SECTION ONE
THE MALE LATEX CONDOM: QUALITY ASSURANCE AND WHO/UNFPA SPECIFICATION

CHAPTER 1
Condom Quality Assurance
Chapter 1 describes and details the key elements of condom quality assurance.

1 Standards

Standards are developed and published by national and international standards bodies to establish the minimum safety, performance and quality requirements for a wide range of products including medical devices such as condoms. Standards may be generic or product-specific. Many different types of organizations and bodies participate in the development of these standards, including manufacturers, national regulatory authorities, researchers, consumer groups, international agencies and testing laboratories.

National regulatory authorities establish local procedures for the regulation and control of medicinal products and medical devices. In many cases these authorities require that a product complies with appropriate national or international standards before it can be marketed. Compliance can be voluntary, but in many cases government or regulatory authorities have made compliance mandatory.

In addition to specifying safety, performance and quality requirements, standards also specify test methods that can be used to verify that products comply with these requirements. These test methods may be included in the standard or specified by reference.

The principal international standards authority is the International Organization for Standardization (ISO), the worldwide federation of national standards bodies. ISO is responsible for drafting international standards based on the best available evidence and practice. ISO Technical Committee 157 (ISO/TC 157)—Non-Systemic Contraceptives and STI Barrier Prophylactics is responsible, inter alia, for developing the international standard for male latex rubber condoms, ISO 4074 Natural Latex Rubber Condoms—Requirements and Test Methods. The committee has a membership of 25 countries, with representatives drawn from a wide range of interested parties including manufacturers, test laboratories, regulatory authorities and consumer associations. A second corrigendum to ISO 4074 was published in April 2008, and the current edition of ISO 4074 is undergoing revision. A summary of the second corrigendum and the expected changes to ISO 4074 are given in Annex I. The date of publication of the revised standard is difficult to estimate but will not be before 2011.

World Health Organization Department of Reproductive Health and Research (WHO/RHR), UNFPA and other partner agencies work with ISO/TC 157 to broaden the standard to provide for situations in which economic and social circumstances dictate the need for:

- appropriate length, width and strength of the condom in relation to effectiveness, comfort and size;
- establishment of requirements for stability data (both real-time and accelerated) to support shelf-life claims and stated expiry dates;
- adequate protection against harsh environmental conditions due to inadequate systems of storage and distribution;
- appropriate packaging, labelling and information on how to use condoms;
- appropriate design options to meet users’ needs.

The current 2002 edition of ISO 4074 can be purchased from national standards organizations or from:

International Organization for Standardization (ISO)
ISO Central Secretariat
1, ch. de la Voie-Creuse
CP 56
1211 Geneva 20, Switzerland
Telephone: +41 22 749 0111
Telefax: +41 22 733 3430
E-mail: central@iso.org

Copies of the standard can also be downloaded (for a fee) from the ISO web site (http://www.iso.org) and the web sites of other national standards organizations. ISO 4074:2002 Corrigendum 1:2003 and ISO 4074:2002 Corrigendum 2:2008 can be downloaded free of charge from the ISO web site (http://www.iso.org/iso/iso_catalogue.htm).
2 Specifications

A specification is a statement of the buyer’s requirements and covers all of the product attributes necessary for buyer acceptance. These include the essential general and performance requirements as well as discretionary design requirements. A specification includes and/or references test methods used to verify the quality of a product and may demand a different level of quality than a published standard requires. WHO/UNFPA and partners have prepared a specification that is internationally accepted for the bulk procurement of male latex condoms; refer to Section 1, Chapter 2 of this document.

The WHO/UNFPA Specification for Male Latex Condoms is based, where appropriate, upon ISO 4074 and includes specific requirements for bulk packaging for public-sector distribution. The WHO/UNFPA Specification, if used in conjunction with the Prequalification Scheme and procurement procedures, will help ensure that a quality product is manufactured, purchased and distributed to the end user.

