any telephone circuit feeding the tone from the equipment shall be within the limits of -9 dbm minimum and -6 dbm maximum.
- (v) Trunk Offering Tone shall be a 360 c/s to 440 c/s continuous voltage. The level of trunk offering tone measured across a 600 ohm non-reactive termination on any telephone circuit feeding the tone from the equipment shall be within the limits of -18 dbm minimum and -15 dbm maximum.
- (vi) Number Unobtainable (NU) Tone shall be a 360 c/s to 440 c/s voltage interrupted 2.25 seconds to 2.75 seconds on and 450 milliseconds to 550 milliseconds off. The level of NU tone measured across a 600 ohm non-reactive termination on any telephone circuit feeding the tone from the equipment shall be within the limits of -9 dbm minimum and -6 dbm maximum.

- 15.7 Stand-by Ring and Tone Equipment. When stipulated by the A.P.O., the installation shall be provided with a stand-by ring and tone equipment having the same characteristics as the main ring and tone equipment and shall be fitted with an automatic change-over facility so that failure of a ring or tone feed to the P.A.B.X. switching equipment automatically connects the stand-by ring and tone equipment in place of the main ring and tone equipment.
- 15.8 Clearing Alternating Current. Installations provided with bothway exchange line circuits shall be provided with an alternating current supply as the means of providing positive supervision of the clearing down of these circuits. The frequency of the clearing alternating current shall not be less than 16 cycles or more than 35 cycles per second. The clearing A.C. supply shall have the same reliability of operation as the main D.C. supply and shall have an output capacity adequate to provide simultaneous clearing of all of the bothway exchange lines that would be required for the five year traffic requirement. Full load output voltage measured at its connection point to the exchange line circuits shall not be less than that stipulated for the P.A.B.X. at type approval and the no load voltage shall not rise above 100 volts. The clearing alternating current voltage shall not be interrupted. The ringing supply may be used as a clearing A.C. supply provided the requirements of Sub-clause 15.6 and this Sub-clause can be simultaneously satisfied.
- 15.9 Fuses. The installation shall be provided with fuses of approved type to provide satisfactory protection for components and wiring and adequate segregation so that a minimum of the equipment is inoperative when a fault occurs. Each fuse shall, when operated, initiate an urgent alarm in accordance with Clause 13. The battery, rectifier and each suite of equipment shall be separately fused. The battery and main distribution fuses shall be housed on an approved power distribution panel or miscellaneous apparatus rack of approved design. Each separate functional circuit shall be individually fused. All fusing shall be in the negative conductor. At each fuse point two complete spare fuse elements of each type of fuse used at that location shall be supplied and suitably mounted.
- 15.10 Earthing. A positive busbar connected to the positive terminal of the battery and positive terminal of the rectifier or battery eliminator shall be connected to the telecommunication earth on the MDF by means of a cable 7/0.036 in or as specified by the A.P.O. The telecommunication earth shall not be connected to an earth connection to be used for any other electrical service.
- 15.11 Cabling and Connections. The size and length of power cables shall be such that the maximum drop of potential between the battery terminals and the main distributing point shall not exceed 0.75 volt, and from the main distributing point to any subsidiary distributing point shall not exceed 0.25 volt, when the full load current for the equipment required to satisfy the five year development is passing, provided the current density of 1000 amperes per square inch in any of the cables is not exceeded. The cable shall be of 250 volt grade in accordance with British Standard No. 2004. All cable connections shall be made in accordance with A.P.O. E.I. INTERNAL PLANT INSTALLATION, Wires and Cables T.3051, or with an approved high pressure clamping method giving equivalent long term reliability, using tinned brass or copper cable connectors or sockets. The cable shall be properly protected and supported and all materials necessary shall be provided by the Contractor.
- 15.12 Power Distribution Panel. An approved type of power distribution panel consisting of battery and distribution fuses, appropriately alarmed and designated and fitted with a positive distribution busbar, shall be provided and installed on a miscellaneous apparatus rack or other approved housing mounted by the Contractor in a location adjacent to, but not in, the battery cabinet.

15.13 Power Circuit Diagram.

- (i) Before commencing any work on any installation, the Contractor shall obtain A.P.O. approval of the details of the proposed method of meeting the requirements of Sub-clauses 15.1 to 15.12 above. For this purpose the Contractor shall prepare a detailed diagram which if acceptable shall be stamped "Approved".
- (ii) Power circuit diagrams for unit type and other P.A.B.X's of limited extensibility in which the power requirements do not vary from installation to installation, shall be registered with the A.P.O. and the approval of power supply arrangements shall be sought by quoting the relevant registered diagram.
- (iii) For all other P.A.B.X's and where it is proposed to depart from an approved and registered arrangement, the Contractor shall make an individual submission of details in respect of each such installation.

15.14 Electricity Supply Mains. The Contractor shall ensure that the Customer has made the necessary arrangements for cables from the electricity supply mains to be run and connected to power points and lighting fittings in accordance with the approved accommodation diagram. The final distribution of the electricity supply mains to the rectifier, battery eliminator, ringing machine or any other mains operated device connected permanently to the equipment, shall be separately fused from all other general purpose and lighting outlets.

15.15 Power equipment and wiring shall comply with Australian Standard CC1, SAA Wiring Rules, modified in accordance with the rules of the appropriate local Electricity Supply Authority.

16. MAIN DISTRIBUTION FRAME.

- 16.1 An approved type of main distribution frame (MDF) for the P.A.B.X. shall be supplied and installed by the Contractor in the position shown in the approved accommodation diagram and in accordance with the approved cabling diagram.
- 16.2 Protectors and fuses when specified, shall be supplied and installed by the Contractor in accordance with A.P.O. Engineering Instruction TELEPHONE, General P.0101.
- 16.3 The MDF shall be provided with a suitable approved type cover, except that where the MDF is installed in a separate equipment room, the cover may not be necessary.
- 16.4 For P.A.B.X's with a 5 year development requirement of 50 extension lines or less and a total MDF cable requirement of 150 pairs or less, the MDF may, at the discretion of the A.P.O., be a terminal box to A.P.O. Drawing No. CE.730.
- 16.5 For P.A.B.X's with a 5 year development requirement of 90 extension lines or less and a total MDF termination requirement of 300 pairs or less, the MDF may, at the discretion of the A.P.O., be a frame to A.P.O. Drawing No. CE.40085 or CE.40086.
- 16.6 For P.A.B.X's having a 5 year development requirement of more than 90 extension lines or having a total cable termination requirement in excess of 300 pairs, the MDF shall be a frame to A.P.O. Drawing No. CE.40079.
- 16.7 The Contractor shall complete an MDF record for each cable pair that is terminated and for each jumper that is run on the MDF. The MDF record material will be supplied to the Contractor by the A.P.O. on request. For MDF's up to and including 500 pairs capacity, the record shall be A.P.O. book number SE.517.

For MDF's in excess of 500 pairs capacity the record shall be on sheet proforma to Drawing CE.90072 Sheet 2.

- 16.8 The Contractor shall provide a holder or cover, on or directly adjacent to the MDF, for the MDF records. For record book SE.517 the holder shall be to A.P.O. Drawing No. CE.90070. For record sheet proforma CE.90072 Sheet 2 the cover shall be to A.P.O. Drawing No. CE.90072 Sheet 1.

