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[SCHEDULE M]

(See rules 71, 74, 76, and 78)

**GOOD MANUFACTURING PRACTICES AND REQUIREMENTS OF PREMISES,
PLANT AND EQUIPMENT FOR PHARMACEUTICAL PRODUCTS**

Note.—To achieve the objectives listed below, each licensee shall evolve appropriate methodology, systems and procedures which shall be documented and maintained for inspection and reference; and the manufacturing premises shall be used exclusively for production of drugs and no other manufacturing activity shall be undertaken therein.

PART I

GOOD MANUFACTURING PRACTICES FOR PREMISES AND MATERIALS

1. GENERAL REQUIREMENTS

1.1. Location and surroundings.—The factory building(s) for manufacture of drugs shall be so situated and shall have such measures as to avoid risk of contamination from external environment including open sewage, drain, public lavatory or any factory which produces disagreeable or obnoxious, odour, fumes, excessive soot, dust, smoke, chemical or biological emissions.

1.2. Buildings and premises.—The building(s) used for the factory shall be designed, constructed, adapted and maintained to suit the manufacturing operations so as to permit production of drugs under hygienic conditions. They shall conform to the conditions laid down in the Factories Act, 1948 (63 of 1948).

The premises used for manufacturing, processing, warehousing, packaging, labeling and testing purposes shall be

- (i) compatible with other drug manufacturing operations that may be carried out in the same or adjacent area / section;
- (ii) adequately provided with working space to allow orderly and logical placement of equipment, materials and movement of personnel so as to
 - (a) avoid the risk of mix-up between different categories of drugs or with raw materials, intermediates and in-process material,
 - (b) avoid the possibilities of contamination and cross-contamination by providing suitable mechanism;
- (iii) designed / constructed / maintained to prevent entry of insects, pests, birds, vermins and rodents. Interior surface (walls, floors, and ceilings) shall be smooth and free from cracks, and permit easy cleaning painting and disinfection;
- (iv) air conditioned where prescribed for the operations and dosage forms under production. The production and dispensing areas shall be well lighted, effectively ventilated, with air control facilities and may have proper Air Handling Units (wherever applicable) to maintain conditions including temperature and, wherever necessary, humidity, as defined for the relevant product. These conditions shall be appropriate to the category of drugs and nature of the operation. These shall also be suitable

1. Schedule L omitted by G.S.R. 462(E). dated 22nd June. 1982 (w.c.f 22-6-1982).

2. Ins. by G.S.R. 894(E), dated 11th December, 2001 (w.e.f. 11-12-2001). Ed. The old Schedule M (See page 423) shall apply to the manufacturers. who are presently licensed to manufacture drugs for the period upto 31st December, 2003.

to the comforts of the personnel working with protective clothing, products handled operations undertaken within them in relation to the external environment. These areas shall be regularly monitored for compliance with required specifications;

- (v) provided with drainage system, as specified for the various categories of products, which shall be of adequate size and so designed as to prevent back-flow and/or to prevent insects and rodents entering the premises. Open channels shall be avoided in manufacturing areas and, where provided, these shall be shallow to facilitate cleaning and disinfection,
- (vi) The walls and floors of the areas where manufacture of drugs is carried out shall be free from cracks and open joints to avoid accumulation of dust. These shall be smooth, washable, covered and shall permit easy and effective cleaning and disinfection. The interior surfaces shall not shed particles. A periodical record of cleaning and painting of the premises shall be maintained.

1.3 Water system.—There shall be a validated system for treatment of water drawn from own or any other source to render it potable in accordance with standards specified by the Bureau of Indian Standards or local Municipality, as the case may be so as to produce Purified Water conforming to Pharmacopoeial specification. Purified Water so produced shall only be used for all the operations except washing and cleaning operations where potable water may be used. Water shall be stored in tanks, which do not adversely affect quality of water and ensure freedom from microbiological growth. The tank shall be cleaned periodically and records maintained by the licensee in this behalf.

1.4 Disposal of waste.-

- (i) The disposal of sewage and effluents (solid, liquid and gas) from the manufactory shall be in conformity with the requirements of Environment Pollution Control Board.
- (ii) All bio-medical waste shall be destroyed as per the provisions of the Bio Medical Waste (Management and Handling) Rules, 1996.
- (iii) Additional precautions shall be taken for the storage and disposal of rejected drugs. Records shall be maintained for all disposal of waste.
- (iv) Provisions shall be made for the proper and safe storage of waste materials awaiting disposal. Hazardous, toxic substances and flammable materials shall be stored in suitably designed and segregated, enclosed areas in conformity with Central and State Legislations.

2. WAREHOUSING AREA

2.1 Adequate areas shall be designed to allow sufficient and orderly warehousing of various categories of materials and products like starting and packaging materials, intermediates, bulk and finished products, products in quarantine, released, rejected, returned or recalled machine and equipment spare parts and change items.

2.2 Warehousing areas shall be designed and adapted to ensure good storage conditions. They shall be clean, dry and maintained within acceptable temperature limits. Where special storage conditions are required (e.g., temperature, humidity), these shall be provided, monitored and recorded. Storage areas shall have appropriate house-keeping and rodent, pest and vermin control procedures and records maintained. Proper racks, bins and platforms shall be provided for the storage of materials.

2.3 Receiving and dispatch bays shall protect materials and products from adverse weather conditions.

2.4 Where quarantine status is ensured by warehousing in separate earmarked areas in the same warehouse or store, these areas shall be clearly demarcated. Any system replacing the physical quarantine, shall give equivalent assurance of segregation. Access to these areas shall be restricted to authorised persons.

2.5 There shall be a separate sampling area in the warehousing area for active raw materials and excipients. If sampling is performed in any other area, it shall

be conducted in such a way as to prevent contamination, cross-contamination and mix-up

2.6 Segregation shall be provided for the storage of rejected, recalled or returned materials or products. Such areas, materials or products shall be suitably marked and secured. Access to these areas and materials shall be restricted.

2.7 Highly hazardous, poisonous and explosive materials such as narcotics, psychotropic drugs and substances presenting potential risks of abuse, fire or explosion, shall be stored in safe and secure Areas. Adequate fire protection measures shall be provided in conformity with the rules of the concerned civic authority.

2.8 Printed packaging material shall be stored in safe, separate and secure areas.

2.9 Separate dispensing areas for a (Beta lactum, Sex Hormones and Cytotoxic substances or any such special categories of products shall be provided with proper supply of filtered air and suitable measures for dust central to avoid contamination. Such areas shall be under differential pressure.

2.10 Sampling and dispensing of sterile materials shall be conducted under aseptic conditions conforming to Grade A. which can also be performed in a dedicated area within the manufacturing facility.

2.11 Regular checks shall be made to ensure adequate steps are taken against spillage, breakage and leakage of containers.

2.12 Rodent treatments (pest control) should be done regularly and at least once in a year and record maintained.

3 PRODUCTION AREA

3.1 The production area shall be designed to allow the production preferably in uni-flow and with logical sequence of operations.

3.2 In order to avoid the risk of cross-contamination, separate dedicated and self-contained facilities shall be made available for the production of sensitive pharmaceutical products like penicillin or biological preparations with live microorganisms. Separate dedicated facilities shall be provided for the manufacture of contamination causing and potent products such as Beta lactum, Sex Hormones and Cyto-toxic substances.

3.3 Working and in process space shall be adequate to permit orderly and logical positioning of equipment and materials and movement of personnel to avoid cross-contamination and to minimize risk of omission or wrong application of any of manufacturing and control measures.

3.4 Pipe-work, electrical fittings, ventilation openings and similar service lines shall be designed, fixed and constructed to avoid creation of recesses. Service lines shall preferably be identified by colours and the nature of the supply and direction of the flow shall be marked/ indicated.

4. ANCILLARY AREAS

4.1 Rest and refreshment rooms shall be separate from other areas. These areas shall not lead directly to the manufacturing and storage areas.

4.2 Facilities for changing storing clothes and for washing and toilet purposes shall be easily accessible and adequate for the number of users. Toilets separate for males and females, shall not be directly connected with production or storage areas. There shall be written instructions for cleaning and disinfection for such areas.

4.3 Maintenance workshops shall be separate and away from production areas. Whenever spares, changed parts and tools are stored in the production area, these shall be kept in dedicated rooms or lockers. Tools and spare parts for use in sterile areas shall be disinfected before these are carried inside the production areas.

4.4 Areas housing animals shall be isolated from other areas. The other requirements regarding animal houses shall be those as prescribed in rule 150C(3) of the Drugs and Cosmetics Rules, 1945 which shall be adopted for production purposes.

5. QUALITY CONTROL AREA

5.1 Quality-Control Laboratories shall be independent of the production areas. Separate areas shall be provided each for physico-chemical, biological, microbiological or radio-isotope analysis. Separate instrument room with adequate area shall be provided for sensitive and sophisticated instruments employed for analysis.

5.2 Quality Control Laboratories shall be designed appropriately for the operations to be carried out in them. Adequate space shall be provided to avoid mix-ups and cross-contamination. Sufficient and suitable storage space shall be provided for test samples, retained samples, reference standards, reagents and records.

5.3 The design of the laboratory shall take into account the suitability of construction materials and ventilation. Separate air handling units and other requirements shall be provided for biological, microbiological and radioisotopes testing areas. The laboratory shall be provided with regular supply of water of appropriate quality for cleaning and testing purposes.

5.4 Quality Control laboratory shall be divided into separate sections, i.e., for chemical, microbiological and wherever required, biological Testing. These shall have adequate area for basic installation and for ancillary purposes. The microbiology section shall have arrangements such as airlocks and laminar air flow workstation, wherever considered necessary.

6. PERSONNEL

6.1 The manufacture shall be conducted under the direct supervision of competent technical staff with prescribed qualifications and practical experience in the relevant dosage form and 1 or active pharmaceutical products.

6.2 The head of the Quality Control Laboratory shall be independent of the manufacturing unit. The testing shall be conducted under the direct supervision of competent technical staff who shall be whole time employees of the licensee.

6.3 Personnel for Quality Assurance and Quality Control operations shall be suitably qualified and experienced.

6.4 Written duties of technical and Quality Control personnel shall be laid and followed strictly.

6.5 Number of personnel employed shall be adequate and in direct proportion to the work-load.

6.6 The licensee shall ensure in accordance with a written instruction that all personnel in production area or into Quality Control Laboratories shall receive training appropriate to the duties and responsibility assigned to them. They shall be provided with regular in-service training.

7. HEALTH CLOTHING AND SANITATION OF WORKERS

7.1 The personnel handling Beta-lactum antibiotics shall be tested for Penicillin sensitivity before employment and those handling sex hormones, cytotoxic substances and other potent drugs shall be periodically examined for adverse effects. These personnel should be moved out of these sections (except in dedicated facilities) by rotation, as a health safeguard.

7.2 Prior to employment, all personnel, shall undergo medical examination including eye examination, and shall be free from Tuberculosis, skin and other communicable or contagious diseases. Thereafter, they should be medically examined periodically, at least once a year. Records shall be maintained thereof. The licensee shall provide the services of a qualified physician for assessing the health status of personnel involved in different activities.

7.3 All persons, prior to and during employment, shall be trained in practices which ensure personnel hygiene. A high level of personnel hygiene shall be observed by all those engaged in the manufacturing processes instructions to this effect shall be displayed in change-rooms and other strategic locations.

7.4 No person showing, at any time apparent illness or open lesions which may adversely affect the quality of products shall be allowed to

handle starting materials packaging materials, in-process materials, and drug products until his condition is no longer judged to be a risk.

7.5 All employees shall be instructed to report about their illness or abnormal health condition to their immediate supervisor so that appropriate action can be taken.

7.6 Direct contact shall be avoided between the unprotected hands of personnel and raw materials, intermediate or finished, unpacked products.

7.7 All personnel shall wear clean body coverings appropriate to their duties. Before entry into the manufacturing area, there shall be change rooms separate for each sex with adequate facilities for personal cleanliness such as wash basin with running water, clean towels, hand dryers, soaps, disinfectants etc. The change rooms shall be provided with cabinets for the storage of personal belongings of the personnel.

7.8 Smoking, eating, drinking, chewing or keeping plants, food, drink and personal medicines shall not be permitted in production, laboratory storage and other areas where they might adversely influence the product quality.

8. MANUFACTURING OPERATIONS AND CONTROLS

8.1 All manufacturing operations shall be carried out under the supervision of technical staff approved by the Licensing Authority. Each critical step in the process relating to the selection, weighing and measuring of raw material addition during various stages shall be performed by trained personnel under the direct personnel supervision of approved technical staff.

The contents of all vessels and containers used in manufacture and storage during the various manufacturing stages shall be conspicuously labeled with the name of the product, batch no, batch size and stage of manufacture. Each label should be initialed and dated by the authorized technical staff.

Products not prepared under aseptic conditions are required to be free from pathogens like *Salmonella*, *Escherichiacoli*, *Pyocyanea* etc.

8.2 Precautions against mix-up and cross-contamination

8.2.1 The licensee shall prevent mix-up and cross-contamination of drug material and drug product (from environmental dust) by proper air-handling system pressure differential, segregation, status labeling and cleaning. Proper records and Standard Operating Procedures thereof shall be maintained.

8.2.2 The licensee shall ensure processing of sensitive drugs like Beta-Lactum antibiotics, sex hormones and cytotoxic substances in segregated areas or isolated production areas within the building with independent air-handling unit and proper pressure differentials. The effective segregation of these areas shall be demonstrated with adequate records of maintenance and services.

8.2.3 To prevent mix-ups during production stages, material under process shall be conspicuously labeled to demonstrate their status. All equipment used for production shall be labeled with their current status.

8.2.4 Packaging lines shall be independent and adequately segregated, It shall be ensured that all left-overs of the previous packaging operations, including labels cartons and caps are cleared before the closing hour.