3 WHO/UNFPA Prequalification Scheme

Prequalification is a procedure designed to assess the capability of a manufacturer to supply a quality product before a contract is awarded. Prequalification reduces the risk of awarding a contract to a manufacturer that is unable to meet the quality requirements defined in the WHO/UNFPA Specification. The purpose of prequalification is to protect both the buyer and the end user.

It is recommended that purchasers buy only from manufacturers that are prequalified under the WHO/UNFPA Prequalification Scheme.

WHO/UNFPA have established a Prequalification Scheme for male latex condoms. This scheme was developed in collaboration with the manufacturing community, international agencies, the donor community and experts. The scheme is harmonized with the WHO Prequalification Scheme for Essential Medicines. The draft WHO/UNFPA Male Latex Condom Prequalification Scheme was approved for publication, subject to external review by the WHO Expert Committee on Specifications for Pharmaceutical Preparations, in October 2007. The WHO/UNFPA Prequalification Scheme was then extensively reviewed electronically by a wide spectrum of public- and private-sector experts and during three workshops, held in Bangkok, Thailand; Beijing, China; and Delhi, India, between December 2007 and March 2008. WHO published the Prequalification Scheme in May 2008; refer to WHO Technical Report Series, No. 948, Annex 2, page 71. Full details of the WHO/UNFPA Prequalification Scheme for male latex condoms are given in Section 2 of this document.

UNFPA maintains a list of prequalified manufacturers. This list is available on the WHO and UNFPA prequalification web sites. It is strongly recommended that only prequalified manufacturers be used for the procurement of condoms for public-sector distribution.

4 Procurement

This document also describes the procurement procedure for male latex condoms. Full details of the procurement process are given in Section 3 of this document. The procedure, when used in conjunction with the WHO/UNFPA Prequalification Scheme and the WHO/UNFPA Specification, ensures that good-quality condoms will be procured.

The WHO/UNFPA Specification, Prequalification Scheme and procurement procedures detailed in this manual are necessary because:

- They specify quality assurance measures designed to protect both the procuring agency and the end user, since there may be substantial differences in the quality of condoms produced by different manufacturers.
- Condoms are likely to degrade unless they are appropriately formulated and packaged.
- Stringent quality control procedures are necessary to ensure LOT-to-LOT consistency and to reduce the risk that quality may vary between production runs.
- A poor-quality product fails to provide adequate protection.
• A poor-quality product will quickly create negative publicity and destroy the credibility of any condom promotion programme.

• A poor-quality product can cause a logistical, political, financial or social crisis since funds would have to be found to replace the poor-quality condoms, and, if funds cannot be found, those condoms would potentially be unavailable for use.

5 Regulatory authorities

Condoms are classified as medical devices and as such are regulated by various regulatory authorities around the world. These bodies license drugs and medical devices for use in a particular country or region. In addition, some carry out or commission factory audits and product testing. They generally have the power to refuse to license manufacturers, to recall products and to close factories in the event of continued noncompliance with their regulations.

It is important for purchasers to work closely with national regulatory authorities and inform them of the procurement procedures and testing protocols that will be used to verify the quality of the condoms before they are shipped to the country. Purchasers also need to be aware of and comply with any specific local regulations or requirements.

If the regulatory authority requires in-country testing, then the local laboratory should be accredited and capable of testing to internationally recognized standards. Local laboratories that are accredited can undertake, subject to a contractual agreement with the procurer, the Pre-shipment compliance testing regime recommended in Section 3 of this document, “Guidelines for Procurement”.

The national regulatory authority may undertake confirmatory testing and in-market compliance testing of the product to ensure that it has not deteriorated during shipping, handling and storage. Procedures for confirmatory testing are outlined in Section 3 of this document.

Two well-established regulatory procedures for condoms are the U.S. Food and Drug Administration (USFDA) 510(k) pre-market clearance procedure and the European Union CE marking scheme.