17. METAL WORK AND FITTINGS.

- 17.1 All frames, racks, ducts, runways and other items of equipment shall be securely fastened to walls or floor to withstand all stresses ordinarily experienced in the maintenance and operation of the P.A.B.X. All metal work and metal fittings shall be finished in accordance with Sub-clause 19.2.
- 17.2 Approved types of ducts and runways shall be supplied and installed by the Contractor. The number and size of the ducts or runways shall be adequate to house satisfactorily all of the cables installed. When required by the A.P.O., ducts shall be provided with a close fitting lid and all cabling openings closed off after installation to prevent the entry of rodents. Where runway is approved for use, current A.P.O. methods and practices shall be applicable.
- 17.3 All exposed metal surfaces of frames, racks and runways shall be adequately connected to the telecommunication earth by the Contractor.
- 17.4 At all points where cables pass through or around metal work, they shall be protected from any possible damage by an approved wood, plastic or fibre grommet section or equivalent supplied and firmly fitted to the metal work by the Contractor.

18. CABLING AND WIRING.

- 18.1 Cable. Switchboard cable shall conform to A.P.O. Specification No. 832.
- 18.2 Standards and Practices. Cabling and wiring required for the P.A.B.X. and associated apparatus shall be carried out by the Contractor in accordance with the details shown on the cabling diagram as approved by the A.P.O. prior to the work being commenced. All cabling and wiring shall be carried out in workman-like manner in accordance with A.P.O.'s standard practices including A.P.O. Engineering Instructions, TELEPHONE, Sub-station IO001, IO004, IO011, A.P.O. TECHNICIAN'S HANDBOOK, Subscribers' Equipment Installation Diagrams and A.P.O. Specification No. 989.
- 18.3 Records. Cabling records for the distributing boxes shall be completed by the Contractor for every P.A.B.X. installation, including those in which the P.A.B.X. is installed using existing cable. The cable record form shall be of the appropriate A.P.O. standard type and will be available from the A.P.O. without charge upon request.
- 18.4 Terminating. The individual wires of a cable shall be terminated and soldered in accordance with the methods described in A.P.O. Engineering Instruction, TELEPHONE, General A1310, and the colour code detailed in A.P.O. Engineering Instruction, TELEPHONE, Sub-station W0010 in which the code wire is the negative wire and the mate the positive.
- 18.5 Jumper Wires. All jumper wire required for the installation shall conform to A.P.O. Specification No. TEQ.3037. Generally for MDF's, IDF's, etc., the wire shall be 0.028 inch diameter, except that provided A.P.O. approval has been obtained, the wire used on certain types of IDF may be 0.020 inch.

18.6 Jumpering. Jumpering shall be carried out in accordance with A.P.O. Engineering Instruction, INTERNAL PLANT INSTALLATION, Wires and Cables J3010. The red wire shall be the negative wire and the white wire shall be the positive wire.

18.7 Solder. Soldering shall be carried out with resin cored solder in accordance with A.P.O. Engineering Instruction, TELEPHONE, General A1320. No separate flux is permitted. Solder shall comply with the following requirements:

- (i) British Standard 441.
- (ii) Diameter shall be 0.045 in. minimum, 0.067 in. maximum.
- (iii) The tin content shall be 65 per cent.
- (iv) The resin shall be activated.

19. INSTALLATION STANDARDS.

19.1 The Contractor shall ensure that the workmanship and finish of the installation are of a high quality and that the following standards are observed.

19.2 Finish on Metal Work.

- (i) The metal work of P.A.B.X. equipment supplied to, and installed for, the A.P.O. shall be finished in A.P.O. Light Grey Stoving Enamel in accordance with A.P.O. Specification No. 983. The metal work of P.A.B.X. equipment supplied to, and installed for, a Customer in accordance with this Specification, shall be to an equivalent finish in a colour acceptable to the Customer.
- (ii) All metal work not having any special finish shall be free from rust and scale and after erection on site, shall be given at least one coat of enamel of a type and colour to match the equipment.
- (iii) Immediately prior to offering the P.A.B.X. equipment for acceptance testing, the Contractor shall touch up all metal work including the heads and exposed threads of screws, bolts, etc., with touch-up enamel in accordance with A.P.O. Specification No. 983. The colour of the enamel shall match that of the equipment.
- (iv) All metal work shall be truly aligned and rigid.
- (v) All tie-bars and runways shall be straight and in general, horizontal or parallel with, or normal to, the equipment suites or racks.
- (vi) All racks and frames shall be vertical.
- (vii) All joints shall be securely and correctly made.
- (viii) All bolts and screws shall be secure, but not over tightened, and shall be free from burrs and distortion.
- (ix) All sharp projections shall be rounded off or otherwise protected.

19.3 Finish to Cabling.

- (i) Cables shall be run in a neat manner.
- (ii) There shall be no kinks in the cable.
- (iii) Cables shall be fastened firmly in position except where they are placed in troughs or ducts of a type approved by the A.P.O. Special attention shall be paid to the points where cables may be visible particularly vertical runs through floors. Where bends are necessary the inner radius of curves shall be smooth and free from

kinks, creases and other distortions.

- (iv) Cables, particularly those entering or leaving conduits or ducts or passing through an opening in a wall or floor, shall be protected from mechanical damage.

19.4 Stripping and Butting Cables and Stripping Wires.

- (i) All butts shall be individually and uniformly made.
- (ii) All stringers shall be formed in a uniform manner.
- (iii) Wires shall not be nicked or kinked and their insulation shall not be damaged.
- (iv) Where the stripping of wires is necessary, the insulation shall be removed completely and cleanly.

19.5 Terminating.

- (i) All terminations shall be made correctly and neatly in a uniform manner.
- (ii) The insulation on wire stringers shall not touch any terminals.
- (iii) Wires shall not be nicked or kinked.
- (iv) The end of the insulation on all wires shall be finished neatly. In the case of screw terminals, the insulation shall not enter under the washer or screw head, but must finish within 1/10 inch of the terminal washer.
- (v) Each wire terminating under a screw terminal shall be separated by individual washers from each of the adjacent wires and from the head of the screw. A wire shall not cross over itself under a screw termination.
- (vi) No wire shall project beyond the end of its tag. No scraps of wire or insulation shall be left among the tags.

19.6 Soldering.

- (i) Soldering of bright copper conductors shall be completed within eight (8) hours of the conductor cleaning operation. Tinned copper conductor terminations shall be soldered as soon as possible after the terminating operation.
- (ii) The solder shall provide a good electrical bond between the conductor and the tag.
- (iii) No excess solder shall remain on the tag.
- (iv) Adjacent blocks, tags and wires shall be protected from damage during soldering operations.
- (v) No solder droppings or splashing shall be left in or about the work.
- (vi) Only high quality resin cored soft solder in accordance with Sub-clause 18.7 shall be used and no flux deposits shall remain.

19.7 Solderless Wrapped Connections.

- (i) Only solderless wrapped connections employing tools, materials and equipment for which A.P.O. type approval has been obtained, may be used.