8.2.5 Before packaging operations are begun, steps shall be taken to ensure that the work area, packaging lines, printing machines, and other equipment are clean and free from any products, materials and spillages. The line clearance shall be performed according to an appropriate checklist and recorded.

8.2.6 The correct details of any printing (for example of hatch numbers

or expiry dates) done separately or in the course of the packaging shall be re-checked at regular intervals. All printing and over printing shall be authorised in writing.

8.2.7 the manufacturing environment shall be maintained at the required levels of temperature, humidity and cleanliness.

8.2.8 Authorised persons shall ensure change-over into specific uniforms before undertaking and manufacturing operations including packaging.

8.2.9 these shall be segregated enclosed areas, secured for recalled or rejected material and for such material which are to be processed or recovered.

9. SANITATION IN THE MANUFACTURING PREMISES

9.1 The manufacturing premises shall be cleaned and maintained in an orderly manner, so that it is free from accumulated waste, dust, debris and other similar material. A validated cleaning procedure shall be maintained.

9.2 The manufacturing areas shall not be used for storage of materials except for the material being processed, It shall not be used as general thoroughfare.

9.3 A routine sanitation program shall be drawn up and observed which shall be properly recorded and which shall indicate:

- (a) specific areas to be cleaned and cleaning intervals.
- (b) cleaning procedure to be followed, including equipment and materials to be used for cleaning, and
- (c) personnel assigned to and responsible for the cleaning operation.

9.4 The adequacy of the working and in process storage space shall permit the orderly and logical positioning of equipment and materials so as to minimise the risk of mix-up between different pharmaceutical products or their components to avoid cross contamination, and to minimise the risk of omission or wrong application of any of the manufacturing or control steps.

9.5 Production areas shall be well lit, particularly where visual on-line controls are carried

10. RAW MATERIALS

10.1 The licensee shall keep an inventory of all raw-materials to be used at any stage of manufacture of drugs and maintain records as per Schedule U.

10.2 All incoming materials shall be quarantined immediately after receipt or processing. All materials shall be stored under appropriate conditions and in an orderly fashion to permit hatch segregation and stock rotation by a 'first in/first expiry' - 'first-out' principle. All incoming materials shall be checked to ensure that the consignment corresponds to the order placed.

10.3 All incoming materials shall be purchased from approved sources under valid purchase vouchers. Wherever possible, raw materials should be purchased directly from the producers.

10.4 Authorised staff appointed by the licensee in this behalf, which may include personnel from the quality control department, shall examine each consignment on receipt and shall check each container for integrity of package and seal. Damaged containers shall be identified, recorded and segregated.

10.5 If a single delivery of material is made up of different batches, each batch shall be considered as a separate hatch for sampling, testing

and release.

10.6 Raw materials in the storage area shall be appropriately labeled. Labels shall be clearly marked with the following information :

- (a) designated name of the product and the internal code reference, where applicable, and analytical reference number;
- (b) manufacturer's name, address and batch number;
- (c) the status of the contents (e.g. quarantine, under test, released, approved, rejected):
- (d) the manufacturing date, expiry date and re-test date.

10.7 There shall be adequate separate areas for materials "under test", "approved ", and "rejected" with arrangements and equipment to allow dry, clean and orderly placement of stored materials and products, wherever necessary. under controlled temperature and humidity.

10.8 Containers from which samples have been drawn shall be identified.

10.9 Only raw materials which have been released by the Quality Control Department and which are within their shelf-life shall be used. It shall be ensured that shelf-life of formulation product shall not exceed with that of active raw materials used.

10.10 It shall be ensured that all the containers of raw materials are placed on the raised platforms/racks and not placed directly on the floor.

11. EQUIPMENT

11.1 Equipment shall be located, designed, constructed, adapted and maintained to suit the operations to be carried out. The layout and design of the equipment shall aim to minimise the risk of errors and permit effective cleaning and maintenance in order to avoid cross-contamination, build-up of dust or dirt and, in general, any adverse effect on the quality of products. Each equipment shall be provided with a log book, wherever necessary.

11.2 Balances and other measuring equipment of an appropriate range, accuracy and precision shall be available in the raw-material stores, production and in process control operations and shall be calibrated and checked on a scheduled basis in accordance with Standard Operating Procedures and records maintained.

11.3 The parts of the production equipment that come into contact with the product shall not be reactive, additive or adsorptive to an extent that would affect the quality of the product.

11.4 To avoid accidental contamination, wherever possible, non-toxic/edible grade lubricants shall be used and the equipment shall be maintained in a way that lubricants do not contaminate the products being produced.

11.5 Defective equipment shall be removed from production and Quality Control areas or appropriately labeled.

12. DOCUMENTATION AND RECORDS

Documentation is an essential part of the Quality assurance system and, as such, shall be related to all aspects of Good Manufacturing Practices (GMP). Its aim is to define the specifications for all materials, method of manufacture and control, to ensure that all personnel concerned with manufacture know the information necessary to decide

whether or not to release a batch or a drug for sale and to provide an audit trail that shall permit investigation of the history of any suspected defective batch.

12.1 Documents designed, prepared, reviewed and controlled, wherever applicable, shall comply with these rules.

12.2 Documents shall be approved, signed and dated by appropriate and authorised persons.

12.3 Documents shall specify the title, nature and purpose. They shall be laid out in an orderly fashion and be easy to check. Reproduced documents shall be clear and legible. Documents shall be regularly reviewed and kept up to date. Any alteration made in the entry of a document shall be signed and dated.

12.4 The records shall be made or completed at the time of each operation in such a way *that* all significant activities concerning the manufacture of pharmaceutical products are traceable. Records and associated Standard Operating Procedures (SOP) shall be retained for at least one year after the expiry date of the finished product.

12.5 Data may be recorded by electronic data processing systems or other reliable means, but Master Formulae and detailed operating procedures relating to the system in use shall also be available in a hard copy to facilitate checking of the accuracy of the records. Wherever documentation is handled by electronic data processing methods, authorized persons shall enter or modify data in the computer. There shall be record of changes and deletions. Access shall be restricted by passwords or other means and the result of entry of critical data shall be independently checked. Batch records electronically stored shall be protected by a suitable, back-up. During the period of retention, all relevant data shall be readily available.

13. LABELS AND OTHER PRINTED MATERIALS

Labels are absolutely necessary for identification of the drugs and their use. "The printing shall be done in bright colours and in a legible manner. The label shall carry all the prescribed details about the product.

13.1 All containers and equipment shall bear appropriate labels. Different colour coded labels shall be used to indicate the status of a product (for example under test, approved, passed, rejected).

13.2 To avoid chance mix-up of printed packaging materials, product leaflets, relating to different products, shall be stored separately.

13.3 Prior to release, all labels for containers, cartons and boxes and all circulars, inserts and leaflets shall be examined by the Quality Control Department of the licensee.

13.4 Prior to packaging and labeling of a given batch of a drug, it shall be ensured by the licensee that samples are drawn from the bulk and duly tested, approved and released by the quality control personnel.

13.5 Records of receipt of all labelling and packaging materials shall be maintained for each shipment received indicating receipt, control reference numbers and whether accepted or rejected. Unused coded and damaged labels and packaging materials shall be destroyed and recorded.

13.6 The label or accompanying document of reference standards and reference culture shall indicate concentration, lot number, potency, date on which container was first opened and storage conditions, where appropriate.

14. QUALITY ASSURANCE

This is a wide ranging concept concerning all matters that individually or collectively influence the equality of a product. It is the totality of the arrangements made with the object of ensuring that products are of the quality required for their intended use.

14.1 The system of quality assurance appropriate to the manufacture of pharmaceutical products shall ensure that

- (a) the pharmaceutical products are designed and developed in a way, that takes account of the requirements of Good Manufacturing Practices (hereinafter referred as GMP) and other associated codes such as those of Good Laboratory Practices (hereinafter referred as GLP) and Good Clinical Practices (herein after, referred as GCP):
- (b) adequate arrangements are made for manufacture, supply, and use of the correct starting and packaging materials;
- (c) adequate controls on starting materials, intermediate products, and bulk products and other in process controls, calibrations and validations are carried out;
- (d) the finished product is correctly processed and checked in accordance with established procedures;
- (e) the pharmaceutical products are not released for sale or supplied before authorised persons have certified that each production batch has been produced and controlled in accordance with the requirements of the label claim and any other provisions relevant to production, control and release of pharmaceutical products.

15. SELF INSPECTION AND QUALITY AUDIT

It may be useful to constitute a self inspection team supplemented with a quality audit procedure for assessment of all or part of a system with the specific purpose of improving it.

15.1 To evaluate the manufacturer's compliance with GMP in all aspects of production and quality control, concept of self-inspection shall be followed. The manufacturer shall constitute a team of independent, experienced, qualified persons from within or outside the company, who can audit objectively the implementation of methodology and procedures evolved. The procedure for self-inspection shall be documented indicating self-inspection results, evaluation, conclusions and recommended corrective actions with effective follow up program. The recommendations for corrective action shall be adopted.

15.2 The program shall be designed to detect "shortcomings in the implementation of Good Manufacturing Practice and to recommend the necessary corrective actions. Self-inspections shall be performed routinely and on specific occasions, like when product recalls or repeated rejections occur or when an inspection by the licensing authorities is announced. The team responsible for self-inspection shall consist of personnel who can evaluate the implementation of Good Manufacturing Practice objectively, all recommendations for corrective action shall be implemented.

15.3 Written instructions for self-inspection shall be drawn up which shall include the following:

- a) Personnel.
- b) Premises including personnel facilities.

- c) Maintenance of buildings and equipment.
- d) Storage of starting materials and finished products.
- e) Equipment.
- f) Production and in-process controls.
- g) Quality control.
- h) Documentation.
- i) Sanitation and hygiene.
- j) Validation and revalidation programmes.
- k) Calibration of instruments or measurement systems.
- l) Recall procedures.
- m) Complaints management.
- n) Labels control.
- o) Results of previous self-inspections and any corrective steps taken.

16. QUALITY CONTROL SYSTEM

Quality control shall be concerned with sampling specifications, testing, documentation, release procedures which ensure that the necessary and relevant tests are actually carried and that the materials are not released for use, nor products released for sale or supply until their quality has been judged to be satisfactory. It is not confined to laboratory operations but shall be involved in all decisions concerning the quality of the product. It shall be ensured that all quality control arrangements are effectively and reliably carried out. The department as a whole shall have other duties such as to establish evaluate. validate and implement all Quality Control Procedures and methods.

16.1 Every manufacturing establishment shall establish its own quality control laboratory manned by qualified and experienced staff.

16.2 The area of the quality control laboratory may be divided into Chemical, Instrumentation Microbiological and Biological testing.

16.3 Adequate area having the required storage conditions shall be provided for keeping reference samples. The quality control department shall evaluate, maintain and store reference samples.

16.4 Standard operating procedures shall be available for sampling, inspecting, and testing of raw materials, intermediate, bulk finished products and packing materials and wherever necessary, for monitoring environmental conditions.

16.5 There shall be authorized and dated specifications for all materials, products, reagents and solvents including test of identity, content, purity and quality. These shall include specifications for water, solvents and reagents used in analysis.

16.6 No batch of the product shall be released for sale or supply until it has been certified by the authorised person(s) that it is in accordance with the requirements of the standards laid down.

16.7 Reference/retained samples from each batch of the products manufactured shall be maintained in a quantity which is at least twice the quantity of the drug required to conduct all the tests, except sterility and pyrogen/Bacterial Endotoxin Test performed on the active material and the product manufactured. The retained product shall be kept in its final pack or

a simulated pack for a period of three months after the date of expiry.

16.8 Assessment of records pertaining to finished products shall include all relevant factors, including the production conditions, the results of in-process testing, the manufacturing (including packaging) documentation, compliance with the specification for the finished product, and an examination of the finished pack. Assessment records should be signed by the in-charge of production and countersigned by the authorised quality control personnel before a product is released for sale or distribution.

16.9 Quality control personnel shall have access to production areas for sampling and investigation, as appropriate.

16.10 The quality control department shall conduct stability studies of the products to ensure and assign shelf life at the prescribed conditions of storage. All records of such studies shall be maintained.

16.11 The in-charge of Quality Assurance shall investigate all product complaints and records thereof shall be maintained.

16.12 All instruments shall be calibrated and testing procedures validated before these are adopted for routine testing. Periodical calibration of instrument and validation of procedures shall be carried out.

16.13 Each specifications for raw materials, intermediates, final products, and packing materials shall be approved and maintained by the Quality Control Department. Periodic revisions of the specifications shall be carried out whenever changes are necessary.

16.14 pharmacopoeia, reference standards, working standards, reference spectra, other references materials and technical books, as required shall be available in the Quality Control Laboratory of the licensee.

17. SPECIFICATIONS

17.1 For Raw materials and Packaging materials.

They shall include.

- (a) the designated name and internal code reference;
- (b) reference, if any, to a pharmacopoeia) monograph;
- (c) qualitative and quantitative requirements with acceptance limits;
- (d) name and address of manufacturer or supplier and original manufacturer of the material;
- (e) specimen of printed material;
- (f) directions for sampling and testing or reference to procedures;
- (g) storage conditions; and
- (h) maximum period of storage before re-testing.

17.2 For product Containers and Closures

17.2.1 All containers and closures intended for use shall comply with the pharmacopoeial requirements. Suitable validated test methods, sample sizes, specifications, cleaning procedure and sterilisation procedure, wherever indicated, shall be strictly followed to ensure that these are not reactive, additive, absorptive: or leach to an extent that significantly affects the quality or purity of the drug. No second hand or used containers and closures shall be used.

17.2.2 Whenever bottles are being used, the written schedule of cleaning shall be laid down and followed. Where bottles are not dried after washing, they should be rinsed with de-ionised water or distilled water as the case may be.

17.3 For in process and bulk products.- Specifications for in-process material, intermediate and bulk products shall be available. The specifications should be authenticated.