• USFDA 510(k) pre-market clearance: Prior to marketing a condom in the USA, the manufacturer must submit documentation to the USFDA and obtain a pre-market clearance (510(k)). The documentation has to demonstrate that the product is equivalent to one that is already on the market. A 510(k) pre-market clearance means that the manufacturer has submitted acceptable safety data on the product and complies with USFDA requirements for the manufacture and distribution of the product. Factory audits are conducted periodically to monitor compliance.

• CE marking in Europe: Condoms intended for sale or distribution within the European Union must carry the CE mark, which verifies that the product meets the essential requirements of the medical device directive 93/42/EEC and 2007/47/EC. Manufacturers are required to follow specific conformity assessment procedures that include submitting a dossier to a European Notified Body. Compliance with EN ISO 4074 (European designation for the standard) can be taken as evidence of compliance with the essential requirements of the medical device directive. Manufacturing facilities are required to be certified to ISO 13485.

Most countries have their own regulatory procedures, which should cite relevant published standards. It is always necessary to review national regulatory policy and guidelines before importing condoms into and, in some cases, exporting condoms out of a country.

6 Manufacturing quality management

A well-run factory will have an audited, documented and effective quality management system. ISO has created a quality management scheme specifically for medical device manufacture; this scheme is described in ISO 13485. This standard prescribes
the documentation, procedures and structures to be followed in all types of establishments to facilitate the production of medical devices of a consistent standard.

The essential components of these systems are documented:

• quality objectives;
• management responsibilities;
• training procedures;
• process and quality assurance procedures;
• systematic record-keeping;
• remedial action in case of product quality problems.

Factories should maintain control over all incoming raw materials and have adequate in-process testing and controls, appropriate in-process remedial procedures, adequate testing of finished products and a functional record-keeping system.

Condoms are non-sterile products but nevertheless should be free from contamination and adulteration. The products, therefore, need to be manufactured in a controlled environment. Periodic monitoring of the environment and the product is required to ensure that there is no contamination and that bioburden levels are maintained within acceptable limits.

A number of organizations offer certification to ISO 13485 by audit. In most countries these organizations are private companies, although in some cases there are government agencies. To determine consistency of manufacturing, the certification schemes generally focus on the effectiveness of and compliance with the factory’s documented management system. The certifying organization should be registered with an appropriate body such as the national standards body of the country where the manufacturer or the certifying organization is located. Some organizations offer more comprehensive national accreditation systems that include product testing, such as NF mark in France and BSI Kitemark in the United Kingdom.

7 LOTS

A LOT is a collection of condoms of the same design, colour, shape, size and formulation.

A LOT must be manufactured at essentially the same time, using the same process, same specification of raw materials, common equipment, same lubricant and any other additive or dressing, and be packed in the same type of individual container, using the same packaging materials. All condoms comprising a LOT will:

• have an identical formulation;
• have the same design, dimensions, colour, shape and surface texture;
• be manufactured on the same production line;
• be vulcanized under identical conditions;
• be in the same packaging;
• have the same lubricant;
• have the same date of expiry printed on the package.

LOT sizes over 500,000 are not permitted due to the risk that the LOT may not be homogeneous.

Manufacturers should retain samples from every LOT to assist in the resolution of any disputes relating to quality. It is recommended that the retained samples be kept under controlled temperature conditions consistent with the manufacturer’s recommended storage conditions for the duration of the shelf-life of the product.

The date of manufacture (MFD) is the date the LOT was dipped, regardless of when packaging was completed.

1 The word “LOT” is capitalized to emphasize that it is the technical term for a batch of condoms and to distinguish it from “a lot”, meaning “many”.
8 LOT-by-LOT Pre-shipment compliance testing

The manufacture of condoms is complex and can be influenced by a variety of different manufacturing and raw material factors. The consequences of purchasing and distributing poor-quality condoms in the public sector are severe. For these reasons WHO/UNFPA also recommends that independent LOT-by-LOT Pre-shipment compliance testing of the finished product be undertaken, using an appropriate sampling plan from ISO 2859–1, before the condoms are accepted for shipment to the purchaser.