- (ii) The connections shall consist of a minimum of six successive non-overlapping helical turns with the first as close as possible to the terminal shoulder. The turns of a connection should touch and the last turn shall be well closed. The maximum space between turns shall be 0.005 in.
- (iii) All wrapped connections having visible imperfections shall be soldered.
- (iv) If a connection on a terminal is to be soldered, all previous or subsequent connections to that terminal shall also be soldered.
- (v) Soldered connections shall be made within the space normally occupied by a solderless wrapped connection.
- (vi) In no circumstances shall wrapped connections be made with conductors which have been unwrapped or stripped from a terminal.
- (vii) Wrapped connections with new conductors may be made on terminals on which connections have been unwrapped. However, wrapped connections are not permissible on terminals from which a wrapped connection has been stripped or a soldered connection removed.
- (viii) Tools shall be examined visually for any defects likely to result in faulty wrapped connections.
- (ix) Prior to commencement of terminating, thirty (30) test solderless wrapped connections shall be made by each operator using each of the tools to be employed for the work and under similar conditions to those prevailing in the normal work. Twenty (20) of these test connections shall be stripped. Stripping forces required shall not be less than 3,000 grammes or more than 10,000 in any connection and the average value of each group of 5 connections shall not be less than 4,000 grammes or more than 7,000 grammes in any group. (Stripping force is the force required to cause perceptible movement of a connection. This may or may not be the force required to strip the connection completely from the terminal.) These terminals shall not be rewrapped for use on the installation or for subsequent tests. Ten (10) connections shall be unwrapped and no breakage of any conductor shall occur during unwrapping. Terminals from which the wires are unwrapped in this part of the test may be reused.
- (x) At the commencement of each terminating session or period of terminating not exceeding 4 hours, each operator shall make 5 wrap connections on terminals similar to those used for the installation and under similar conditions. Each connection shall withstand a stripping force of 3,000 grammes. If this requirement is not met the tool concerned will be immediately withdrawn from the work.
- (xi) Records shall be kept of the results of all tests applied to each wrapping tool by each operator. These records shall be made available for examination by the A.P.O. inspecting officer during installation and until the installation is approved.

20. TESTING THE INSTALLATION.

20.1 The Contractor's Tests.

- (i) The Contractor shall take all reasonable measures to ensure that the installation is in a satisfactory condition before it is handed over to the A.P.O. for acceptance testing. The whole P.A.B.X. installation, or in the case of a progressive cutover

at the Customer's request, that part of the installation offered to the A.P.O. for acceptance testing, shall be completely and thoroughly tested by the Contractor.

- (ii) The Contractor shall test the installation in accordance with the testing schedule supplied by the manufacturer of the equipment or his agent. This schedule shall be as approved by the A.P.O., and shall include the tests outlined in Clause 21 of this Specification together with any others that may be necessary to ensure that the installation will function correctly.

20.2 Acceptance Tests.

- (i) When acceptance testing of the installation is required, the Contractor shall notify the A.P.O. in writing that the installation is complete in all respects and has been fully tested in accordance with the provisions of this Specification.
- (ii) The A.P.O. will carry out such tests as it deems necessary to ascertain that the installation has been completed in accordance with all relevant requirements. If so requested by the A.P.O., the Contractor's staff shall vacate the P.A.B.X. equipment room whilst A.P.O. acceptance testing is in progress.
- (iii) Any defect located during the progress of acceptance tests shall be remedied by the Contractor immediately after the conclusion of the tests. If the A.P.O. determines that the defect is of a minor nature and would not interfere with, or prolong, the subsequent testing, the Contractor may be permitted to correct the defect during the progress of the tests. An installation which fails to pass an acceptance test may not be accepted, in which case it can be re-submitted for acceptance testing only in accordance with Sub-clause 20.2 (i) above, and when all defects have been satisfactorily corrected and the installation has been re-tested in accordance with Sub-clause 20.1.
- (iv) Following an initial non-acceptance of the installation and when any subsequent visit is incurred by the acceptance test staff, the A.P.O. will debit the Contractor for the testing time and other expenses in excess of those normally allowed for such an installation.

21. TESTS.

21.1 General. Tests shall be applied to ensure compliance with this Specification, and any other conditions necessary, to prove the proper operation of each and every part of the installation. Among other tests in accordance with the approved test schedule for the equipment type the following shall be applied by the Contractor before the installation is offered to the A.P.O. for acceptance.

21.2 Visual Inspection. A visual inspection of installation will be a preliminary to all other functional tests. The Contractor shall carry out a 100% check and the A.P.O. will sample check the following items:

- (i) The supply of the correct quantities and satisfactory quality of materials and equipment.
- (ii) The equipment layout is in accordance with the approved accommodation diagram.
- (iii) The stipulated power plant is correctly provided.

- (iv) Only the equipment stipulated is provided and all provided facilities have adequate A.P.O. approval.
- (v) The documentation of the installation is complete and satisfactory.
- (vi) The MDF and IDF layouts, jumpering and terminations are correctly provided and in accordance with the required standards.
- (vii) The extension, exchange and tie category strappings are in accordance with the requirements of the installation.
- (viii) The installation standards as set out in Sub-clauses 4.9, 4.11, 18.2 and Clause 19 have been complied with.
- (ix) The installation is completely and satisfactorily designated.
- (x) All the records are complete and neat.
- (xi) The traffic measuring facilities have been adequately and correctly provided.
- (xii) The maintenance and alarm facilities have been adequately and correctly provided.
- (xiii) All the relays are assembled and adjusted to operate correctly in accordance with the manufacturer's recommendations as approved by the A.P.O.

21.3 Insulation Tests. The Contractor shall measure the insulation resistance of each extension line before the telephone apparatus is connected to the line. When testing from the main distribution frame through all wiring, jumpers, frames, etc., with a 250 volt insulation tester, the insulation resistance of any cable pair shall not be less than 10 megohms.

21.4 Extension Telephone Apparatus. The Contractor shall test each item of extension telephone apparatus, using an approved type test equipment, for the following conditions:

- (i) The correct functioning of all facilities.
- (ii) Performance of all dials to the current A.P.O. Standard.
- (iii) Operation of all bells or other signalling devices.
- (iv) A transmission test through the 40 db attenuator.
- (v) Installation standards in accordance with Clauses 18 and 19 of this Specification.

21.5 Switch Examination. The Contractor shall examine as follows each electro-mechanical switch before it is placed into service:

- (i) Check the switch for standard adjustment in accordance with the manufacturer's recommendation as approved by the A.P.O.
- (ii) Electrically test the switch under the limit operating conditions as approved for the particular P.A.B.X. equipment.

21.6 Automatic Equipment Functional Tests. The Contractor shall undertake a predetermined pattern of functional tests of the installed equipment to ensure that all of the traffic facilities and circuit paths as shown on the approved trunking diagram have been provided, are in correct working order and each has its correct traffic source and availability. The Contractor shall state the probability of error and the confidence level of each conclusion from the test result. The following items, together with others as necessary for the particular installation,

shall be concluded from the tests:

- (i) Each extension is correctly classified and may originate and receive calls to and from the equipment.
- (ii) Each extension can call every other extension connected to the P.A.B.X.
- (iii) Each extension can call each available information circuit.
- (iv) Each extension can call via each available outgoing tie-line circuit.
- (v) Each exchange access extension can call via each available outgoing or bothway exchange line.
- (vi) Each dial pulse receiving device when operating at its stipulated voltage limits can correctly respond to pulse limits of 25 to 50 milliseconds make and 50 to 88 milliseconds break applied with a 2 microfarad and 100 ohm spark quench, separately via a series resistor (long line) and a shunt resistor (short-line) equal to the published and approved maximum extension line loop resistance and minimum extension line leakage resistance respectively.
- (vii) Each ring feeding device can feed at least 5 milliamperes of ring current to a series circuit consisting of 0.65 microfarad, 90 henries and 7,500 ohm resistance plus the published and approved maximum extension line loop resistance whilst the ring supply voltage is 75 volts. With the maximum published and approved voltages applied to the equipment, the ring circuits do not disconnect (i.e., trip) when applied directly to a 6 microfarad capacitor but do disconnect (trip) without chatter when the capacitor is replaced by a short circuit. With the minimum published and approved voltages applied to the equipment, the ring circuits disconnect (trip) within 250 milliseconds of the application of a resistor having a value equal to 1.25 times the published and approved maximum extension line resistance.
- (viii) Each tone feed operates correctly and is in accordance with Sub-clauses 15.6 and 15.7 of this Specification.
- (ix) Each transmission path does not introduce a loss that is worse than the published and approved loss, due to equipment, of the particular path for the type of equipment installed. The difference between the longitudinal impedance at 1000 c/s of each leg of the transmission path (i.e. out of balance) does not exceed 10 per cent of the lesser value.
- (x) Each incoming exchange line can be connected with each exchange access extension and exchange access tie-line.
- (xi) Each incoming tie-line can connect with each telephonist, each extension telephone and each available outgoing tie-line.
- (xii) Each automatic call back and enquiry facility operates correctly.
- (xiii) Each automatic transfer facility operates correctly.
- (xiv) Each night switching facility operates correctly.
- (xv) Each group hunting arrangement operates correctly.
- (xvi) Each camp on facility operates correctly.
- (xvii) Each emergency service during power failure connection has been made and functions correctly in accordance with Sub-clause 15.1.

- (xviii) Each and every call connection is adequately guarded against intrusion by another call.
- (xix) Each circuit is adequately guarded from simultaneous seizure from more than one source.
- (xx) Each service control meter facility (see Sub-clause 12.3) and each trouble recorder (see Sub-clause 12.4) operates correctly.

21.7 Exchange Line Functional Tests. Each exchange line shall be tested in accordance with its specified A.P.O. registered approval for:

- (i) Pulsing performance to current A.P.O. requirements.
- (ii) The correct operation of out-calls.
- (iii) The correct operation of in-calls for normal and night-service.
- (iv) The exchange line terminating conditions during the progress of calls, particularly the continuity and adequacy of the exchange line holding circuitry during any call back enquiry and transfer operations.
- (v) The correct clearing and guarding so that ineffective follow-on calls or double seizures are limited to the possibility of not more than 1 lost call in 1,000 calls.
- (vi) The correct operation of the exchange line busying facilities including back busying of outgoing exchange lines.
- (vii) The correct operation of indialling facilities.
- (viii) The correct operation of trunk access barring facilities.

21.8 Manual Switchboard Functional Tests. Each manual switchboard (or normal exchange line answering telephone, where applicable) shall be tested for:

- (i) The correct operation and satisfactory performance of the telephonist's circuit.
- (ii) The correct operation in accordance with specific A.P.O. registered approval of all exchange line facilities including the pulse performance of all dials and keysenders.
- (iii) The correct operation of the extension line access facilities on each circuit.
- (iv) The correct operation of the trunk offering and speech splitting facilities on each circuit.
- (v) The correct operation of the "camp-on" facility on each circuit.
- (vi) The correct operation of each information circuit.
- (vii) The correct timing of any automatic telephonist recall and automatic night-switching facility on each circuit.
- (viii) The correct operation of the overlapping facility.
- (ix) The correct operation of any busy lamp display.
- (x) The satisfactory operation of any other telephonist's facilities that may be provided.
- (xi) The correct functioning of all keys and lamps.

21.9 Equipment Performance Test. The Contractor shall apply artificial telephone traffic to the P.A.B.X. equipment to test for the satisfactory performance of all the circuits, paths, routes and facilities provided by the installed equipment. The artificial traffic may be generated from standard A.P.O. type telephones or their equivalent or an A.P.O. approved traffic generating test set. The Contractor shall state the number of test calls applied for at least each of the following functions and the number of faults encountered, during the final testout:

- (i) Extensions to extensions (complete calls).
- (ii) Extensions to exchange (detection of exchange dial tone only).
- (iii) Simulated exchange to telephonist.
- (iv) Simulated exchange to extensions (night switch or indial).
- (v) Extensions to telephonists (complete calls).

21.10 Equipment Load Test. The Contractor shall apply simultaneous calls to the P.A.B.X. equipment to ensure that the traffic requirement will be satisfied without congestion, misoperation or interference from one circuit to another. The number of simultaneous calls for each function shall be determined by the number of common paths (registers, link circuits, etc.) in accordance with the approved trunking diagram. The Contractor shall state the number of simultaneous calls in each test and the number of attempted and successful tests for at least each of the following functions:

- (i) Seizure from extension lines.
- (ii) First pulse from extension lines.
- (iii) Last pulse to extension lines.
- (iv) Last pulse to seize outgoing exchange lines automatically.
- (v) Last pulse to seize information circuits.
- (vi) Last pulse to seize tie-line and any other service line facilities.
- (vii) Simultaneous call back operations.
- (viii) Simultaneous call transfer operations.

If mutual interference is possible, the abovementioned functions shall be tested simultaneously and the Contractor shall state that this has been undertaken.

21.11 Sparking Tests. The Contractor shall, under normal lighting conditions, observe the P.A.B.X. switching equipment during the functional, performance and load tests applied in accordance with Sub-clauses 21.6 to 21.10. If sparking is perceived at any contact of the equipment, an appropriate spark quenching device shall be provided in the relevant circuit to mitigate adequately the sparking. The tests shall thereupon be repeated.

21.12 Noise Test. The Contractor shall ensure that no extension suffers interference from any other line activated by ring current, dial pulses, system tones or normal voice transmission. The listening device shall be a normal A.P.O. 800 type telephone which shall be correctly connected to the line under test from which all service tones shall have been removed. All detected interference, crosstalk and noise will be investigated, and its source determined. It shall be mitigated to the extent that it satisfies the following additional tests:

- (i) Crosstalk shall be measured at a frequency of 1,000 cycles per second with the circuits under test each terminated with a 600 ohm non-reactive impedance. The minimum crosstalk path attenuation shall be 70 db.
- (ii) Noise shall be measured with a peak reading voltmeter similar to the U.K. peak programme meter (C.C.I.T.T. Red Book, Volume III, Annex 49, page 429) having a charging time constant of 0.25 millisecond (in lieu of 2.5 milliseconds) used in conjunction with a weighting network in accordance with the table of weights for the C.C.I.T.T. 1951 psophometer. The mean noise introduced into any transmission circuit during any hour when so measured shall not exceed a level of -55 dbm0 (weighted). Occasional peaks of -40 dbm0 will be permissible.