17.4 For finished products.—Appropriate specifications for finished products shall include

- (a) the designated name of the product and the code reference;
- (b) the formula or a reference to the formula and the pharmacopoeial reference;
- (c) directions for sampling and testing or a reference to procedures;
- (d) a description of the dosage form and package details;
- (e) the qualitative and quantitative requirements, with the acceptance limits for release;
- (f) the storage conditions and precautions where applicable, and
- (g) the shelf-life.

17.5 For preparation of containers and closures.—The requirement mentioned in the Schedule do not include requirements of machinery, equipments and premises required for preparation of containers and closures for different dosage forms and categories of drugs. The suitability and adequacy of the machinery, equipment and premises shall be examined taking into consideration the requirements of each licensee in this respect.

18. MASTER FORMULA RECORDS

There shall be Master Formula records relating to all manufacturing procedures for each product and batch size to be manufactured. These shall be prepared and endorsed by the competent technical staff, i.e., head of production and quality control. The Master Formula shall include

- (a) the name of the product together with product reference code relating to its specifications;
- (b) the patent or proprietary name of the product along with the generic name, a description of the dosage form, strength, composition of the product and batch size;
- (c) name, quantity, and reference number of all the starting materials to be used. Mention shall be made of any substance that may 'disappear' in the course of processing;
- (d) a statement of the expected final yield with the acceptable limits, and of relevant intermediate yields, where applicable;
- (e) a statement of the processing location and the principal equipment to be used;
- (f) the methods, or reference to the methods, to be used for preparing the critical equipment including cleaning, assembling, calibrating, sterilizing;
- (g) detailed stepwise processing instructions and the time taken for each step;
- (h) the instructions for in-process controls with their limits;
- (i) the requirements for storage conditions of the products, including the container, labelling and special storage conditions where applicable;
- (j) any special precautions to be observed;
- (k) packing details and specimen labels.

19. PACKAGING RECORDS

There shall be authorised packaging instructions for each product, pack size and type. These shall include or have a reference to the following:

- (a) name of the product;
- (b) description of the dosage form, strength and composition;
- (c) the pack size expressed in terms of the number or doses, weight or volume of the product in the final container;
- (d) complete list of all the packaging materials required for a standard batch size, including quantities, sizes and types, with the code or reference number relating to the specifications of each packaging material;
- (e) reproduction of the relevant printed packaging materials and specimens indicating where batch number and expiry date of the product have been applied;
- (f) special precautions to be observed, including a careful examination of the area and equipment in order to ascertain the line clearance before the operations begin;
- (g) description of the packaging operation, including any significant subsidiary operations and equipment to be used;
- (h) details of in-process controls with instructions for sampling and acceptance;
- (i) upon completion of the packing and labeling operation a reconciliation shall be made between number of labeling and packaging units issued, number of units labeled, packed and excess returned or destroyed. Any significant or unusual discrepancy in the numbers shall be carefully investigated before releasing the final batch.

20. BATCH PACKAGING RECORDS

20.1 A batch packaging record shall be kept for each batch or part batch processed. It shall be based on the relevant parts of the packaging instructions, and the method of preparation of such records shall be designed to avoid transcription errors.

20.2 Before any packaging operations begins, checks shall be made and recorded that the equipment and the work stations are clear of the previous products, documents or materials not required for the planned packaging operations, and that the equipment is clean and suitable for use.

21. BATCH PROCESSING RECORDS

21.1 There shall be Batch processing Record for each product. It shall be based on the relevant parts of the currently approved Master Formula. The method of preparation of such records indicated in the Master Formula shall be designed to avoid transcription errors:

21.2 Before any processing begins, check shall be performed and recorded to ensure that the equipment and work station are clear of previous products, documents/or materials not required for the planned process are removed and that equipment is clean and suitable for use.

21.3 During processing, the following information shall be recorded at the time each action is taken and the record shall be dated and signed by, the person responsible for the processing operations:

- a) the name of the product.
- b) the number of the batch being manufactured,

- c) dates and time of commencement, of significant intermediate stages and of completion of production,
- d) Initials of the operator of different significant steps of production and where appropriate, of the person who checked each of these operations,
- e) the batch number and/or analytical control number as well as the quantities of each starting material actually weighed.
- f) any relevant processing operation or event and major equipment used,
- g) a record of the in-process controls and the initials of the person(s) carrying them out, and the results obtained.
- h) the amount of product obtained after different and critical stages of manufacture (yield).
- i) comments or explanations for significant deviations from the expected yield limits shall be given,
- j) notes on special problems -including details, with signed authorization, for any deviation from the master formula,
- k) addition of any recovered or reprocessed material with reference to recovery or reprocessing stages.

22 STANDARD OPERATING PROCEDURES (SOPS) AND RECORDS, REGARDING

22.1 Receipt of Materials.

22.1.1 There shall be written Standard Operating Procedures and records for the receipt of each delivery of raw, primary and printed packaging material.

22.1.2 The records of the receipts shall include,

- (a) the name of the material on the delivery note and the number of the containers:
- (b) the date of receipt:
- (c) the manufacturer's and/or supplier's name.
- (d) the manufacturers batch or reference number:
- (e) the total quantity. and number of containers, quantity in each container received:
- (f) the control reference number assigned after receipt:
- (g) any other relevant comment or information.

22.1.3 There shall be written standard operating procedures for the internal labeling quarantine and storage of starting materials, packaging materials and other materials, as appropriate.

22.1.4. There shall be Standard Operating Procedures available for each instrument and equipment and these shall be placed in close proximity to the related instrument and equipment.

22.2 Sampling

22.2.1 There shall be written Standard Operating Procedures for sampling, which include the person(s) authorised to take the samples.

22.2.2 The sampling instructions shall include

- (a) the method of sampling and the sampling plan,
- (b) the equipment to be used,
- (c) any precautions to be observed to avoid contamination of the material or any deterioration in its equality,
- (d) the quantity of samples to be taken.
- (e) instructions for any required sub-division or pooling of the samples,
- (f) the type of sample container to be used,
- (g) any specific precautions to be observed, especially in regard to sampling of sterile or hazardous material.

22.3 Batch Numbering

22.3.1 There shall be Standard Operating Procedures describing the details of the batch (lot) numbering set up with the objective of ensuring that each batch of intermediate, bulk or finished product is identified with a specific batch number.

22.3.2 Batch numbering standard operating procedures applied to a processing stage and to the respective packaging stage shall be same or traceable to demonstrate that they belong to one homogenous mix.

22.3.3 Batch number allocation shall be immediately recorded in a logbook or by electronic data processing system. The record shall include date of allocation product identity and size of batch.

22.4 Testing

22.4.1 There shall be written procedures for testing materials and products at different stages of manufacture, describing the methods and equipment to be used. The tests performed shall be recorded.

22.5 Records of analysis

22.5.1 The records shall include following data:

- (a) name of the material or product and the dosage form,
- (b) batch number and, where appropriate the manufacturer and/ or supplier,
- (c) references to the relevant specifications and testing procedures,
- (d) test results, including observations and calculations, and reference to any specifications (limits),
- (e) dates of testing,
- (f) initials of the persons who performed the testing,
- (g) initials of the persons who verified the testing and the detailed calculations.
- (h) a statement of release or rejection, and
- (i) signature and date of the designated responsible person.

22.5.2 There shall be written standard operating procedures and the associated records of actions taken for:-

- a) equipment assembly and validation;
- b) analytical apparatus and calibration:
- c) maintenance, cleaning and sanitation:
- d) personnel matters including qualification, training.

- clothing hygiene;
- e) environmental monitoring;
- f) pest control;
- g) complaints;
- h) recalls made;
- i) returns received.

23. REFERENCE SAMPLES

23.1 Each lot of every active ingredient, in a quantity sufficient to carry out all the tests except sterility and pyrogens/Bacterial Endotoxin. Test shall be retained for a period of 3 months after the date of expiry of the last batch produced from that active ingredient.

212 Samples of finished formulations shall be stored in the same or simulated containers in which the drug has been actually marketed.

24. REPROCESSING AND RECOVERIES

24.1 Where reprocessing is necessary, written procedures shall be established and approved by the Quality Assurance Department that shall specify the conditions and limitations of repeating chemical reactions. Such reprocessing shall be validated.

24.2 If the product batch has to be reprocessed, the procedure shall be authorised and recorded. An investigation shall be carried out into the causes necessitating re-processing and appropriate corrective measures shall be taken for prevention of recurrence. Re-processed batch shall be subjected to stability evaluation.

24.3 Recovery of product residue may be carried out, if permitted, in the master production and control records by incorporating it in subsequent batches of the product.

25. DISTRIBUTION RECORDS

25.1 Prior to distribution or dispatch of given batch of a drug, it shall be ensured that the batch has been duly tested, approved and 'released' by the quality control personnel. Pre-dispatch inspection shall be performed on each consignment on a random basis to ensure that only the correct goods are dispatched. Detailed instructions for warehousing and stocking of Large Volume Parenterals, if stocked, shall be in existence and shall be complied with after the batch is released for distribution. Periodic audits of warehousing practices followed at distribution centers shall be carried out and records thereof shall be maintained. Standard Operating Procedures shall be developed for warehousing of products_

25.2 Records for distribution shall be maintained in a manner such that finished batch of a drug can be traced to the retail level to facilitate prompt and complete recall of the batch, if and when necessary.

26. VALIDATION AND PROCESS VALIDATION

26.1 Validation studies shall be an essential part of Good Manufacturing Practices and shall be conducted as per the pre-defined protocols. These shall include validation of processing, testing and cleaning procedures.

26.2 A written report summarising recorded results and conclusions shall be prepared, documented and maintained.

26.3 Processes and procedures shall be established on the basis of validation study and undergo periodic revalidation to ensure that they remain capable of achieving the intended results. Critical processes shall be validated, prospectively or retrospectively.

26.4 When any new master formula or method of preparation is adopted, steps shall be taken to demonstrate its suitability for routine processing. The defined process, using the materials and equipment specified shall be demonstrated to yield a product consistently of the required quality.

26.5 Significant changes to the manufacturing process, including any change in equipment or materials that may affect product quality and / or the reproducibility of the process, shall be validated.

27. PRODUCT RECALLS

27.1 A prompt and effective product recall system of defective products shall be devised for timely information of all concerned stockists, wholesalers, suppliers, up to the retail level within the shortest period. The licensee may make use of both print and electronic media in this regard.

27.2 There shall be an established written procedure in the form of Standard Operating Procedure for effective recall of products distributed by the licensee. Recall operations shall be capable of being initiated promptly so as to effectively reach at the level of each distribution channel.

27.3 The distribution records shall be readily made available to the persons designated for recalls.

27.4 The designated person shall record a final report issued, including a reconciliation between the delivered and the recovered quantities of the products.

27.5 The effectiveness of the arrangements for recalls shall be evaluated from time to time.

27.6 The recalled products shall be stored separately in a secured segregated area pending final decision on them.

28. COMPLAINTS AND ADVERSE REACTIONS

28.1 All complaints thereof concerning product quality shall be carefully reviewed and recorded according to written procedures. Each complaint shall be investigated/evaluated by the designated personnel of the company and records of investigation and remedial action taken thereof shall be maintained.

28.2 Reports of serious adverse drug reactions resulting from the use of a drug along with comments and documents shall be forthwith reported to the concerned Licensing Authority.

28.3 There shall be written procedures describing the action to be taken, recall to be made of the defective product.

29. SITE MASTER FILE

The licensee shall prepare a succinct document in the form of Site Master File containing specific and factual Good Manufacturing Practices about the production and/or control of pharmaceutical manufacturing preparations carried out at the licensed premises. It shall contain the following:-

29.1 General information

(a) brief information of the firm;

- (b) pharmaceutical manufacturing activities as permitted by the licensing authority;
- (c) other manufacturing activities, if any, carried out on the premises;
- (d) type of products licensed for manufacture with flowcharts mentioning procedures and process flow;
- (e) number of employees engaged in the production, quality controls storage and distribution;
- (f) use of outside scientific, analytical or other technical assistance in relation to manufacture and analysis;
- (g) select description of the Quality Management system of the firm;
- (h) products details registered

with foreign countries.

29.2 Personnel

- (a) organisational chart showing the arrangement for quality assurance including production and quality control;
- (b) qualification, experience and responsibilities of key personnel;
- (c) outline for arrangements for basic and in-services training and how the records are maintained;
- (d) health requirements for personal engaged in production;
- (e) personnel hygiene requirements, including clothing.

29.3 Premises

- (a) simple plan or description of manufacturing areas drawn to scale;
- (b) nature of construction and fixtures/fittings;
- (c) brief description of ventilation systems. More details should be given for critical areas with potential risk of airborne contamination (schematic drawing of systems) Classification of the rooms used for the manufacture of sterile products should be mentioned;
- (d) special areas for the handling of the highly toxic, hazardous and sensitising materials.
- (e) brief description of water systems (schematic drawings of systems), including sanitation;
- (f) description of planned preventive maintenance programs for premises and of the recording system.

29.4 Equipment

- a) brief description of major equipment used in production and quality control laboratories (a list of equipment required);
- b) description of planned preventive maintenance programs for equipment and of the recording system;
- (c) qualification and calibration, including the recording systems and arrangements for computerised systems validation.

29.5 Sanitation

- (a) availability of written specifications and procedures for cleaning manufacturing areas and equipment.

29.6 Documentation

- (a) arrangements for the preparation, revision and distribution of;
- (b) necessary documentation for the manufacture;
- (h) any other documentation related to product quality that is not mentioned elsewhere (e.g., microbiological controls about air and water).

29.7 Production

- (a) brief description of production operations using, wherever possible, flow sheets and charts specifying important parameters;
- (b) arrangements for the handling of starting materials, packaging materials, bulk and finished products, including sampling, quarantine, release and storage;
- (c) arrangements for the handling of rejected materials and products;
- (d) brief description of general policy for

process validation.