The methods of sampling the condoms for Pre-shipment compliance testing and the relative merits of testing prior to delivery are discussed in Section 3, Guidelines for Procurement. Either a sampling agency or the testing laboratory should take the samples. The manufacturer must not select the samples. The selection of suitable test laboratories is discussed in Section 1, Chapter 1, Clause 12. It is recommended that only one set of Pre-shipment compliance testing be carried out, and this must be done by an accredited laboratory.

Manufacturers must satisfy themselves that individual LOTS meet the specification before LOTS are submitted for Pre-shipment compliance testing.

9 Sampling

The quality of each LOT is estimated by testing a randomly selected sample of condoms from that LOT. The sample sizes are defined in ISO 4074 using sampling plans specified in ISO 2859–1 Sampling Procedures for Inspection by Attributes. These are the most widely used sampling plans for assessing attribute criteria (i.e. whether the product conforms or does not conform to the requirements detailed in the specification).

Sampling for independent testing should be done by either an independent accredited laboratory or by an independent sampling organization and not by the factory producing the condoms. Such sampling is required for prequalification and Pre-shipment compliance testing.

The sampler must verify that each LOT that is sampled complies with the definition of a LOT, as specified in Clause 7.

Samples must be:

- taken in accordance with pre-agreed sampling procedures;
- representative of the LOT of condoms;
- randomly selected (preferably based on random numbers);
- taken by or under the personal full-time supervision of the sampler.

The sample, once taken, must be sealed and dispatched under the sampler’s supervision.

An example of an acceptable sampling procedure is the “Square Root + 1” plan, in which the number of cases from which to take samples is determined by calculating the square root of the total number of cases in the LOT (i.e. SqR of 100 = 10), plus one additional case. The total number of samples required for testing is then randomly selected equally among the cases.

At the request of the manufacturer or the procurer, a duplicate sample may be taken for use in case of disputes. The sampling agency must issue a report giving full details of the sampling process. The report shall include the sampling procedures, identification of the cases from which samples are taken and the total number of cases offered for sampling. The sampler should mark the cases from which samples are taken for buyer reference at receipt.
10 Acceptable Quality Limit (AQL)

In ISO 4074 and the WHO/UNFPA Specification, the limits for the maximum percentage of defective condoms are specified in terms of Acceptable Quality Limits (AQLs). The technical definition of an AQL is given in the glossary in Annex V.

For important performance properties the AQLs are set as low as practically possible. For example, the limit for freedom from holes is set at 0.25% to ensure that the end user is adequately protected. For properties that are less important and do not affect the performance of the condom, such as non-critical visible defects, slightly higher AQLs are acceptable.

Compliance with the specified AQLs is assessed by testing a sample from each LOT. Testing a sample can only give an estimate of the percentage of defective products in a LOT. The accuracy of this estimate will increase with the size of the sample. The average percentage of defective products—the process average—can be estimated by pooling the results of testing from many LOTS. For further details on process average, refer to Annex IV.

As discussed in the previous section, testing is conducted according to sampling plans specified in ISO 2859–I. This standard contains sets of tables giving the maximum number of defective products that are allowed in a sample taken from a LOT. The sampling plans are designed to give a high probability (usually greater than 95%) of a LOT being accepted if the process average of defective products is equal to or less than the AQL. In the long run, therefore, the percentage of LOTS being rejected should not exceed 5%. If it does, then there is a risk that the manufacturer is not in compliance with the relevant AQL. More information on AQLs and sampling is given in Annex IV. If you need assistance, contact the Help-Line: HELPLINEcondomquality@fhi.org.

11 Monitoring quality

As well as reviewing the results of Pre-shipment compliance testing on a LOT-by-LOT basis, it is recommended that purchasers monitor quality on an ongoing basis. This can be done by calculating the process averages or using control charts (e.g. Shewhart charts). Monitoring quality using these methods provides excellent information about trends in product quality and/or early warning of potential problems. Refer to Annex IV for details.

12 Testing laboratories

Laboratories may be:

- manufacturers’ laboratories;
- independent accredited test laboratories;
- national regulatory laboratories.