21.13 Maintenance Facility and Alarm Tests.

- (i) Maintenance Facility Tests. The Contractor shall check the maintenance facilities provided in accordance with Clause 12 and, in particular, shall test for the correct operation of:
 - (a) Access jacks, occupation lamps and make busy keys or controls for the traffic carrying circuits.
 - (b) Test Sets.
 - (c) Service control meter facility equipment, where appropriate.
 - (d) Automatic circuit routiner or trouble recording unit, where appropriate.
 - (e) Dial test facility equipment.
 - (f) All facility equipment mounted on the test rack where appropriate.
 - (g) The Technician's telephone circuit.
 - (h) Multiple jacks and battery jacks with fuses.
- (ii) Alarm Tests. The Contractor shall check the alarm facilities provided in accordance with Clause 13 and, in particular, shall test the alarms for:
 - (a) The adequacy of provision and correctness of classifications.
 - (b) The correct rating of fuses and correct operation of the urgent alarm from each fuse mounting.
 - (c) The correct timing and operation of the various alarm categories.
 - (d) The correct provision and operation of the alarm indicators.
 - (e) The correct operation of the extended alarm circuitry.
 - (f) The correct operation and display of the supervisory alarm from each alarm category.

21.14 Power Plant Tests. The Contractor shall check that the equipment and provision is in accordance with the approved power circuit diagram.

- (i) Electricity Supply Mains. The Contractor shall check that:
 - (a) The relevant parts of the installation have been approved by the local Electricity Supply Authority.
 - (b) All relevant items of plant are satisfactorily earthed.

(c) The rating, type and designation of the final sub-circuit fuse feeding the P.A.B.X. power plant are correct.

(ii) Battery. The Contractor shall certify that the battery has been installed and charged in accordance with Sub-clauses 15.2 and 15.3 of this Specification with particular reference to the following tests and checks:

(a) Initial Test Discharge. The Contractor shall carry out an initial test discharge in accordance with Section 8 of A.P.O. Engineering Instruction POWER PLANT, Batteries IO010 except that the 10 hour test may be replaced by the 3 hour test in accordance with Sub-clause 18.2 of A.P.O. Specification No. 662 Cells Secondary, Stationary-Pasted Plate, Fully Enclosed Type. The Contractor shall record the results of the test in the Log Book (see Clause 23). The battery must be recharged immediately on completion of the test discharge.

(b) Float Voltage and Cell Specific Gravity Equalisation. The Contractor shall check the battery in accordance with Section 9 of A.P.O. Engineering Instruction POWER PLANT, Batteries IO010 and shall record the readings in the Log Book.

(c) Voltage Drop of Connections. The Contractor shall check that the voltage drop of connections in accordance with Paragraph 9.5 of A.P.O. Engineering Instruction POWER PLANT, Batteries IO010 does not exceed the specified figure.

(d) Battery Fuse. The Contractor shall check that the battery fuse is of the correct rating and that spare cartridge fuses have been provided.

(iii) Rectifier or Battery Eliminator. The Contractor shall check and, where appropriate, test the rectifier or battery eliminator with particular reference to the following:

(a) The mounting of all components is satisfactory.

(b) All screw and soldered connections have been satisfactorily made.

(c) All fuses are rated in accordance with the fuse rating plate and circuit requirements, and spare cartridge fuses have been provided.

(d) Correct operation of the charge fail alarm and the various indicator lamps.

(e) The D.C. voltmeter operates correctly and its accuracy at the normal working position is in accordance with British Standard 89.

(f) The input A.C. voltage adjustment is in the correct position.

(g) The D.C. output voltage at the various output adjustments is correct.

(h) The voltage regulation and the overload limits of the rectifier automatic control are satisfactory.

(j) The noise across the power supply at the D.C. distribution fuse does not exceed the specified figure.

(k) Terminal designations and safety features have been correctly provided.

(iv) D.C. Distribution and Cabling. The Contractor shall check that:

(a) The location and mounting of the power distribution panel is satisfactory.

(b) The ratings and designations of the fuses in the power distribution panel are correct, and the alarm feature operates correctly.

(c) The cable, together with its mounting and connections, is satisfactory.

(d) All switches and fuses are in the active leg.

(e) The voltage across the terminals at the P.A.B.X. equipment fuses, with a load connected equal to the maximum rating of the equipment, does not fall below the specified minimum operating voltage for the particular P.A.B.X. type.

(f) The difference between the voltage across the terminals at the P.A.B.X. equipment fuses with a load connected as in Division (e) above, and the voltage at the battery or battery eliminator output fuse, shall not exceed one (1) volt.

(v) Ring and Tone Equipment.

(a) The Contractor shall test the main ring and tone supplies for correct operation in accordance with Sub-clause 15.6 and in particular, the voltage of the ringing current supply under full load and no load conditions.

(b) The Contractor shall test the standby ring and tone supplies and, in particular, the automatic changeover feature, for correct operation in accordance with Sub-clause 15.7.

(vi) Clearing Alternating Current. The Contractor shall check that all bothway exchange line circuits will clear simultaneously.

22. INSTRUCTIONS AND DRAWINGS.

22.1 General. The Contractor, at his own cost and expense, shall prepare for each type of installation complete sets of technical instructions and drawings, telephonist's operating instructions and extension user's instructions. The instructions and drawings shall contain all information necessary for the proper installation, operation and maintenance of the P.A.B.X. system. The wording of the instructions and drawings shall be exclusively in the English language.

22.2 Distribution. The Contractor, at his own cost and expense, shall distribute the instructions and drawings, and positive transparencies, as follows:

- (i) Initially at the type approval stage, and subsequently before each alteration or modification is implemented - three complete or revised sets of instructions and drawings to the First Assistant Director-General, Engineering Works, A.P.O. Headquarters.
- (ii) Initially at the type approval stage - three sets in draft form, for A.P.O. approval if satisfactory, of the telephonist's operating instructions and the extension user's instructions to the First Assistant Director-General, Telecommunications Division, A.P.O. Headquarters.
- (iii) Prior to the installation of any type of manual switchboard which has not been previously installed in Australia - 100 sets of the A.P.O. approved telephonist's operating instructions and extension user's instructions to the First Assistant Director-General, Telecommunications Division, A.P.O. Headquarters.
- (iv) Prior to the commencement of each installation - two complete sets of technical instructions and drawings, and one set of positive transparencies relative to the equipment to be installed - to the Assistant Director, Engineering, in the State concerned.
- (v) Prior to offering the installation for acceptance testing -
 - (a) two complete sets of technical instructions and drawings to the installation, and
 - (b) one copy to the installation of the A.P.O. approved telephonist's operating instructions for each manual switchboard forming part of the P.A.B.X. together with one copy of the A.P.O. approved extension user's instructions for each extension up to the equipped capacity of the installation.

22.3 Technical Instructions and Drawings.

- (i) Cover. Each set of instructions and associated drawings shall be assembled in loose leaf form in an indexed cover, capable of opening flat. The cover shall be made of leather-board, fibreboard or equivalent material and shall be fitted with two, three or four snap ring binders suitably spaced. The spine of each cover shall be appropriately designated as to the information contained therein. The overall dimensions of the cover shall be:

- (a) Minimum - $11\frac{1}{2}$ in. x 10 in. x $1\frac{1}{2}$ in. to hold sheets 10 in. x 8 in. to a thickness of 1 inch.
- (b) Maximum - $13\frac{1}{2}$ in. x $10\frac{1}{2}$ in. x 2 in. to hold sheets 12 in. x $8\frac{1}{2}$ in. to a thickness of $1\frac{1}{2}$ inches.
- (ii) Instructions. Instructions shall include relay data, circuit descriptions, circuit aid charts, etc., and technical information covering maintenance operations and adjustments for all special or proprietary components. The dimensions of the instruction sheets shall not be less than 10 in. x 8 in. or greater than 12 in. x $8\frac{1}{2}$ in. and shall be uniform in size. The Contractor may include, as part of the instructions, any of the manufacturer's handbooks applicable to the installation provided that the wording of such handbooks is exclusively in the English language and the dimensions of the handbook sheets, and of associated drawings when folded, are uniform with those of the instruction sheets.
- (iii) Printing. Instructions and drawings, including the manufacturer's handbooks when supplied, shall be prepared by a good quality printing or duplicating process with dyeline prints (carbon copies are not acceptable to the A.P.O.). Photo-reductions of drawings to suit instruction sheet dimensions will be acceptable provided that detail necessary for installation and maintenance is not impaired.
- (iv) Drawings. The size of drawings shall not exceed 26 in. x 28 in. Drawings which are not bound with the instructions shall be folded to a size of approximately 8 in. x 13 in. and shall be stamped with an index number on the lower left or upper right corner of each sheet so that it is visible without the need to unfold drawings. Each set of unbound drawings shall be contained in a folder of plastic or similar suitable material. Drawings which are bound with the instructions and directly associated with the text, shall open up clear of the instructions and when folded, shall be of the same dimensions as those of the instruction sheets. Circuit drawings shall be of the schematic type using the associated contact principle or a co-ordinated system of a detached type. The layout of such drawings shall be neat and orderly and only symbols in accordance with A.P.O. Engineering Instruction, DRAFTING Symbols, as listed in Clause 24 may be used unless an explanatory code defining any other symbol used is included on the sheet on which the symbol is used.
- (v) Transparencies. Positive transparencies shall be supplied unfolded in rolls, with a list of the contents on the outside of each roll.
- (vi) Index. The drawing index shall state the function of the equipment to which the drawing refers, together with a reference such as "Circuit Diagram" or "Wiring Diagram". The drawing numbering system shall be clearly indicative of the relationship to the particular items of equipment, and shall be assembled in appropriate groups. In addition, a numerical index shall be provided in each folder of drawings in accordance with Sub-clause 22.3 (iv) above.
- (vii) Table of Contents. Each set of instructions shall contain a table of contents which shall list the various section headings and corresponding sheet numbers.

22.4 Telephonist's Operating Instructions. The telephonist's operating instructions shall be in the form of a loose leaf handbook and shall describe the operating features of the manual switchboard and the procedures to be adopted for handling all types of calls. The handbook cover shall be made of leather-board, cardboard or plastic. The approximate overall dimensions of the cover and instructions shall not be greater than 11 in. x 9½ in. The instructions shall be printed on good quality paper to permit of frequent usage, and the printing shall be as specified in Sub-clause 22.3 (iii) above.

22.5 Extension User's Instructions. The extension user's instructions shall be in the form of a simple handbook or instruction card of approximate overall maximum dimensions 11 in. x 9½ in. and shall set out the method of utilising the facilities available with the P.A.B.X. The instructions shall be printed on good quality paper or card to permit of frequent usage, and the printing shall be as specified in Sub-clause 22.3 (iii) above.

23. LOG BOOK.

23.1 The A.P.O. will supply the Contractor free of charge with a log book for each P.A.B.X. installation. The log book will contain space in which the Contractor shall enter the undernoted information and also space for the subsequent recording of A.P.O. maintenance attention to the installation. When not in use, the log book will be placed in the special cupboard or compartment (see Sub-clause 12.12) for safe keeping.

23.2 The Contractor shall collect the log book from the A.P.O. and in the case of each new P.A.B.X. installation shall, prior to offering the installation for acceptance testing, prepare the log book as follows:

- (i) Enter a list of all separate items of equipment provided in accordance with Sub-clause 4.2.
- (ii) Enter a list of titles and reference numbers covering all installation, operating and maintenance instructions, and all drawings provided for the installation in accordance with Clause 22.
- (iii) Enter a list showing the tool provision in accordance with Sub-clauses 12.11 and 12.13.
- (iv) Enter an itemised list of the spare parts stock holding provided in accordance with Sub-clause 10.1.
- (v) Enter details of all results and records of the testing of the installation, particularly in respect of the battery initial discharge test, and the float voltage and specific gravity equalisation test.

23.3 The Contractor, in the case of each extension to an existing P.A.B.X. installation and prior to offering the extension for acceptance testing, shall act generally in accordance with Sub-clause 23.2 above in respect of -

- (i) All additional items of equipment provided.
- (ii) All additional instructions and drawings provided.
- (iii) All additional tools provided.

(iv) All additional spare parts provided, and

(v) All additional tests performed.

23.4 The Contractor, on every occasion that he visits the installation subsequent to its acceptance by the A.P.O., shall enter in the log book details of all activities associated with the P.A.B.X. equipment including maintenance attention and the carrying out of modifications.

24. ASSOCIATED SPECIFICATIONS, ETC.

24.1 The whole, or relevant parts as indicated, of the undernoted drawings, Specifications, engineering instructions and handbook form part of this Specification but in the event of any discrepancy between them and this Specification, the latter shall be followed.

24.2 A.P.O. Specifications 834, 835, and 875 refer to the supply and installation of particular types of P.A.B.X. equipment and shall remain relevant to the details of these particular types. However, where any inconsistency or anomaly exists between those Specifications and this Specification, the conditions of this Specification shall apply.

24.3 The latest issue, as at the date of issue of the relevant A.P.O. Telephone Order (Tel.1) or specific letter of request (see Sub-clause 3.17), of all drawings, specifications, engineering instructions and handbook referred to herein, shall apply.

24.4 A.P.O. Drawings.

| <u>Number.</u> | <u>Title.</u> |
|--------------------|------------------------------------|
| CE.462 | Test Rack Circuits and Facilities. |
| CE.730 | Box, Internal Distribution. |
| CE.909 | Blocks, Terminal. |
| CE.939 | Technician's Stool. |
| CE.40075 | Technician's Ladder. |
| CE.40076 | Technician's Bench. |
| CE.40079 | MDF Floor Mounted. |
| CE.40085 | MDF Wall Mounted, 2 Vertical. |
| CE.40086 | MDF Wall Mounted, 3 Vertical. |
| CE.64001 (Sheet 1) | Jack, Knife. |
| CE.90070 | Holder for MDF Record Book. |
| CE.90072 (Sheet 1) | Cover for MDF Record Sheet. |
| CE.90072 (Sheet 2) | MDF Record Sheet Proforma. |
| CZ.2000 | Battery Cupboard. |
| CZ.2008 | Hydrometer. |
| CZ.2026 | Thermometer. |
| CZ.2002 | Battery stand. |

24.5 A.P.O. Specifications.

| <u>Number.</u> | <u>Title.</u> |
|----------------|--------------------------------------------------------------------|
| 662 | Cells Secondary, Stationary, Pasted Plate, Fully Enclosed Type. |
| 832 | Cable P.V.C. insulated and P.V.C. or lead sheathed for indoor use. |
| 834 | Supply and installation of a Line Finder Type P.A.B.X. |

| <u>Number.</u> | <u>Title.</u> |
|----------------|-----------------------------------------------------------------------------------------------|
| 835 | Supply and Installation of Uniselector Type P.A.B.X. |
| 849 | Closely Regulated, Smoothed, Power Supply Rectifiers, 400 Ampere Maximum. |
| 875 | Supply and Installation of "C" and "CA" Type P.A.B.X. |
| 876 | Regulated, Smoothed, Power Supply Rectifiers, 50 Ampere maximum. |
| 906 | Unregulated Power Supply Rectifiers (Eliminators). |
| 983 | A.P.O. Light Grey Stoving Enamel for Telecommunication Equipment. |
| 989 | Block cabling of Buildings by Contractors (under issue). |
| TEQ.3037 | P.V.C. Insulated Conductors, Jumper, Wires and Switchboard or Rack Wires. |
| TEQ.9000 | Basic Technical Conditions for Privately Owned and Maintained Attachments to Telephone Lines. |