29.8 Quality control

- (a) description of the quality control system and of the activities of the quality control department. Procedures for the release of the finished products.

29.9 Loan licence manufacture and licensee

- (a) description of the way in which compliance of Good Manufacturing Practices by the loan licensee shall be assessed.

29.10 Distribution, complaints and product recall

- (a) arrangements and recording system for distribution;
- (b) arrangements for the handling of complaints and

product recalls.

29.11 Self-Inspection

- (a) short description of the self-inspection system indicating whether an outside, independent and experienced external expert was involved in evaluating the manufacturer's compliance with Good Manufacturing Practices in all aspects of production.

29.12 Export of drugs

- (a) products exported to different countries;
- (b) complaints and product recall, if any.

PART IA

**SPECIFIC REQUIREMENTS FOR MANUFACTURE OF STERILE PRODUCTS,
PARENTERAL PREPARATIONS (SMALL VOLUME INJECTABLES AND LARGE VOLUME PARENTERALS) AND STERILE OPHTHALMIC PREPARATIONS**

Note.—The General Requirements as given in Part I of this Schedule relating to Requirements of Good Manufacturing Practices for Premises and

Materials for pharmaceutical products shall be complied with, *mutatis mutandis*, for the manufacture of Sterile products, Parenteral preparations (Small Volume Injectables and Large Volume Parenterals) and Sterile Ophthalmic Preparations. In addition to these requirements, the following Specific Requirements shall also be followed, namely: -

1. GENERAL

Sterile products, being very critical and sensitive in nature, a very high degree of precautions, prevention and preparations are needed. Dampness, dirt and darkness are to be avoided to ensure aseptic conditions in all areas. There shall be strict compliance in the prescribed standards especially in the matter of supply of water, air, active materials and in the maintenance of hygienic environment.

2. BUILDINGS AND CIVIL WORKS

2.1 The Building shall be built on proper foundation with standardised materials to avoid cracks in critical areas like aseptic solution preparation, filling and sealing rooms.

2.2 Location of services like water, steam, gases, etc., shall be such that their servicing or repair shall not pose any threat to the integrity of the facility. Water lines shall not pose any threat of leakage to aseptic area.

2.3 The manufacturing areas shall be clearly separated into support areas (e.g. washing and component preparation areas, storage areas etc.), preparation areas (e.g. bulk manufacturing area_ non-aseptic blending areas etc.) change areas and aseptic areas. Operations like removal of outer cardboard wrappings of primary packaging materials shall be done in the de-cartoning areas which are segregated from the washing areas. Wooden pallets, fiber board drums, cardboard and other particle shedding materials shall not be taken inside the preparation areas.

2.4 In aseptic areas

- (a) Walls, floors and ceiling should be impervious, non-shedding, non flaking and non-cracking. Flooring should be unbroken and provided with a cove both at the junction between the wall and the floor as well as the wall and the ceiling;
- (b) walls shall be flat, and ledges and recesses shall be avoided. Wherever other surfaces join the wall (e.g. sterilisers, electric sockets, gas points etc.) these shall flush the walls. Walls shall be provided with a cove at the joint between the ceiling and floor;
- (c) ceiling shall be solid and joints shall be sealed. Light-fittings and air-grills shall be flush with the walls and not hanging from the ceiling, so as to prevent contamination;
- (d) there shall be no sinks and drains in Grade A and Grade B areas:
- (e) doors shall be made of non-shedding material. These may be made preferably of Aluminium or Steel material. Wooden doors shall not be used. Doors shall open towards the higher-pressure area so that they close automatically due to air pressure;
- (f) Windows shall be made of similar material as the doors, preferably with double panel and shall be flush with the walls. If tire escapes are to be provided, these shall be suitably fastened to the walls without any gaps;
- (g) the furniture used shall be smooth, washable and made of stainless steel or any other appropriate material other than

wood.

2.5 The manufacturing and the support areas shall have the same quality of civil structure described above for aseptic areas, except the environmental standards which may vary in the critical areas.

2.6 Change rooms with entrance in the form of air-locks shall be provided before entry into the sterile product manufacturing areas and then to the aseptic area. Separate exit space from the aseptic areas is advisable. Change rooms to the aseptic areas shall be clearly demarcated into 'black', 'gray' and 'white rooms' with different levels of activity and air cleanliness. The 'black' change room shall be provided with a handwashing sink. The sink and its drain in the un-classified (first) change rooms may be kept clean all the time. The specially designed drain shall be periodically monitored to avoid presence of pathogenic microorganisms. Change room doors shall not be opened simultaneously. An appropriate inter-locking system and a visual and/ or audible warning system may be installed to prevent the opening of more than one door at a time.

2.7 For communication between aseptic areas and non-aseptic areas, intercom telephones or speak-phones shall be used. These shall be minimum in number.

2.8 Material transfer between aseptic areas and outside shall be through suitable air-locks or pass-boxes. Doors of such air-locks and pass-boxes shall have suitable interlocking arrangements.

2.9 Personal welfare areas like rest rooms, tea room, canteen and toilets shall be outside and separated from the sterile product manufacturing area.

2.10. Animal houses shall be away from the sterile product manufacturing area and shall not share a common entrance or air handling system with the manufacturing area.

3. AIR HANDLING SYSTEM (CENTRAL AIR-CONDITIONING)

3.1 Air Handling Units for sterile product manufacturing areas shall be different from those for other areas. Critical areas, such as the aseptic filling area, sterilised components unloading area and change rooms conforming to Grades B, C and D respectively shall have separate Air Handling Units. The filter configuration in the air handling system shall be suitably designed to achieve the Grade of air as given in Table 1. Typical operational activities for clean areas are highlighted in Table II and Table III.

3.2 For products which are filled aseptically, the filling room shall meet Grade B conditions at rest unattended. This condition shall also be obtained within a period of about 30 minutes of the personnel leaving the room after completion of operations.

3.3 The filling operations shall take place under Grade A conditions which shall be demonstrated under working of simulated conditions which shall be achieved by providing Laminar Air flow work stations with suitable FIEPA filters or isolator technology.

3.4 For products, which are terminally sterilized, the filling room shall meet Grade C conditions at rest. This condition shall be obtainable within a period of about 30 minutes of the personnel leaving the room after completion of operations.

3.5 Manufacturing and component preparation areas shall meet Grade C conditions.

3.6 After completion of preparation, washed components and vessels shall be protected with Grade C background and if necessary, under Laminar

Air Flow work station.

3.7 The minimum air changes for Grade B and Grade C areas shall not be less than 20 air changes per hour in a room with good air flow pattern and appropriate HEPA filters. For Grade A Laminar Air Flow work stations, the air flow rates shall be 0.3 meter per second \pm 20% (for vertical flows) and 0.45 meter per second + 20% (for horizontal flows).

3.8 Differential pressures between areas of different environmental standards shall be at least 15 Pascal (0.06 inches or 1.5 mm water gauge). Suitable manometers or gauges shall be installed to measure and verify pressure differential

3.9 The final change rooms shall have the same class of air as specified for the aseptic area. The pressure differentials in the change rooms shall be in the descending order from 'white to 'black'.

3.10 Unless there are product specific requirements, temperature and humidity in the aseptic areas shall not exceed 27 degree centigrade and relative humidity 55% respectively.

TABLE I

Air Borne Particulate Classification For Manufacture of Sterile Products

Grade	At rest (b)		In operation (a)	
	Maximum number of permitted particles per cubic meter equal to or above			
	0.5 μ m	5 μ m	0.5 μ m	5 μ m
A	3520	29	3500	29
B(a)	35,200	293	3.52,000	2, 930
C(a)	3,52.000	2,930	35.20,000	29, 300
D(a)	35.20,000	29, 300	Not defined (c)	Not defined (c)

Notes.

(a) In order to reach the B, C and D air grades, the number of air changes shall be related to the size of the room and the equipment and personnel present in the room. The air system shall be provided with the appropriate filters such as HEPA for Grades A, B and C. The maximum permitted number of particles in the "at rest" condition shall approximately be as under:

Grade A corresponds with Class 100 or M 3.5 or ISO class 5: Grade B with class 1000 or M 4.5 or ISO Class 6; Grade C with Class 10000 or M 5.5 or ISO Class 7: Grade D with Class 100,000 or M 6.5 or ISO Class 8.

(b) The requirement and limit for the area shall depend on the nature of the operation carried out.

(c) Type of operations to be carried out in the Various grades are given in Table II and Table III as under:

TABLE II
**Types of Operations To Be Carried Out in The Various Grades For
 Aseptic
 Preparations**

Grade	Types of operations for aseptic preparations.
A	Aseptic preparation and filling
B	Background room conditions for activities requiring Grade A
C	Preparation of solution to be filtered.
D	Handling of, components after washing

TABLE III
**Types of Operations To Be Carried Out In The Various Grades For
 Terminally
 Sterilized Products**

Grade	Types of operations for terminally sterilized products.
A	Filling of products, which are usually at risk.
C	Placement of filling and sealing machines, preparation of solutions, when usually at risk. Filling of product when unusually at risk.
D	Moulding, blowing (pre forming) operations of plastic containers. Preparations of solutions and components for subsequent filling.

ENVIRONMENTAL MONITORING

4.1 All environmental parameters listed under para 3.1 to 3.10 shall be verified and established at the time of installation and thereafter monitored at periodic intervals. The recommended frequencies of periodic monitoring shall be as follows:

- (a) Particulate monitoring in air — 6 Monthly
- (b) HEPA filter integrity testing (smoke testing)—Yearly
- (c) Air change rates — 6 Monthly
- (d) Air pressure differentials — Daily
- (e) Temperature and humidity — Daily
- (f) Microbiological monitoring by settle plates and/or swabs in aseptic areas — Daily, and at decreased frequency in other areas

Note.—The above frequencies of monitoring shall be changed as per the requirements and load in individual cases.

4.2 There shall be a written environmental monitoring program and microbiological results shall be recorded. Recommended limits for microbiological monitoring of clean areas "in operation" are as given in the table below:

TABLE
**Recommended Limits For Microbiological Monitoring
Of Clean Areas "In-operation"**

Grade	Air sample Cfu/m ³	Settle plates (dia 90 mm. Cfu/2 hrs.	Contact plates (dia 55mm) cfu per plate	Glove points (five fingers) cfu per glove
A	<1	<1	<1	<1
B	10	5	5	5
C	100	50	25	-
D	500	100	50	-

Notes.

- (a) These are average values;
- (b) Individual settle plates may be exposed for not less than two hours in Grade B, C and D areas and for not less than thirty minutes in Grade A area.

4.3 Appropriate action shall be taken immediately if the result of particulate and micro-biological monitoring indicates that the counts exceed the limits—The Standard Operating Procedures shall contain corrective action. After major engineering modification to the HVAC system of any area, all monitoring shall be re-performed before production commences.

5. GARMENTS

5.1 This section covers garments required for use by personnel working only in aseptic areas. Outdoor clothing shall not be brought into the sterile areas.

5.2 The garments shall be made of non-shedding and tight weave material cotton garments shall not be used. The garments shall shed virtually no fibers or particulate matter.

5.3 The clothing and its quality shall be adopted to the process and the work place and worn in such a way as to protect the product from contamination. Garments shall be single piece with fastenings at cuffs, neck and at legs to ensure close fit. Trouser legs shall be tucked inside the cover boots. Suitable design of garments shall either include a hood (head-cover) or a separate hood which can be tucked inside the over-all. Pockets, pleats and belts shall be avoided in garments. Zips (if any) shall be of Plastic material. Garments with damaged zips shall not be used.

5.4 Only clean, sterilized and protective garments shall be used at each work session where aseptic filtration and filling operations are undertaken and at each work shift for products intended to be sterilized, post-filling. The mask and gloves shall be changed at every work session in both instances.

5.5 Gloves shall be made of latex or other suitable plastic in materials and shall be powder-free. These shall be long enough to cover wrists completely and allow the over-all cuff to be tucked in.

5.6 The footwear shall be of suitable plastic or rubber material and shall be daily cleaned with a bactericide.

5.7 Safety goggles or numbered glasses with side extensions shall be used inside aseptic areas. These shall be sanitised by a suitable method.

5.8 Garment changing procedure shall be documented and operators trained in this aspect. A full size mirror shall be provided in the final change room for the operator to verify that he is appropriately attired in the garments. Periodic inspection of the garments shall be done by responsible staff

6. SANITATION

6.1 There shall be written procedures for the sanitation of sterile processing facilities. Employees carrying out sanitation of aseptic areas shall be trained specifically for this purpose.

6.2 Different sanitising agents shall be used in rotation and the concentrations of the same shall be as per the recommendations of the manufacturer. Records of rotational use of sanitising agents shall be maintained.

6.3 Distilled water freshly collected directly from the distilled water plant or water maintained above 70 degree centigrade from the re-circulation loop shall be used for dilution of disinfectants Alternately, -.distilled water sterilised by autoclaving or membrane filtration shall be used. The dilution shall be carried out in the `white' change room.

6.4 Where alcohol or isopropyl alcohol is used for dilution of disinfectants for use as hand sprays, the preparation of the same shall be done in the bulk preparation area and the diluted solution membrane-filtered into suitable sterile containers held in aseptic area.

6.5 Diluted disinfectants shall bear the label 'use before', based on microbiological establishment of their germicidal properties. The solutions shall be adequately labeled and documents maintained.

6.6 Formaldehyde or any other equally effective fumigant is recommended for the fumigation of aseptic areas or after major civil modifications. There shall be Standard Operating Procedures for this purpose . Its use for routine purposes shall be discouraged and an equally effective surface, cleaning regime shall be followed.

6.7 Cleaning of sterile processing facilities shall be undertaken with air suction devices or with non-linting sponges or clothes.

