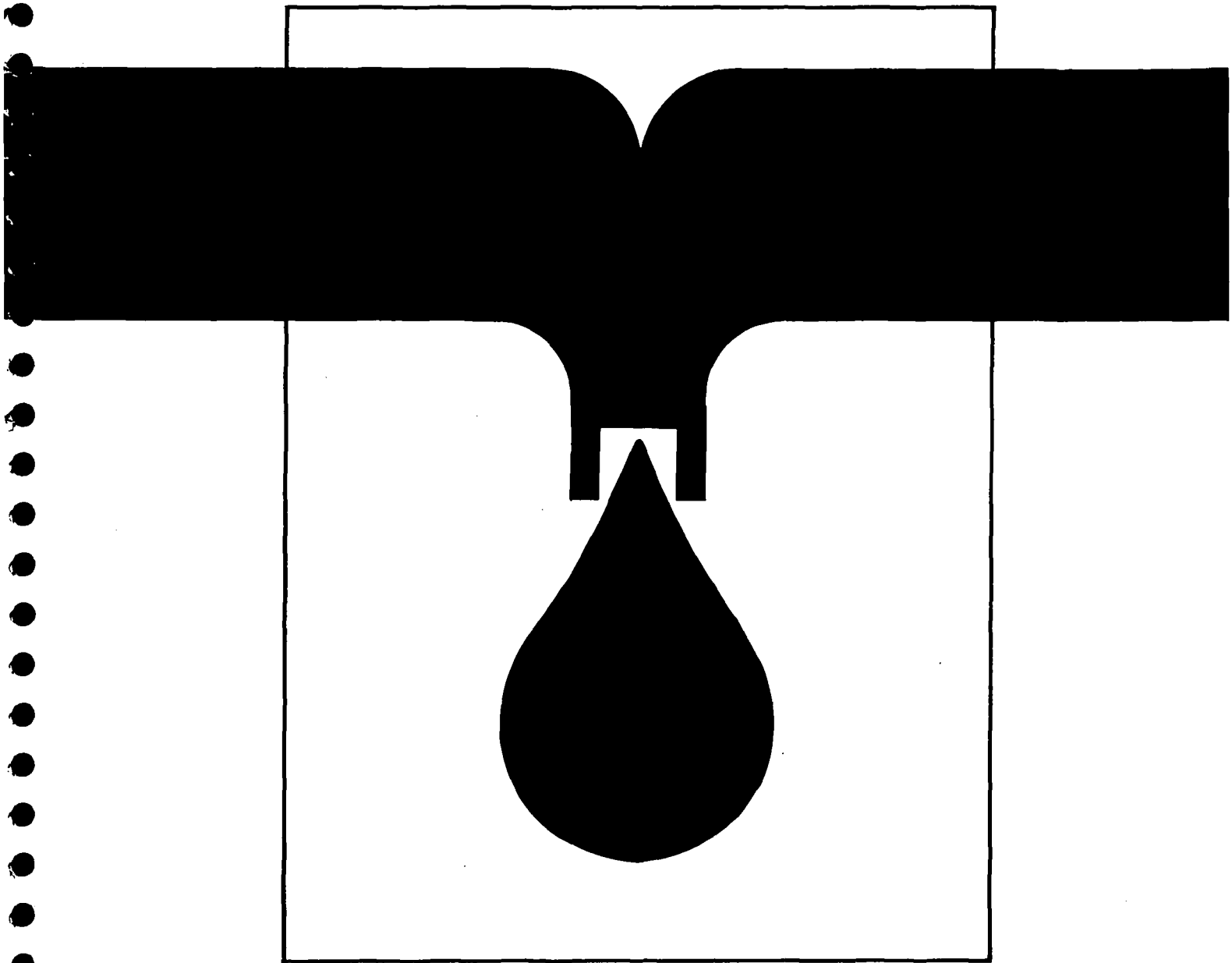
TRAINING MODULES
FOR
WATERWORKS PERSONNEL



Special Skills

3.8 b

Installation of appurtenances

Foreword

Even the greatest optimists are no longer sure that the goals of the UN "International Drinking Water Supply and Sanitation Decade", set in 1977 in Mar del Plata, can be achieved by 1990. High population growth in the Third World combined with stagnating financial and personnel resources have led to modifications to the strategies in cooperation with developing countries. A reorientation process has commenced which can be characterized by the following catchwords:

- use of appropriate, simple and – if possible – low-cost technologies,
- lowering of excessively high water-supply and disposal standards,
- priority to optimal operation and maintenance, rather than new investments,
- emphasis on institution-building and human resources development.