24.6 A.P.O. Engineering Instructions and Handbook.

| <u>Title.</u> | <u>Number.</u> |
|------------------------------------------------------------|----------------|
| <u>E.I. TELEPHONE, General:</u> | |
| Soldering Wires to Tags | A.1310 |
| Use of Resin Cored Solder | A.1320 |
| Protection of Circuits | P.0101 |
| <u>E.I. TELEPHONE, Substation:</u> | |
| Standard Telephone Facilities | A.0010 |
| Installation of Substation Services - | |
| General Installation Notes | I.0001 |
| Installing Simple Services | I.0004 |
| Fixing Methods. | I.0011 |
| Cable for Substation Installation | W.0010 |
| <u>A.P.O. TECHNICIAN'S HANDBOOK:</u> | |
| Subscribers' Equipment Installation Diagrams. | |
| <u>E.I. INTERNAL PLANT INSTALLATION, Wires and Cables:</u> | |
| Jumpering | J.3010 |
| Terminating Lugs and Cables on Electric Power Cable | T.3051 |
| <u>E.I. POWER PLANT, Batteries:</u> | |
| Installation of Stationary Batteries using Enclosed Cells | I.0010 |

DRAFTING, Symbols.

| Nos. | | | |
|--------|--------|--------|--------|
| S.0100 | S.0110 | S.0200 | S.0210 |
| S.0220 | S.0230 | S.0240 | S.0250 |
| S.0260 | S.0270 | S.0280 | S.0290 |
| S.0300 | S.0310 | S.0320 | S.0350 |
| S.0370 | S.0380 | S.0390 | S.0410 |

24.7 A.P.O. Forms and Books.

| <u>Number.</u> | <u>Title.</u> |
|----------------|--------------------------------------|
| TEL 1 | Telephone Order Form. |
| TEL 133 | P.A.B.X. Proposal Form. |
| P 275 | Declaration Form. |
| SE 515 | Record Card, 5 and 10 Pair Blocks. |
| SE 516 | Record Card, 50 and 100 Pair Blocks. |
| SE 517 | Record Book, MDF. |
| - | Log Book P.A.B.X. (under issue). |

24.8 Australian Standards.

| <u>Number.</u> | <u>Title.</u> |
|--------------------------|--------------------------------------------------------------------|
| AS. C 59 } AS. C 60 } | Distilled Water and Sulphuric Acid for use in Secondary Batteries. |
| AS. CA 30 | Code for Artificial Lighting of Buildings. |
| AS. CC 1 | SAA Wiring Rules. |

24.9 British Standards.

| <u>Number.</u> | <u>Title.</u> |
|----------------|------------------------------------------------------------------------------------|
| B.S.89 | Electrical Indicating Instruments. |
| B.S.441 | Resin-cored Solder Wire. |
| B.S.2004 | PVC-insulated Cables and Flexible Cords for Electric Power and Lighting. |
| B.S.2831 | Methods for Test for Air Filters used in Air Conditioning and General Ventilation. |

24.10 The International Telegraph and Telephone Consultative Committee (C.C.I.T.T.).

Red Book, Volume 111, Line Transmission and Protection.

25. GLOSSARY AND INDEX.

25.1 The technical terms and expressions used in this Specification are generally in accordance with British Standard 204 : Glossary of Terms used in Telecommunication (including Radio) and Electronics.

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END OF SPECIFICATION.

Telephone Regulations under the Post and Telegraph Act

Regulation No.111 (1) The Department may, on the application of a subscriber install a private branch exchange at premises of the subscriber.

(2) A subscriber may with the consent in writing of a Director enter into an agreement with a person approved by the Director-General of Posts and Telegraphs for the installation of a private branch exchange at premises of the subscriber.

(3) A person may install a private branch exchange in pursuance of an agreement referred to in the last preceding sub-regulation.

(4) In this regulation "private branch exchange" includes telephone and other equipment the property of the Commonwealth, provided by the Department for installation in connexion with the private branch exchange and wiring and other equipment necessary for the operation of the private branch exchange.

Regulation No.112. Where a private branch exchange has been installed, in pursuance of an agreement referred to in sub-regulation (2) of the last preceding regulation, at premises of a subscriber, the subscriber shall not, except with the approval in writing of a Director or a person authorised by a Director, make, or permit to be made, an alteration to, or a modification of, the exchange or any equipment installed in connexion with the exchange.

Penalty : Fifty pounds.

List of Essential, Desirable and Optional Facilities for Private Automatic Branch Exchanges supplied by Approved Contractors.

Essential Facilities to be provided with every P.A.B.X.

- (a) Extension to Extension calls dialled direct.
- (b) Extension Calls to Public Network dialled direct.
- (c) Extension Calls to Operator dialled direct.
- (d) Extensions Barred to public network.
- (e) Enquiry - An extension user holds an incoming exchange call and calls another extension, or the telephonist, or, in the case of P.A.B.X's of more than 50 lines, the public network, afterwards reverting to the original caller.
- (f) Incoming Calls - Answered at the manual switchboard or selected answering position and routed by the telephonist to the required extension.
- (g) Revertive Calls - Set up by telephonist to public network number and then reverted to extension.
- (h) Nightswitching - After hours, incoming exchange line calls to the P.A.B.X. are diverted to a selected extension or group of extensions. Alternatively, selected exchange lines may be connected to selected extensions. The night-switching facility shall not interfere with normal P.A.B.X. facilities particularly those concerning transfer.
- (i) Trunk Offer - Each switchboard shall be equipped with a trunk offer circuit to enable the telephonist to break into established conversations. Standard tone shall be provided.
- (j) Information Circuits - Each switchboard shall be equipped with at least two information circuits to provide telephonist access to and from extensions.
- (k) Tie-Lines - Provision shall be made for tie-lines to other P.A.B.X's. The tie-lines must be capable of being barred access to and from the exchange lines as required.
- (l) Cordless Switchboards - The manual switchboard shall be floor or table mounted and employ keys for all manual switching functions (cord type switchboards may be used only on special approval by the A.P.O.). The following facilities must be provided with P.A.B.X's using cordless switchboards.
 - (i) Keysender - To enable operator to digit extension numbers. Should permit operator to set up second call whilst previous number is being connected.
 - (ii) Camp-on-Busy - Telephonist-connected call to busy extension is switched through automatically when the called extension becomes free. Only one call may be camped at a time on any busy extension.
 - (iii) Divided Working - Provided on connecting circuits to permit the telephonist to speak to either party or both as required.

- (iv) Automatic Transfer - To enable incoming exchange calls to be transferred from an extension to the telephonist or to another extension. Required on indialled calls also.
- (v) Overlapping - To permit the telephonist to continuously monitor an outgoing exchange call originated from the switchboard whilst dealing with other calls.
- (vi) Through Clearing - All telephonist-connected exchange calls automatically clear when the extension finishes the call.
- (vii) Automatic Operator Recall - To indicate to the telephonist that the required extension has not answered within 30-45 seconds.