6.8 Air particulate quality shall be evaluated on a regular basis and records maintained

7. EQUIPMENT

7.1 The special equipment required for manufacturing sterile products includes component washing machines; steam sterilisers, dry heat sterilizers, membrane filter assemblies. manufacturing vessels. blenders, liquid filling machines, powder tilling machines, sealing and labeling machines, vacuum testing chambers, inspection machines, lyophilisers, pressure vessels etc. Suitable and fully integrated washing-sterilizing-filling lines may be provided. depending upon the type and Volume of activity.

7.2 Unit-sterilisers shall be double-ended with suitable inter-locking arrangements between the doors. The effectiveness of the sterilization process shall be established initially by biological inactivation studies using microbial spore indicators and then at least once a year by carrying out thermal mapping of the chamber. Various sterilization parameters shall be established based on these studies and documented. For membrane filters used for filtration, appropriate filter integrity tests that ensure sterilization shall be carried out before and after filtration,

7.3 Filling machines shall be challenged initially and then at periodic intervals by simulation trials including sterile media fill. Standard Operating Procedures and acceptance criteria for media fills shall be established,

justified and documented. Special simulation trial procedures shall be developed, validated and documented for special products like ophthalmic ointments.

7.4 The construction material used for the parts which are in direct contact with products and the manufacturing vessels may be stainless steel 316 or 13mo-silicate glass (if glass containers) and the tubing shall be capable of being washed and autoclaved.

7.5 On procurement, installation qualification of each of the equipment shall be done by engineers with the support of production and quality assurance personnel. Equipment for critical processes like aseptic filling and sterilizers shall be suitably validated according to a written program before putting them to use.

6 Standard Operating Procedures shall be available for each equipment for its calibration and operation and cleaning. Gauges and other measuring devices attached to equipment shall be calibrated at suitable intervals against a written program. Calibration Status of equipment and gauges shall be adequately documented and displayed.

8. WATER AND STEAM SYSTEMS

8.1 Potable water meeting microbiological specification of not more than 500 cfu/ml and indicating absence of individual pathogenic micro-organisms. *Escherichia coli*, *Salmonella*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* per 100 ml. sample shall be used for the preparation of purified water.

8.2 Purified water prepared by de-mineralisation shall meet the microbiological specification of not more than 100 cfu per ml and indicate absence of pathogenic micro-organisms in 100 ml. Purified water shall also meet IP specifications for chemical quality. Purified water shall be used for hand washing in change rooms. Containers, closures and machine parts may be washed with potable water followed by suitably filtered purified water. Purified water shall be stored in stainless steel tanks or plastic tanks.

8.3 Water for injection (hereinafter referred as WFI) shall be prepared from potable water or purified water meeting the above specifications by distillation. Water for Injection shall meet micro-biological specification of not more than 10 cfu per 100 ml WFI shall also meet IP specification for Water for Injection and shall have an endotoxin level of not more than 0.25 EU I ml. Bulk solutions of liquid parenterals shall be made in WFI. Final rinse of product containers and machine parts shall be done with WFI. Disinfectant solutions for use in aseptic areas shall be prepared in WFI.

8.4 Water for Injection for the manufacture of liquid injectables shall be freshly collected from the distillation plant or from a storage or circulation loop where the water, has been kept at above 70 degree centigrade. At the point of collection, water may be cooled using suitable heat exchanger.

8.5 Water for non-injectable sterile products like eye drops shall meet IP specifications for Purified water. In addition, microbiological specification of not more than 10 cfu per 100 ml and absence of *Pseudomonas aeruginosa* and *Enterobacter coil* in 100 ml shall also be met.

8.6 Water for Injection shall be stored in steam jacketted stainless steel tanks. of suitable size and the tanks shall have hydrophobic bacterial retention with 0.22 .t vent filters. The filters shall be suitably sterilized at periodic intervals. The distribution lines for purified water and distilled water shall be of stainless steel 316 construction and shall not shed particles.

8.7 There shall be a written procedure and program for the sanitation of different water systems including storage tanks, distribution lines, pumps and other related equipment. Records of sanitation shall be maintained.

8.8 There shall be written microbiological monitoring program for different types of water. The results shall justify the frequency of sampling and testing. Investigation shall be carried out and corrective action taken in case of deviation from prescribed limits.

8.9 Steam coming in contact with the product, primary containers and other product contact surfaces shall be sterile and pyrogen free. The steam condensate shall meet microbiological specification of not more than 10⁵ cfu per 100 ml. The condensate shall also meet IP specification for Water for Injection and shall have an endotoxin levels of not more than 0.25 EU/ml. There shall be a suitable schedule for the monitoring of steam quality.

9. MANUFACTURING PROCESS

9.1 Manufacture of sterile products shall be carried out only in areas under defined conditions.

9.2 Bulk raw materials shall be monitored for bio-burden periodically. Bioburden of bulk solution prior to membrane filtration shall be monitored periodically and a limit of not more than 100 cfu per ml is recommended.

9.3 The time between the start of the preparation of the solution and its sterilization or filtration through a micro-organism retaining filter shall be minimised. There shall be a set maximum permissible time for each product that takes into account its composition and method of storage mentioned in the Master formula record

9.4 Gases coming in contact with the sterile product shall be filtered through two 0.22µ hydrophobic filters connected in-series. These filters shall be tested for integrity. Gas cylinders shall not be taken inside aseptic areas.

9.5 Washed containers shall be sterilized immediately before use. Sterilized containers, if not used within an established time, shall be rinsed with distilled or filtered purified water and re-sterilized.

9.6 Each lot of finished product shall be filled in one continuous operation. In each case, where one batch is filled in using more than one operation. Each lot shall be tested separately for sterility and held separately till sterility test results are known.

9.7 Special care shall be exercised while filling products in powder form so as not to contaminate the environment during transfer of powder to filling machine-hopper.

10. FORM-FILL-SEAL TECHNOLOGY OR BLOW, FILL-SEAL

TECHNOLOGY

10.1 Form-Fill-Seal units are specially built automated machines in which through one continuous operation, containers are formed from thermoplastic granules, filled and then sealed. Blow fill-seal units are machines in which containers are moulded/blown (pre-formed) in separate clean rooms, by non continuous operations.
Note.

- (i) These shall be installed in at least Grade C environment.
- (ii) These shall comply with the limits as recommended in Table at item 4.2.

10.2 Form-Fill-Seal/Blow, Fill-Seal machines used for the manufacture of products for terminal sterilization shall be installed in at

least Grade C environment and the filling zone within the machine shall fulfil Grade A requirements.

10.3 Terminally Sterilized Products

10.3.1 Preparation of primary packaging material such as glass, bottles, ampoules and rubber stoppers shall be done in at least Grade D environment. Where there is unusual risk to the product from microbial contamination, the above operation shall be done in Grade C environment. All the processes used for component preparation shall be validated.

10.3.2 Filling of products requiring terminal sterilization shall be done under Grade A environment with a Grade C background.

10.4 Preparation of solutions, which are to be sterilized by filtration, shall be done in Grade C environment, and if not to be filtered the preparation of materials and products shall be in Grade A environment with Grade B in background.

10.5 Filtration (Membrane)

- (i) Solutions for Large Volume Parenterals shall be filtered through a non-fiber releasing, sterilizing grade cartridge/membrane filter of nominal pore size of 0.22 µ for aseptic filling whereas 0.45 µ porosity shall be used for terminally sterilized products.
- (ii) A second filtration using another 0.22 µ sterilizing grade cartridge/membrane filter shall be performed immediately prior to filling. Process specifications shall indicate the maximum time during which a filtration system may be used with a view to precluding microbial build up to levels that may affect the microbiological quality of the Large Volume Parenterals.
- (iii) The integrity of the sterilized filter shall be verified and confirmed immediately after use by an appropriate method such as Bubble Point, Diffusive Flow or Pressure Hold Test.

10.6 Sterilization (Autoclaving)

10.6.1 Before any sterilization process is adopted, its suitability for the product and its efficiency in achieving the desired sterilizing conditions in all parts of each type of load pattern to be processed, shall be demonstrated by physical measurements and by biological indicators, where appropriate.

10.6.2 All the sterilization processes shall be appropriately validated. The validity of the process shall be verified at regular intervals, but at least annually. Whenever significant modifications have been made to the equipment and product, records shall be maintained thereof.

10.6.3 The sterilizer shall be double ended to prevent mix-ups.

10.6.4 Periodic bio-burden monitoring of products before terminal sterilization shall be carried out and controlled to limits specified for the product in the Master Formula.

10.6.5 The use of biological indicators shall be considered as an additional method for monitoring the sterilization. These shall be stored and used according to the manufacturer's instructions. Their quality shall be checked by positive controls. If biological indicators are used, strict precautions shall be taken to avoid transferring microbial contamination from them.

10.6.6 There shall be clear means of differentiating 'sterilized' and 'unsterilized' products. Each basket, tray or other carrier of products or components shall be clearly labeled with the name of the material, its batch number and sterilization status. Indicators shall be used, where appropriate, to indicate whether a batch (or sub-batch) has passed through the sterilization process.

10.6.7 Sterilization records shall be available for each sterilization run and may also include thermographs and sterilization monitoring strips. They shall be maintained as part of the batch release procedure.

10.7 Sterilization (By Dry Heat)

10.7.1 Each heat sterilization cycle shall be recorded on a time-temperature chart of a suitable size by appropriate equipment of the required accuracy and precision. The position of temperature probes used for controlling and/or recording shall be determined during the validation and, where applicable, shall also be checked against a second independent temperature probe located in the same position. The chart shall form a part of the batch record. Container mapping may also be carried out in the case of Large Volume Parenterals.

10.7.2 Chemical or biological indicators may also be used, but shall not take the place of physical validation.

10.7.3 Sufficient time shall be allowed for the load to reach the required temperature before measurement of sterilization time commences. This time shall be separately determined for each type of load to be processed.

10.7.4 After the high temperature phase of a heat sterilization cycle, precautions shall be taken against contamination of sterilized load during cooling. Any cooling fluid or gas in contact with the product shall be sterilized unless it can be shown that any leaking container would not be approved for use. Air inlet and outlets shall be provided with bacteria retaining filters.

10.7.5 The process used for sterilization by dry heat shall include air-circulation within the chamber and the maintenance of a positive pressure to prevent the entry of non-sterile air. Air inlets and outlets should be provided with micro-organism retaining filters. Where this process of sterilization by dry heat is also intended to remove pyrogens, challenge tests using endotoxins would be required as part of the validation process.

10.8 Sterilization (By Moist Heat)

10.8.1 Both the temperature and pressure shall be used to monitor the process. Control instrumentation shall normally be independent of monitoring instrumentation and recording charts. Where automated control and monitoring systems are used for these applications, these shall be validated to ensure that critical process requirements are met. System and cycle faults shall be registered by the system and observed by the operator. The reading of the independent temperature indicator shall be routinely checked against the chart-recorder during the sterilization period. For sterilizers fitted with a drain at the bottom of the chamber, it may also be necessary to record the temperature at this position throughout the sterilization period. There shall be frequent leak tests done on the chamber during the vacuum phase of the cycle.

10.8.2 The items to be sterilized, other than products in sealed containers, shall be wrapped in a material which allows removal of air and penetration of steam but which prevents re-contamination after sterilization. All parts of the load shall be in contact with the sterilizing agent at the required temperature for the required time.

10.8.3 No Large Volume Parenteral shall be subjected to steam sterilization cycle until it has been filled and sealed.

10.8.4 Care shall be taken to ensure that the steam used for sterilization is of a suitable quality and does not contain additives at a level which could cause contamination of the product or equipment.

10.9 Completion/Finalisation of Sterile Products

10.9.1 All unit operations and processes in the manufacture of a batch

shall have a minimum time specified and the shortest validated time shall be used from the start of a hatch to its ultimate release for distribution.

10.9.2 Containers shall be closed by appropriately validated methods. Containers closed by fusion, e.g. glass or plastic ampoules shall be subjected to 100% integrity testing. Samples of other containers shall be checked for integrity according to appropriate procedures.

10.9.3 Containers sealed under vacuum shall be tested for required vacuum conditions.

10.9.4 Filled containers of parenteral products shall be inspected individually for extraneous contamination or other defects. When inspection is done visually. It shall be done under suitably controlled conditions of illumination and background. Operators doing the inspection shall pass regular eye-sight checks with spectacles, if worn, and be allowed frequent rest from inspection. Where other methods of inspection are used, the process shall be validated and the performance of the equipment checked at suitable intervals. Results shall be recorded.

11. PRODUCT CONTAINERS AND CLOSURES

11.1 All containers and closures intended for use shall comply with the pharmacopoeia] and other specified requirements. Suitable sample sizes, specifications, test methods, cleaning procedures and sterilization procedures, shall be used to assure that containers, closures and other component parts of drug packages are suitable and are not reactive, additive, adsorptive or leachable or presents the risk of toxicity to an extent that significantly affects the quality or purity of the drug. No second hand or used containers and closures shall be used.

11.2 Plastic granules shall also comply with the Pharmacopoeia] requirements including physio-chemical and biological tests.

11.3 All containers and closures shall be rinsed prior to sterilization with water for injection according to written procedure.

11.4 The design of closures, containers and stoppers shall be such as to make cleaning, easy and also to make an airtight seal when fitted to the bottles.

11.5 It shall be ensured that containers and closures chosen for a particular product are such that when coming into contact they are not absorbed into the product and they do not affect the product adversely. The closures and stoppers should be of such quality substances as not to affect the quality of the product and avoid the risk of toxicity.

11.6 Whenever glass bottles are used, the written schedule of cleaning shall be laid down and followed. Where bottles are not dried after washing, these shall be finally rinsed with distilled water or pyrogen free water, as the case may be, according to written procedure.

11.7 Individual containers of parenteral preparations, ophthalmic preparations shall be examined against black/white background fitted with diffused light after filling so as to ensure freedom from foreign matters.