Laboratories that test condoms for regulatory or compliance purposes need to have systems in place to ensure the reliability of their results. ISO has developed a quality management system specifically for laboratories, ISO 17025. Laboratories that comply with ISO 17025 will also operate in accordance with ISO 9001. ISO 17025 covers the essential elements of ISO 9001 as well as laboratory-specific requirements, such as technical requirements for equipment, calibration, uncertainty management and technical competence of the staff. The laboratory must conduct regular, traceable calibration of its measuring equipment, have an adequate maintenance system, and have systems in place to ensure the technical competence of their staff. Condom testing laboratories used for prequalification and Pre-shipment compliance testing should be accredited to ISO 17025.

There are a number of international mutual recognition agreements among accreditation bodies, which audit each other for quality. The international umbrella body is:

International Laboratory Accreditation Cooperation (ILAC), The ILAC Secretariat, P.O. Box 7507, Silverwater, NSW 2128, Australia. Telephone: +61 2 9736 8222; Fax: +61 2 9745 5311. http://www.ilac.org.

It is recommended that all laboratories—national, independent and manufacturers—confirm their competence by participation in condom inter-laboratory proficiency trials. In such trials laboratories test samples of condoms supplied by the trial organizers. The
results of the tests are returned to the organizers, who analyze them and provide feedback to each participating laboratory. The test results are reported anonymously to all the test laboratories, allowing participants the opportunity to investigate any tests in which their results disagree with those of other participants.

When assessing a testing laboratory, the following factors should be considered:

- whether the laboratory is accredited by an internationally recognized body;
- whether the laboratory participates in inter-laboratory proficiency trials;
- the reputation of the laboratory among large-volume purchasers.

13 Testing costs

Some buyers question the cost of independent LOT-by-LOT Pre-shipment compliance testing when they deal with a supplier with whom they have experience and in whom they have developed confidence.

Some have experimented with “consignment testing”, i.e. regarding the whole shipment as a single LOT. The trouble with this method is that it is unlikely that the whole shipment has been manufactured under the same conditions. The shipment is therefore unlikely to meet the definition of a LOT, as described in Clause 7. Since the homogeneity of the shipment cannot be guaranteed, the statistical principles behind LOT sampling and testing are likely to be compromised. Furthermore, it is difficult to detect problems that may be present in individual LOTS.

The use of this method increases the risk of a poor LOT being accepted. Buyers who have experimented with it have found that the savings were a false economy.

14 Confirmatory testing

In many countries national regulatory authorities confine their role to reviewing the data and conclusions reached by the accredited independent laboratory that has been contracted to undertake the Pre-shipment compliance testing. In some countries, in contrast, the national regulatory authority may require in-country confirmatory testing. Where feasible, the confirmatory testing should be undertaken by the same laboratory that undertook the Pre-shipment compliance testing. Where possible, confirmatory testing, if required, should replace, rather than repeat, Pre-shipment compliance testing. These requirements should be written into the contractual agreement between the purchaser and the receiving country and/or procuring agency. The testing should be undertaken by a laboratory accredited to ISO 17025.

If Pre-shipment compliance testing and confirmatory testing are undertaken by different laboratories, there is a risk of contradictory results.

On occasion the national regulatory authority may have a valid concern regarding possible deterioration of the product during transportation. If this is the case, then confirmatory testing may be undertaken.

Local regulatory authorities must take into account the results of Pre-shipment compliance testing before reaching any conclusions about the quality of the product.

Confirmatory testing can be restricted to selected LOTS chosen at random from a shipment or consignment. If one or more of the selected LOTS fail to comply with the specifications, the remaining LOTS should be tested.

It is recommended that, when such testing is undertaken, priority be given to the critical performance parameters of airburst properties and pack integrity. The risk of statistical LOT failures due to sampling error should be considered when interpreting such tests. Occasional differences in results between the Pre-shipment compliance tests and the confirmatory tests must be expected. Guidance on action to take in such circumstances can be found in Section 1, Chapter 4, Resolution of Disputes.