Desirable Facilities which must be capable of being readily added to the P.A.B.X. at any time.

- (a) Extension Trunk Access Barred - Selective barring of extensions must deny direct access to both manual and automatic trunk codes.
- (b) Monitoring of Established Exchange Line Calls - Enables the telephonist to listen on any exchange line call established manually.
- (c) Group Search on Extensions - A group of extensions is called by a common number, the first free line of the group receiving the call. The normal operation of the extensions in the group shall not be affected and calls to other numbers in the group shall test only the line called.
- (d) Nightswitch Incoming Lines to Bell System - Incoming exchange line calls after hours are signalled by a system of bells or buzzers. Access to the call is gained from any extension instrument either by dialling a digit or the operation of a button on the instrument. These calls must be capable of being transferred in the usual manner.
- (e) Automatic Nightswitch - If the switchboard is left unattended, automatic nightswitching should take place 60 seconds after the arrival of an incoming call. The nightswitched condition will prevail until the telephonist resumes.
- (f) In-dialling - This permits network callers to dial directly to the required P.A.B.X. extension. Where a large percentage of the incoming traffic is in-dialled, one group of lines from the exchange will normally be provided for calls to both the extensions and the operator. Where a small percentage of the traffic is in-dialled, two separate groups of lines may be provided, one to the operator and the other to the extensions. The condition of the called extension will be signalled by standard tones. It is not necessary for in-dialled calls to be automatically diverted to the telephonist, if unanswered after a pre-determined period, but this facility may be provided if practicable.
- (g) Interception of Calls to Individual Extensions - Selected extensions may divert incoming calls to other extensions by means of key or dial control at the instrument.
- (h) Operator Restriction of Extension Access to Exchange Lines - In peak traffic periods the telephonist can deny direct extension access to the exchange lines by key control.

- (i) Dialling Tie-Lines - This facility permits inter-P.A.B.X. dialling either on an open or closed numbering basis. The tie-lines must be capable of being barred access to and from the exchange lines as required.

Optional Facilities which may be provided to meet particular user requirements.

- (a) Executive Lines - These lines provide for calls to the telephonist to be specially signalled for urgent attention.
- (b) Enquiry on Outgoing Exchange Call - Extension may hold an outgoing exchange call and call another extension or the telephonist afterwards reverting to the original called party.
- (c) Automatic Transfer of Outgoing Exchange Call - Outgoing exchange calls may be capable of being transferred from one extension to another without the intervention of a telephonist.
- (d) Automatic Changeover from Individual Nightswitching to Group Nightswitching - This facility provides for the nightswitching arrangements to be automatically changed at a predetermined time each day.
- (e) Conference Calls - Provides for up to five extension lines to be interconnected simultaneously to conduct a conference. Exchange access is not permitted.
- (f) Priority Break-in - Permits an extension to break in on an extension to extension call only.
- (g) Exchange Key Digiting - Enables the telephonist to use a keysender in lieu of dial for setting up outgoing calls.
- (h) Rapid Call Keys - Enables the telephonist to call frequently wanted network numbers by means of a key controlled repertory dialler.
- (i) Visual Signal Paging - Allows for a number of persons to be paged by means of coded lamp signals by the telephonist or any extension. The person called can answer from any telephone by dialling a special code.
- (j) Centralised Dictation - With this facility, extensions have access to centralised recording equipment by dialling a particular code. The functions of the recording machine may be controlled by the dial on the extension user's telephone or by auxiliary control units.
- (k) Automatic Call Back - An extension calling a busy extension can be connected to a waiting circuit and then be recalled as soon as the wanted extension becomes available.
- (l) Interception of Calls to Selected Extensions - Incoming calls to a number of extensions may be diverted to a common answering point. The answering point must provide visual signals to identify the called extension.
- (m) Watchman Control Service - This facility provides for the identification and registration of extension numbers from which a watchman signals in accordance with a pre-determined schedule. If a call is not received from the watchman within a given time after the previous call, an alarm is brought into operation.

- (n) Direct Access Unit - This equipment enables calls to be made by an extension user to selected extensions by means of keys in lieu of dialling. The key-set also may provide for immediate access to an outgoing exchange line.
- (o) Busy Extension Lamp Display - This display is located at the switchboard and indicates which extensions are busy.
- (p) Alternative Answering Points for Incoming Calls - This facility is only provided on P.A.B.X's not normally equipped with a switchboard. It enables the incoming calls to be routed to a choice of alternative answering points.
- (q) Blind Operator's Facility - A switchboard modified for use by a blind operator.

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Maintenance Tools for Use on General

Subscribers' Equipment

TOOL KIT NO. 1

Common Tool Kit.

| <u>A.P.O. Drg.</u> | <u>Description</u> |
|--------------------|---------------------------------------------------------------------------------|
| CT.78 | Brush, sash tool, Size 6. |
| CT.88 | Cleaner, contact. |
| CT.121 | File, hand, parallel, second cut, one safe edge, 6", with handle (Tool No.162). |
| CT.159 | Hammer, cross pein, 4 oz., handled. |
| CT.181 | Knife, pocket. |
| CT.209 | Pliers, diagonal cutting. |
| CT.213 | Pliers, half round, stripping nose. |
| CT.215 | Pliers, side cutting. |
| CT.258 | Screwdriver, 5-1/2" x 3/16". |
| CT.259 | Screwdriver, 4" x 1/4". |
| CT.263 | Cloth, duster, imitation chamois, 27" wide. |
| CT.408 | Tool, soldering, liquid petroleum gas. |

Tool Kit No. 2

Substation Maintenance Kit.

CT.10 Adjuster, spring (key and general use).
CT.38 Attache case 14-1/2" x 12" x 6-1/2".
CT.82B Case, calling dial, leather, small.
CT.139 Gauge, thickness, 0.0015" to 0.015", tapered blades.
CT.151 Gauge, tension 10 to 80 grammes with Pointers Nos. 1 and 2.
(Tools Nos. 167 and 167A).
CT.185 Lamp, cycle (where required).
CT.202 Oilcan, small.
CT.216 Pliers, wiring, long nose, 2" jaws.
CT.246 Scissors, 4".
CT.255 Screwdriver, forked, 5/16" (Bell Sets).
CT.257 Screwdriver, pocket.
CT.261 Screwdriver, .12" x 3/16".
CT.264 Screwdriver, small.
CT.270 Spanner, box 3/8", switch hook plungers - 300 type handset telephone.
CT.280 Spanner, box D.E., 1/4" and 9/32", with tommy.
CT.336 Tool roll, Technician's.
- Multimeter A.P.O. No.2.
CMS.1003 Case, Multimeter, A.P.O.

TOOL Kit No. 2A

Substation Maintenance - Additional Kit for Automatic Exchange Areas

CT.17 Adjuster, spring, P.A.B.X. relay
CT.20 Adjuster, spring (offset, insulated), Strowger type relays.
32 mils each end.
CT.22 Adjuster, spring (wiper, governor and general).
CT.115 Extractor, lamp cap.
CT.190 Lamp, test.
CT.210 Pliers, duckbill.
CT.262 Screwdriver, large.
CT.301 Spanner, adjustable, 4".
CT.204 Pencil, test, 500 ohm.
Test Handset No.4 (red), complete with cord and dial.