11.8 Glass bottles

1 1.8.1 Shape and design of the glass bottle shall be rational and standardized. Glass bottles made of USP Type-1 and USP Type-11 glass shall only be used. Glass bottles shall not be reused. Before use, USP Type-II bottles shall be validated for the absence of particulate matter generated over a period of the shelf-life of the product and shall be regularly monitored after production, following statistical sampling methods. USP Type-111 glass containers may be used for non-parenteral sterile products such as Otic Solutions.

11.9 Plastic Containers

11.9.1 Pre-formed plastic containers intended to be used for the packing of Large Volume Parenteral shall be moulded in-house by one-continuous operation through an automatic machine.

11.9.2 Blowing, filling and sealing (plugging) operations shall be conducted in room(s) conforming to requirements as mentioned in Table 111 of item 3.10. Entry to the area where such operations are undertaken, shall be through a series of air locks. Blowers shall have an air supply which is filtered through 0.22 µ filters. Removal of runners and plugging operations shall be conducted under a laminar airflow work station.

11.10 Rubber stoppers

11.10.1 The rubber stoppers used for Large Volume Parenterals shall comply with specifications prescribed in the current edition of the Indian Pharmacopoeia.

12. Documentation

12.1 The manufacturing records relating to manufacture of sterile products shall indicate the following details:

- (1) Serial number of the Batch Manufacturing Record.
- (2) Name of the product.
- (3) Reference to Master Formula Record.
- (4) Batch/Lot number.
- (5) Batch/Lot size.
- (6) Date of commencement of manufacture and date of completion of manufacture.
- (7) Date of manufacture and assigned date of expiry.
- (8) Date of each step in manufacturing.
- (9) Names of all ingredients with the grade given by the quality control department.
- (10) Quantity of all ingredients.
- (11) Control reference numbers for all ingredients.
- (12) Time and duration of blending, mixing etc. whenever applicable.
- (13) pH of solution whenever applicable.
- (14) Filter integrity testing records.
- (15) Temperature and humidity records whenever applicable.
- (16) Records of plate-counts whenever applicable.
- (17) Results of pyrogen and/or bacterial endotoxin and toxicity.
- (18) Records of weight or volume of drug filled in containers.
- (19) Bulk sterility in case of aseptically filled products.
- (19) Leak test records.
- (20) Inspection records.
- (21) Sterilization records including autoclave, leakage test records, load details, date, duration, temperature, pressure, etc.
- (22) Container washing records.
- (23) Total number of containers filled.
- (24) Total numbers of containers rejected at each stage.

- (25) Theoretical yield, permissible yield, actual yield and variation thereof.
- (26) Clarification for variation in yield beyond permissible yield.
- (27) Reference numbers of relevant analytical reports.
- (28) Details of reprocessing, if any.
- (29) Name of all operators carrying out different activities.
- (30) Name of all operators carrying out different activities.
- (31) Environmental monitoring records.
- (32) Specimens of printed packaging material.
- (33) Records of destruction of rejected containers and printed packaging materials.
- (34) Signature of the competent technical staff responsible for manufacture and testing.

Notes.-

- (1) Products shall be released only after complete filling and testing.
- (2) Result of the tests relating to sterility, pyrogens, and Bacterial endotoxins shall be maintained in the analytical records.
- (3) Validation details and simulation trial records shall be maintained separately.
- (4) Records of environmental monitoring like temperature, humidity, microbiological data etc. shall be maintained. Records of periodic servicing of HEPA filters, sterilizers and other periodic maintenance of facilities and equipment carried out shall also be maintained.
- (5) Separate facilities shall be provided for filling-cum-sealing of Small Volume Injectable and Large Volume Parenterals.
- (6) It is advisable to provide separate facilities for manufacture of Large Volume Parenterals in glass containers and/or plastic containers.
- (7) For manufacture of Large Volume Parenterals in plastic containers, it is advisable to install automatic (with all operations). Form-Fill-Seal machines having one-continuous operation.

PART 1B

**SPECIFIC REQUIREMENTS FOR MANUFACTURE OF ORAL SOLID
DOSAGE
FORMS (TABLETS AND CAPSULES)**

Note.—The General Requirements as given in Part I of this Schedule relating to Requirements of Good Manufacturing Practices for Premises and Materials for pharmaceutical products shall be complied with, *mutatis mutandis*, for the manufacture of Oral Solid Dosage Forms (Tablets and Capsules). In addition to these requirements, the following Specific Requirements shall also be followed, namely:

1. GENERAL

- 1.1 The processing of dry materials and products creates problems of dust control and cross-contamination. Special attention is, therefore, needed in the design, maintenance and use of premises and equipment in order to overcome these problems. Wherever required, enclosed dust control manufacturing systems shall be employed.

1.2 Suitable environmental conditions for the products handled shall be maintained by installation of air-conditioning wherever necessary. Effective air-extraction systems, with discharge points situated to avoid contamination of other products and processes shall be provided. Filters shall be installed to retain dust and to protect the factory and local environment.

1.3 Special care shall be taken to protect against subsequent contamination of the product by particles of metal or wood. The use of metal detector is recommended. Wooden equipment should be avoided. Screens, sieves, punches and dies shall be examined for wear and tear or for breakage before and after each use.

1.4 All ingredients for a dry product shall be sifted before use unless the quality of the input material can be assured. Such sifting shall normally be carried out at dedicated areas.

1.5 Where the facilities are designed to provide special environmental conditions of pressure differentials between rooms, these conditions shall be regularly monitored and any specification results brought to the immediate attention of the Production and Quality assurance departments which shall be immediately attended to.

1.6 Care shall be taken to guard against any material lodging and remaining undetected in any processing or packaging equipment. Particular care shall be taken to ensure that any vacuum, compressed air or an extraction nozzles are kept clean and that there is no evidence of lubricants leaking into the product from any part of the equipments.

2. SIFTING, MIXING AND GRANULATION

2.1. Unless operated as a closed system mixing, sifting and blending equipments shall be fitted with dust extractors.

2.2. Residues from sieving operations shall be examined periodically for evidence of the presence of unwanted materials.

2.3 Critical operating parameters like time and temperature for each mixing blending and drying operation shall be specified in a Master Formula monitored during processing, and recorded in the batch records.

2.4. Filter bags fitted to fluid-bed-drier shall not be used for different products without being washed in-between use with certain highly potent or sensitising products, bags specific to one product only shall be used. Air entering the drier shall be filtered. Steps shall be taken to prevent contamination of the site and local environment by dust in the air leaving the drier due to close positioning of the air-inlets and exhaust.

2.5 Granulation and coating solutions shall be made, stored and used in a manner which minimises the risk of contamination or microbial growth.

3. COMPRESSION (TABLETS)

3.1 Each tablet compressing machine shall be provided with effective dust control facilities to avoid cross contamination. Unless the same product is being made on each machine, or unless the compression machine itself provides its own enclosed air controlled environment, the machine shall be installed in separate cubicles.

3.2 Suitable physical, procedural and labeling arrangements shall be made to prevent mix-up of materials, granules and tablets on compression machinery.

3.3 Accurate and calibrated weighing equipment shall be readily available and used for in-process monitoring of tablet weight variation.

Procedures used shall be capable of defecting out-of-limits tablets.

3.4 At the commencement of each compression run and in case of multiple compression points in a compression machine, sufficient individual tablets shall be examined at fixed intervals to ensure that a tablet from each compression station or from each compression point has been inspected for suitable pharmacopoeial parameters like 'appearance', weight variation', 'disintegration', 'hardness', 'friability' and 'thickness'. The results shall be recorded as part of the batch documentation.

3.5 tablets shall be de-dusted, preferably by automatic device and shall be monitored for the presence of foreign materials besides any other defects.

3.6 tablets shall be collected into clean, labeled containers.

3.7 Rejected or discarded tablets shall be isolated in identified containers and their quality recorded in the Batch Manufacturing Record.

3.8 In-process control shall be employed to ensure that the products remain within specification. During compression, samples of tablets shall be taken at regular intervals of not greater than 30 minutes to ensure that they are being produced in compliance with specified in-process specification. The tablets shall also be periodically checked for additional parameters such as 'appearance', 'weight variation', 'disintegration', 'hardness', 'friability' and 'thickness' and contamination by lubricating oil.

4. COATING (TABLETS)

4.1 Air supplied to coating pans for doing purposes shall be filtered air and of suitable quality. The area shall be provided with suitable exhaust system and environmental control (temperature, humidity) measures.

4.2 Coating solutions and suspensions shall be made afresh and used in a manner, which shall minimise the risk of microbial growth. Their preparation and use shall be documented and recorded.

5. FILLING OF HARD GELATIN CAPSULE

Empty capsules shells shall be regarded as 'drug component' and treated accordingly. They shall be stored under conditions which shall ensure their safety from the effects of excessive heat and moisture.

6. PRINTING (TABLETS AND CAPSULES)

6.1 Special care shall be taken to avoid product mix-up during any printing of tablets and capsules. Where different products, or different batches of the same product, are printed simultaneously, the operations shall adequately be segregated. Edible grade colours and suitable printing ink shall be used for such printing.

6.2 After printing, tablets and capsules shall be approved by Quality Control before release for packaging or sale.

7. PACKAGING (STRIP AND BLISTER)

7.1 Care shall be taken when using automatic tablet and capsule counting, strip and blister packaging equipment to ensure that all 'rogue' tablets, capsules or foils from packaging operation are removed before a new packaging operation is commenced. There shall be an independent recorded check of the equipment before a new batch of tablets or capsules is handled.

7.2 Uncoated tablets shall be packed on equipment designed to minimise the risk of cross-contamination. Such packaging shall be carried out in an isolated area when potent tablets or Beta-lactum containing tablets are being packed.

7.3 The strips coming out of the machine shall be inspected for defects such as misprint, cuts on the foil, missing tablets and improper sealing.

7.4 Integrity of individual packaging strips and blisters shall be subjected to vacuum test ^{per}iodically to ensure leak proofness of each pocket strip and blister and records maintained.

PART IC

SPECIFIC REQUIREMENTS FOR MANUFACTURE OF ORAL LIQUIDS (SYRUPS, ELIXIRS, EMULSIONS AND SUSPENSIONS)

Note.—The General Requirements as given in Part I of this Schedule relating to Requirements of Good Manufacturing Practices for Premises and Materials for pharmaceutical products shall be complied with, *mutatis mutandis*, for the manufacture of (Syrups, Elixirs, Emulsions and Suspensions). In addition to these requirements, the following Specific Requirements shall also be followed, namely:-

1. BUILDING AND EQUIPMENT

1.1 The premises and equipment shall be designed, constructed and maintained to suit the manufacturing of Oral Liquids. The layout and design of the manufacturing area shall strive to minimize the risk of cross-contamination and mix-ups.

1.2 Manufacturing area shall have entry through double door air-lock facility. It shall be made fly proof by use of 'fly catcher' and/or 'air curtain'.

1.3 Drainage shall be of adequate size and have adequate traps, without open channels and the design shall be such as to prevent back flow. Drains shall be shallow to facilitate cleaning and disinfecting.

1.4 The production area shall be cleaned and sanitised at the end of every production process.

1.5 tanks, containers, pipe work and pumps shall be designed and installed so that they can be easily cleaned and sanitized. Equipment design shall be such as to prevent accumulation of residual microbial growth or cross-contamination.

1.6 Stainless Steel or any other appropriate material shall be used for parts of equipments coming in direct contact with the products. The use of glass apparatus shall be minimum.

1.7 Arrangements for cleaning of containers, closures and droppers shall be made with the help of suitable machines/devices equipped with high pressure air, water and steam jets.

1.8 The furniture used shall be smooth, washable and made of stainless steel.

2. PURIFIED WATER

2.1 The chemical and microbiological quality of purified water used shall be specified and monitored routinely. The microbiological evaluation shall include testing for absence of pathogens and shall not exceed 100 cfu/ml (as per Appendix 12.5 of IP 1996).

2.2 There shall be a written procedure for operation and maintenance

of the purified water system. Care shall be taken to avoid the risk of microbial proliferation with appropriate methods like recirculation, use of UV treatment, treatment with heat and sanitizing agent. After any chemical sanitisation of the water system, a flushing shall be done to ensure that the sanitizing agent has been effectively removed.

3. MANUFACTURING

3.1 Manufacturing personnel shall wear non-fiber shedding clothing to prevent contamination of the product.

3.2 Materials likely to shed fiber like gunny bags, or wooden pallets shall not be carried into the area where products or cleaned containers are exposed.

3.3 Care shall be taken to maintain the homogeneity of emulsion by use of appropriate emulsifier and suspensions by use of appropriate stirrer during filling. Mixing and tilling processes shall be specified and monitored. Special care shall be taken at the beginning of the filling process, after stoppage due to any interruption and at the end of the process to ensure that the product is uniformly homogenous during the filling process.

3.4 The primary packaging area shall have an air supply which is filtered through 5 micron filters. The temperature of the area shall not exceed 30 degrees centigrade.

3.5 When the bulk product is not immediately packed, the maximum period of storage and storage conditions shall be specified in the Master Formula. The maximum period of storage time of a product in the bulk stage shall be validated.

PART ID

SPECIFIC REQUIREMENTS FOR MANUFACTURE OF TOPICAL PRODUCTS

i.e. EXTERNAL PREPARATIONS (CREAMS, OINTMENTS, PASTES, EMULSIONS, LOTIONS, SOLUTIONS, DUSTING POWDERS AND IDENTICAL PRODUCTS

Note.—The General Requirements as given in Part I of this Schedule relating to Requirements of Good Manufacturing Practices for Premises and Materials for pharmaceutical products shall be complied with, *mutatis mutandis*, for the manufacture of Topical Products i.e. External Preparations (Creams, Ointments, Pastes, Emulsions, Lotions, Solutions, Dusting powders and Identical products used for external application). In addition to these requirements, the following Specific Requirements shall also be followed, namely:

1. The entrance to the area where topical products are manufactured shall be through a suitable airlock. Outside the airlock, insectocutors shall be installed.

2. The air to this manufacturing area shall be filtered through at least 20 air filters and shall be air-conditioned. The area shall be ventilated.

3. The area shall be fitted with an exhaust system of suitable capacity to effectively remove vapours, fumes, smoke, floating dust particles.

4. The equipment used shall be designed and maintained to prevent the product from being accidentally contaminated with any foreign matter or lubricant.

5. No rags or dusters shall be used in the process of cleaning or drying the process equipment or accessories used.
6. Water used in compounding shall be Purified Water IP.
7. Powders, whenever used, shall be suitably sieved before use.
8. Heating vehicles and a base like petroleum jelly shall be done in separate mixing area in suitable stainless steel vessels, using steam, gas, electricity, solar energy etc.
9. A Separate packing section may be provided for primary packaging of the products. PART 1E

SPECIFIC REQUIREMENTS FOR MANUFACTURE OF METERED-DOSE INHALERS (MDI)

Note.—The General Requirements as given in Part 1 of this Schedule relating to Requirements of Good Manufacturing Practices for Premises and Materials for pharmaceutical products shall be complied with, *mutatis mutandis*, for the manufacture of Metered-Dose Inhalers (MDI). In addition to these requirements, the following Specific Requirements shall also be followed, namely:

1. GENERAL

Manufacture of Metered-Dose Inhalers shall be done under conditions which shall ensure minimum microbial and particulate contamination. Assurance of the quality of components and bulk product is very important. Where medicaments are in suspended state, uniformity of suspension shall be established.

2. BUILDING AND CIVIL WORKS

2.1 The building shall be located on a solid foundation to reduce risk of cracking walls and floor due to the movement of equipment and machinery.

2.2 All building surfaces shall be impervious, smooth and non-shedding. Flooring shall be continuous and provided with a cove between the floor and the wall as well the wall to the ceiling. Ceiling shall be solid, continuous and covered to walls. Light fittings and air-grills shall be flush with the ceiling. All service lines requiring maintenance shall be erected in such a manner that these are accessible from outside the production area.

2.3 The manufacturing area shall be segregated into change rooms for personnel, container preparation area, bulk preparations and filling area, quarantine area and spray testing and packing areas.

2.4 Secondary change rooms shall be provided for operators to change from factory clothing to special departmental clothing before entering the manufacturing and filling area.

2.5 Separate area shall be provided for de-cartoning of components before they are air washed.

2.6 The propellants used for manufacture shall be delivered to the manufacturing area distribution system by filtering them through 2 μ filters. The bulk containers of propellants shall be stored, suitably identified, away from the manufacturing facilities.

3. ENVIRONMENTAL CONDITIONS

3.1 Where products or clean components are exposed, the area shall be supplied with filtered air of Grade C.

3.2 The requirements of temperature and humidity in the manufacturing area shall be decided depending on the type of product and propellants handled in the facility. Other support areas shall have comfort levels of temperature and humidity.

3.3 There shall be a difference in room pressure between the manufacturing area and the support areas and the differential pressure shall be not less than 15 Pascals, (0.06 inches or 1.5 mm Water gauge).

3.4 There shall be a written schedule for the monitoring of environmental conditions. Temperature and humidity shall be monitored daily.

4. GARMENTS

4.1 Personnel in the manufacturing and filling section shall wear suitable single-piece-garment made out of non-shedding, tight weave material. Personnel in support areas shall wear clean factory uniforms.

4.2 Gloves made of suitable material having no interaction with the propellants shall be used by the operators in the manufacturing and filling areas. Preferably, disposable gloves shall be used.

4.3 Suitable department-specific personnel protective equipment like footwear and safety glasses shall be used wherever *hazard* exists.

5. SANITATION

5.1 There shall be written procedures for the sanitation of the MDI manufacturing facility. Special care should be taken to handle residues and rinses of propellants.

5.2 Use of water for cleaning shall be restricted and controlled. Routinely used disinfectants are suitable for sanitising the different areas. Records of sanitation shall be maintained.

6. EQUIPMENT

6.1 Manufacturing equipment shall be closed system. The vessels and supply lines shall be stainless steel.

6.2 Suitable check weights, spray testing machines and labelling machines shall be provided in the department.

6.3 All the equipment shall be suitably calibrated and their performance validated on receipt and thereafter periodically.

7. MANUFACTURE

7.1 There shall be an approved Master Formula Records for the manufacture of metered dose inhalers. All propellants, liquids and gasses shall be filtered through 2 μ filters to remove particles.

7.2 The primary packing material shall be appropriately cleaned by compressed air suitably filtered through 0.2 μ filter. The humidity of the compressed air shall be controlled as applicable.

7.3 The valves shall be carefully handled and after de-cartoning, these

shall be kept in clean, closed containers in the filling room.

7.4 For suspensions, the bulk shall be kept stirred continuously.

7.5 In-process controls shall include periodical checking of weight of bulk formulation filled in the containers. In a two-shot-filling process (liquid filling followed by gaseous filling), it shall be ensured that 100% check on weight is carried out.

7.6 Filled containers shall be quarantined for a suitable period established by the manufacturer to detect leaking containers prior to testing, labelling and packing.

8. DOCUMENTATION

8.1 In addition to the routine good manufacturing practices documentation, manufacturing records shall show the following additional information:

- (1) Temperature and humidity in the manufacturing area.
- (2) Periodic filled weights of the formulation.
- (3) Records of rejections during on line check weighing.
- (4) Records of rejection during spray testing.

PART IF

SPECIFIC REQUIREMENTS OF PREMISES, PLANT AND MATERIALS FOR MANUFACTURE OF ACTIVE PHARMACEUTICAL INGREDIENTS (BULK DRUGS)

Note.—The General Requirements as given in Part I of this Schedule relating to Requirements of Good Manufacturing Practices for Premises and Materials for pharmaceutical products shall be complied with, *mutatis mutandis*, for the manufacture of active pharmaceutical ingredients (Bulk Drugs). In addition to these requirements, the following Specific Requirements shall also be followed. namely:-

1. BUILDINGS AND CIVIL WORKS

1.1 Apart from the building requirements contained in Part I, General ante, the active pharmaceutical ingredients facilities for manufacture of hazardous reactions, Beta-Lactum antibiotics. Steroids and Steroidal Hormones/Cytotoxic substances shall be provided in confined areas to prevent contamination of the other drugs manufactured.

1.2 The final stage of preparation of a drug, like isolation/filtration/drying/milling/sieving and packing operations shall be provided with air filtration systems including pre-filters and finally with a 5 micron filter. Air handling systems with adequate number of air changes per hour or any other suitable system to control the air borne contamination shall be provided. Humidity/Temperature shall also be controlled for all the operations wherever required.

1.3 Air filtration systems including pre-filters and particulate matter retention air filters shall be used, *where* appropriate for air suppliers to production areas. If air is re-circulated to production areas, measures shall be taken to control re-circulation of floating dust particles from production. In areas where air contamination occurs during production, there shall be adequate exhaust system to control contaminants.

1.4 Ancillary area shall be provided for Boiler-house. Utility areas like heat exchangers, chilling workshop, store and supply of gases shall also be

provided.

1.5 For specified preparation like manufacture of sterile products and for certain antibiotics, sex hormones, cytotoxic and oncology products. separate enclosed areas shall be designed. The requirements for the sterile active pharmaceutical ingredient shall be in line with the facilities required for formulations to be filled aseptically.

2. STERILE PRODUCTS

Sterile active pharmaceutical ingredient filled aseptically shall be treated as formulation from the stage wherever the process demands like crystallisation, lyophilisation, filtration etc. All conditions applicable to formulations that are required to be filled aseptically shall apply *animas mutandis* for the manufacture of sterile active pharmaceutical ingredients involving stages like filtration, crystallisation and lyophilisation.

3. UTILITIES/SERVICES

Equipment like chilling plant, boiler, heat exchangers, vacuum and gas storage vessels shall be serviced. Cleaned, sanitised and maintained at appropriate intervals to prevent malfunctions or contamination that may interfere with safety, identity, strength, quality or purity of the drug product.

4. EQUIPMENT DESIGN, SIZE AND LOCATION

4.1 Equipment used in the manufacture, processing, packing or holding of an active pharmaceutical ingredient shall be of appropriate design, adequate size and suitably located to facilitate operations for its intended use and for its cleaning and maintenance.

4.2 If equipment is used for different intermediates and active pharmaceutical ingredients, proper cleaning before switching from one product to another becomes particularly important. If cleaning of a specific type of equipment is difficult, the equipment may need to be dedicated to a particular intermediate or active pharmaceutical ingredient.

4.3 The choice of cleaning methods, detergents and levels of cleaning shall be defined and justified. Selection of cleaning agents (e.g. solvents) should depend on

- (a) the suitability of the cleaning agent to remove residues of raw materials, intermediates, precursors, degradation products and isomers, as appropriate.
- (b) whether the cleaning agent leaves a residue itself.
- (c) compatibility with equipment construction materials like centrifuge/filtration. dryer, fluid bed dryer, rotocone proton dryer, vacuum dryer, frit mill, multi-mill/jet mills/ sewetters cut sizing;
- (d) test for absence of intermediate or active pharmaceutical ingredient in the final rinse.

4.4 A written procedures shall be established and followed for cleaning and maintenance of equipment, including utensils used in the manufacture, processing, packing or holding of active pharmaceutical ingredients. These procedures shall include but should not be limited to the following:

- (a) assignment of responsibility for cleaning and maintaining equipment;
- (h) maintenance and cleaning program schedules, including where appropriate, sanitizing schedules;

- (c) a complete description of the methods and materials used to clean and maintain equipment, including instructions for dis-assembling and re-assembling each article of equipment to ensure proper cleaning and maintenance;
- (d) removal or obliteration of previous batch identification;
- (e) protection of clean equipment from contamination prior to use;
- (f) inspection of equipment for cleanliness immediately before use;
- (g) establishing the maximum time that may elapse between completion of processing and equipment cleaning as well as between cleaning equipment reuse.

4.5 Equipment shall be cleaned between successive batches to prevent contamination and carry-over of degraded material or contaminants unless otherwise established by validation.

4.6 As processing approaches the final purified active pharmaceutical ingredient, it is important to ensure that incidental carry over between batches does not have adverse impact on the established impurity profile. However, this does not generally hold good for any biological, active pharmaceutical ingredient where any of the processing steps are accomplished aseptically and where it is necessary to clean and sterilize equipment between batches.

5. IN-PROCESS CONTROLS

5.1 In-process controls for chemical reactions may include the following:—

- (a) reaction time or reaction completion;
- (b) reaction mass appearance, clarity, completeness or pH solutions;
- (c) reaction temperature;
- (d) concentration of a reactant;
- (e) assay or purity of the product;
- (f) process completion check by TLC/any other means.

5.2 In-process controls for physical operations may include the following:

- a. appearance and color;
- b. uniformity of the blend;
- c. temperature of a process;
- d. concentration of a solution;
- e. processing rate or time;
- f. particle size analysis;
- g. bulk/tap density;
- h. pH determination;
- i. moisture content.

6. PRODUCT CONTAINERS AND CLOSURES

6.1 All containers and closures shall comply with the pharmacopoeia) or any other requirement, suitable sampling methods, sample sizes, specifications, test methods, cleaning procedures and sterilization procedures, when indicated, shall be used to assure that containers, closures and other component parts of drug packages are suitable and are not reactive, additive, adsorptive or leachable to an extent that significantly affects the quality or purity of the drug.

6.2 The drug product container shall be re-tested or re-examined as appropriate and approved or rejected and shall be identified and controlled under a quarantine system designed to prevent their use in manufacturing or processing operations for which these are unsuitable.

6.3 Container closure system shall provide adequate protection against foreseeable external factors in storage/transportation and use that may cause deterioration or contamination of the active pharmaceutical ingredient.

6.4 Bulk containers and closures shall be cleaned and, where indicated by the nature of the active pharmaceutical ingredient, sterilized to ensure that they are suitable for their intended use.

6.5 The container shall be conspicuously marked with the name of the product and the following additional information concerning:

- (a) quality and standards, if specified;
- (b) manufacturing licence number/drug master file number (whichever applicable), batch number;
- (c) date of manufacture and date of expiry;
- (d) method for container disposal (label shall give the methodology if required).
- (e) storage conditions, if specified and name and address of the manufacturer, if available.

6.6 Areas for different operation of active pharmaceutical ingredients (Bulk drugs) section shall have appropriate areas which may be suitably partitioned for different operations.

PART II

REQUIREMENTS OF PLANT AND EQUIPMENT

1. EXTERNAL PREPARATIONS

The following equipment is recommended for the manufacture of 'External preparations' i.e., Ointments, Emulsion, lotions, Solutions, Pastes, Creams, Dusting Powders and such identical products used for external applications whichever is applicable namely:

- (1) Mixing and storage tanks (Stainless steel)
- (2) Jacketted Kettle (steam, gas or electrically heated)
- (3) Mixer (Electrically operated)
- (4) Planetary mixer
- (5) A colloid mill or a suitable emulsifier.
- (6) A triple roller mill or an ointment mill.
- (7) Liquid filling equipment (Electrically operated).

- (8) Jar on table filling equipment (Electrically operated).

Area.— (1) A minimum area of thirty square meters for basic installation and ten square meters for Ancillary area is recommended.

- (2) Areas for formulations meant for external use and internal use shall be separately proved to avoid mix up.

2. ORAL LIQUID PREPARATIONS

The following equipment is recommended for the manufacture of oral/internal use preparations, i.e., Syrups, Elixirs, Emulsions and Suspensions. whichever is applicable, namely:

- (1) Mixing and storage tanks (Stainless steel).
- (2) Jacketted Kettle/Stainless steel tanks (steam, gas or electrically heated).
- (3) Portable stirrer (Electrically operated).
- (4) A colloid mill or a suitable emulsifier (Electrically operated).
- (5) Suitable filtration equipment (Electrically operated).
- (6) Semi-automatic/automatic bottle filling machine.
- (7) Pilfer proof cap sealing machine.
- (8) Water distillation unit. or deioniser.
- (9) Clarity testing inspection units.

Area.— A minimum area of thirty square meters for basic installation and ten square meters for Ancillary area is recommended.

3. TABLETS

The tableting section shall be free from dust and floating particles and may be air-[∞]conditioned. For this purpose each tablet machine shall be isolated into cubicles and connected to a vacuum dust collector or an exhaust system for effective operations, the tablet production department shall be divided into four distinct and separate sections as follows:—

- (a) Mixing, Granulation and Drying section.
- (b) Tablet compression section
- (c) Packaging section (strip/blister machine wherever required).
- (d) Coating section (wherever required).

3.1 The following electrically operated equipment are recommended for the manufacture of compressed tablets and hypodermic tablets. in each of the above sections, namely:

- (a) Granulation-cum-Drying section.
 - (1) Disintegrator and sifter
 - (2) Power mixer
 - (3) Mass mixer/Planetary mixer/Rapid mixer granulator
 - (4) Granulator
 - (5) Thermostatically controlled hot air oven with trays (preferably mounted on a trolley)/Fluid bed dryer
 - (6) Weighing machines.

(b) Compression section

- (1) Tablet compression machine, single/multi punch/rotatory
- (2) Punch and dies storage cabinets.
- (3) Tablet de-duster
- (4) Tablet inspection unit/belt
- (5) Dissolution test apparatus
- (6) in-process testing equipment like single pan electronic balance, hardness tester, friability and disintegration test apparatus.
- (7) Air-conditioning and dehumidification arrangement (wherever necessary)

(c) Packaging section.

- (1) Strip/blister packaging machine
- (2) Leak test apparatus (vacuum system)
- (3) Tablet counters (wherever applicable)
- (4) Air-conditioning and dehumidification arrangement (wherever applicable)

Area.— A minimum area of sixty square meters for basic installation and twenty square meters for Ancillary area is recommended for an coated tablets.

(d) Coating section

- (1) Jacketted kettle (steam, gas, or electrically heated for preparing coating suspension)
- (2) Coating pan (Stainless steel)
- (3) Polishing pan (where applicable)
- (4) Exhaust system (including vacuum dust collector)
- (5) Air-conditioning and Dehumidification Arrangement
- (6) Weighing balance.

3.2 The coating section shall be made dust free with suitable exhaust system to remove excess powder and fumes resulting from solvent evaporation it shall be air-conditioned and defumidified wherever considered necessary.

Area.—A minimum additional area of thirty square metres for coating section for basic installation and ten square meters for ancillary area is recommended.

Separate area and equipment for mixing, granulation, drying tablet compression, coating and packing shall be provided for Penicillin group of drugs on the lines indicated above. In case of operations involving dust and floating particles, care shall be exercised to avoid cross-contamination.

3.3 The manufacture of Hypodermic tablets shall be conducted under aseptic conditions in a separate air-conditioned room. the walls of which shall be smooth and washable. The granulation, tableting and packing shall be done in this room.

3.4 The manufacture of effervescent and soluble/dispersible tablets shall be carried out in air-conditioned and dehumidified areas.

4. POWDERS

The following equipment is recommended for the manufacture of powders namely:

- (1) Disintegrator
- (2) Mixer (electrically operated)
- (3) Sifter
- (4) Stainless steel vessels and scoops of suitable sizes
- (5) Filling equipment (electrically operated)
- (6) Weighing balance.

In the case of operation involving floating particles of fine powder, a suitable exhaust system shall be provided. Workers should be provided with suitable masks during operation.

Area.—A minimum area of thirty square metres is recommended to allow for the basic installations. Where the actual blending is to be done on the premises, an additional room shall be provided for the purpose.

5. CAPSULES

For the manufacture of capsules, separate enclosed area suitably air-conditioned and dehumidified with an airlock arrangement shall be provided. The following equipment is recommended for filling Hard Gelatin Capsules namely:

- (1) Mixing and blending equipment (electrically or power driven)
- (2) Capsule filling units (preferably semi automatic or automatic filling machines)
- (3) Capsules counters (wherever applicable)
- (4) Weighing balance
- (5) Disintegration test apparatus
- (6) Capsule polishing equipment

Separate equipment and filling and packaging areas shall be provided in pencillin and non-pencillin sections. In case of operations involving floating particles of fine powder, a suitable exhaust system shall be provided. Manufacture and filling shall be carried out in air-conditioned areas. The room shall be dehumidified.

Area.—A minimum area of twenty five square metres for basic installation and ten square metres for Ancillary area each for pencillin and non-pencillin sections is recommended.

6. SURGICAL DRESSING

The following equipment is recommended for the manufacture of surgical dressings other than Absorbent Cotton Wool, namely:

- (1) Rolling machine
- (2) Trimming machine
- (3) Cutting equipment
- (4) Folding and pressing machine for gauze

- (5) Mixing tanks for processing medicated dressing.
- (6) Hot air dry oven
- (7) Steam sterilizer or dry heat sterilizer or other suitable equipment.
- (8) Work tablets/benches for different operations.

Area.—A minimum area of thirty square meters is recommended to allow for the basic installations. In case medicated dressings are to be manufactured, another room with a minimum area of thirty square shall be provided.

7. OPHTHALMIC PREPARATIONS

For the manufacture of Ophthalmic preparations separate enclosed areas with air lock arrangement shall be provided. The following equipment is recommended for manufacture under aseptic conditions of Eye-Ointments, Eye lotions and other preparations for external use, namely:

- (1) Thermostatically controlled hot air ovens (preferably double ended)
- (2) Jacketted kettle/Stainless steel tanks (steam, gas or electrically heated)
- (3) Mixing and storage tanks of stainless steel/Planetary mixer
- (4) Colloid mill or ointment mill.
- (5) Tube filling and crimping equipment (semi-automatic or automatic filling machines).
- (6) Tube cleaning equipment (air jet type)
- (7) Tube washing and drying equipment, if required
- (8) Automatic vial washing machine
- (9) Vial drying oven.
- (10) Rubber bung washing machine.
- (11) Sintered glass funnel, seitz or filter candle (preferably cartridge and membrane filters)
- (12) Liquid filling equipment (semi-automatic or automatic filling machines)
- (13) Autoclave (preferably ventilator autoclave)
- (14) Air-conditioning and dehumidification arrangement (preferably centrally air-conditioned and dehumidification system).
- (15) Laminar air flow units.

Area.—(1) A minimum area of twenty five square meters for basic installations and ten square meters for Ancillary area is recommended. Manufacture and filling shall be carried out in air-conditioned areas under aseptic conditions. The rooms shall be further dehumidified as considered necessary if preparations containing antibiotics are manufactured.

(2) Areas of formulations meant for external use and internal use shall be separately provided to avoid mix up.

8. PESSARIES AND SUPPOSITORIES

(i) The following equipment is recommended for manufacture of Pessaries and Suppositories. namely: -

- (1) Mixing and pouring equipment.
- (2) Moulding equipment
- (3) Weighing devices.

Area.—A minimum area of twenty square meters is recommended to allow for the basic installation.

(ii) in the case of pessaries manufactured by granulation and compression, the requirements as indicated under 'item 3 of Tablet', shall be provided.

9. INHALERS AND VITRALLAE

The following equipment is recommended for manufacture of inhalers and vitrallae, namely:

- (1) Mixing equipment
- (2) Graduated delivery equipment for measurement of the medicament during filling.
- (3) Sealing equipment.

Area.—An area of minimum twenty square metres is recommended for the basic installations.

10. REPACKING OF DRUGS AND PHARMACEUTICAL CHEMICALS

The following equipment is recommended for repacking of drugs and pharmaceuticals, chemicals. namely:

- (1) Powder disintegrator
- (2) Powder sifter (Electrically operated)
- (3) Stainless steel scoops and vessels of suitable sizes.
- (4) Weighing and measuring equipment.
- (5) Filling equipment (semi-automatic/automatic machine)
- (6) Electric sealing machine.

Area.—An area of minimum of thirty square metres is recommended for the basic ^{inst}allation. In case of operations involving floating particles of fine powder, a suitable exhaust system shall be provided.

11. PARENTAL PREPARATIONS

The whole operation of manufacture of parenteral preparations (small volume injectables and large volume parenterals) in glass and plastic containers may be divided into the following separate areas/rooms namely: -

11.1 Parenteral preparations in glass containers.

- (1) Water management area. This includes water treatment and storage.
- (2) Containers and closures preparation area. This includes washing and drying of ampoules, vials, bottles and closures.
- (3) Solution preparation area. This includes preparation and filtration

of solution.

- (4) Filling capping and sealing area. This includes filling and sealing of ampoules and/ or filling, capping and sealing of vials and bottles.
- (5) Sterilization area.
- (6) Quarantine area.
- (7) Visual inspection area.
- (8) Packaging area.

The following equipment is recommended for different above mentioned areas, namely:

(a) Water management area.

- (1) De-ionised water treatment unit.
- (2) Distillation (multi column with heat exchangers) unit
- (3) Thermostatically controlled water storage tank.
- (4) Transfer pumps
- (5) Stainless steel service lines for carrying water into user areas.

(c) Containers and closures preparation area.

- (1) Automatic rotary ampoule/vial/bottle washing machine having separate air, water, distilled water jets.
- (2) Automatic closures washing machine.
- (3) Storage equipment for ampoules, vials, bottles and closures.
- (4) Dryer/sterilizer (double ended)
- (5) dust proof storage cabinets
- (6) Stainless steel benches/stools

(c) Solution preparation area.

- (1) Solution preparation and mixing Stainless steel tanks and other containers.
- (2) Portable -stirrer.
- (3) Filtration equipment with cartridge and membrane filters/bacteriological filters.
- (4) Transfer pumps
- (5) Stainless steel benches/stools

(d) Filling, capping and sealing area.—

- (1) Automatic ampoule/vial/bottle filling, sealing and capping machine under laminar air flow work station.
- (2) Gas lines (Nitrogen, Oxygen Carbon dioxide) wherever required
- (3) Stainless steel benches/stools

(e) Sterilization area.

- (1) Steam sterilizer (preferably with computer control for sterilization cycle along with trolley sets or loading/unloading containers before and after sterilization)
- (2) Hot Air sterilizer (preferably double ended)
- (3) Pressure teak test apparatus

(f) Quarantine area.-

- (1) Storage cabinets
- (2) Raised platforms/steel racks.

(g) Visual inspection area.

- (1) Visual inspection units (preferably conveyor belt type and composite white and black assembly supported with illumination)
- (2) Stainless steel benches/stools

(h) Packaging area.

- (1) Batch coding machine (preferably automatic)
- (2) Labeling unit (preferably conveyor belt type)
- (3) benches/stools

Area.—(1) A minimum area of one hundred and fifty square meters for the basic installation and an Ancillary area of one hundred square metres for Small Volume Injectables is recommended. For Large Volume Parenterals an area of one hundred and fifty square metres each for the basic installation and for Ancillary area is recommended. These areas shall be partitioned into suitable enclosures with airlock arrangements.

- (2) Areas for formulations meant for external use and internal use shall be separately provided to avoid mix up.
- (3) Packaging materials for large volume Parenteral shall have a minimum area of 100 square metres.

11.2 Parenteral preparations in Plastic containers by Form-Fill-Seal/Blow, Fill-Seal technology.—The whole operation of manufacture of large volume parenteral preparations in Plastic containers including plastic pouches by automatic (all operations in one station) Form-Fill-Seal machine or by semi-automatic blow moulding, filling-cum-sealing machine may be divided into following separate areas/rooms, namely:

- (1) Water management area
- (2) Solution preparation area

- (3) Container moulding-cum-filling and sealing area
- (4) Sterilization area
- (5) Quarantine area
- (6) Visual inspection area
- (7) Packaging area

The following equipment is recommended for different above mentioned areas

- (a) Water management area.
 - (1) De-ionised water treatment unit
 - (2) Distillation unit (multi column with heat exchangers)
 - (3) Thermostatically controlled water storage tank.
 - (4) Transfer pumps.
 - (5) Stainless steel service lines for carrying water into user areas.
- (b) Solution preparation area.
 - (1) Solution preparation and storage tanks
 - (2) Transfer pumps
 - (3) Cartridge and membrane filters)
- (c) Container moulding-cum-filling and sealing area.
 - (1) Sterile Form-Fill-Seal machine (all operations in one station with built in Laminar air flow work station having integrated container output conveyor belt through pass box)
 - (2) Arrangement for feeding plastic granules through feeding-cum-filling tank into the machine.
- (d) Sterilization area.—Super heated steam sterilizer (with computer control for sterilization cycle along with trolley sets for loading/unloading containers for sterilization).
- (e) Quarantine area.—Adequate number of platforms/racks with storage system.
- (f) Visual inspection area.— Visual inspection unit (with conveyor belt and composite white and black assembly supported with illumination).
- (g) Packaging area.
 - (1) Pressure leak test apparatus (pressure belt or rotating disc type).
 - (2) Batch coding machine (preferably automatic)
 - (3) Labelling unit (preferably conveyor belt type.)

Area.—(1) A minimum area of two hundred and fifty square metres for the basic installation and an Ancillary area of one hundred and fifty square metres for large volume parenteral preparations in plastic containers by Form-Fill-Seal technology is recommended. These areas shall be partitioned into suitable enclosures with air-lock arrangements.

- (2).Areas for formulations meant for external use and internal use shall be separately provided to avoid mix up".
- (3) Packaging materials for large volume Parenteral shall have a minimum area of 100 square meters."