Our training modules are an effort to translate the last two strategies into practice. Experience has shown that a standardized training system for waterworks personnel in developing countries does not meet our partners' varying individual needs. But to prepare specific documents for each new project or compile them anew from existing materials on hand cannot be justified from the economic viewpoint. We have therefore opted for a flexible system of training modules which can be combined to suit the situation and needs of the target group in each case, and thus put existing personnel in a position to optimally maintain and operate the plant.

The modules will primarily be used as guidelines and basic training aids by GTZ staff and GTZ consultants in institution-building and operation and maintenance projects. In the medium term, however, they could be used by local instructors, trainers, plant managers and operating personnel in their daily work, as check lists and working instructions.

45 modules are presently available, each covering subject-specific knowledge and skills required in individual areas of waterworks operations, preventive maintenance and repair. Different combinations of modules will be required for classroom work, exercises, and practical application, to suit in each case the type of project, size of plant and the previous qualifications and practical experience of potential users.

Practical day-to-day use will of course generate hints on how to supplement or modify the texts. In other words: this edition is by no means a finalized version. We hope to receive your critical comments on the modules so that they can be optimized over the course of time.

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It is my sincere wish that these training modules will be put to successful use and will thus support world-wide efforts in improving water supply and raising living standards.

Dr. Ing. Klaus Erbel
Head of Division
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Eschborn, May 1987

INSTALLATION OF APPURTENANCES

1. Introduction

As described in module 2.8, appurtenances are necessary for water supply units to meet the functional and hygienic requirements. This module 3.8b introduces the installation of appurtenances.

2. Appurtenances

For the purpose of this module appurtenances incude inlet pipes, outletpipes, overflow pipes, washout pipes, by-pass pipes, vents, manhole covers, ladders, climbing irons, valves, watermeters, and level indicators.

3. Installation

3.1 General

Appurtenances should be installed in such a manner that

- they are in their correct position;
- they are rendered watertight;
- they are arranged so as to facilitate operation and maintenance; and
- they are not damaged either during construction or during operation and maintenance.

3.2 Timing

Installation can be made at different times relative to the structural cnstruction:

(a) at the same time as the construction;

(b) after the removal of formwork or the completion of masonry work; and

(c) after the completion of other works on the unit.

3.3 Installation at the same time as construciton

As far as possible appurtenances or their components are placed in position before concrete is poured, during construction of formwork or placement of reinforcement steel.

All pipes, ducts, etc., which are required to be built in the concrete or through the concrete, must be firmly fixed in the formwork that should be neatly and accurately cut and fitted around them.

If the construction is partially in masonry the parts should be embedded in the masonry as the walls are built.

Installations made at this stage are those that do not hamper the construction and are not likely to be damaged.

Installation during construction has the advantage that the parts are properly embedded in the structure, thereby ensuring that they are securely fixed and watertight. However, great care

should be taken to prevent their displacement before concreting, or during placing and compacting of concrete, or during the removal of the formwork. When installing at the same time as construction, arrangement should be made for the installation of the other component(s) of the appurtenance at a later stage. Furthermore, installed parts should be protected from damage by other construction or workmen.

Example: pipes through walls and slabs

3.4 Installation after removal of formwork or completion of masonry work

Appurtenances that would interfere with the construction or whose installation according to paragraph 3.3 would be impractical are installed after the removal of formwork or the completion of masonry work; provided that they would not be damaged during the course of subsequent work.

Installation after the construction of the structural part can be done in one of two ways:

(a) by boxing-out during concreting for subsquent installation; or

(b) by chiseling the masonry or concrete; in the latter case before the concrete has hardened.

Where the installation is made after boxing out or chiseling, the opening should be filled with mortar and other approved material to ensure that the part is firmly fixed and rendered watertight. Great care should be taken to ensure that the installed part is not displaced from its correct postition.

Example: Ladders, climbing irons, vents, pipe supports, and the pipes they support.

3.5 Installation after completion of other work on the unit

Appurtenances that can be damaged or whose installation according to paragraph 3.3 or 3.4 would be impractical are installed after other work on the unit has been completed.

Example: watermeters, water level indicators, and other devices.

3.6 Arrangement

All installation must be made in such a way that the appurtenances are properly aligned, leveled, and plumbed, as appropriate. Where they should be inclined they should be given the correct slope. There are units that could house pipes, fittings, valves, and measuring devices. A neat grouping and arrangement of the installations is necessary, so that one facility does not hinder the installation, operation, maintenance or replacement of the others.

The pump attendant or technician should have sufficient space to carry out the necessary installations, inspections, maintenance or repair works.

Appurtenances that have to be removed and re-installed for operation and maintenance purposes should be arranged in such a way that they could be dismantled and re-installed with ease. Enough space must be left between the appurtenance and the walls, floor or ceiling of the unit.

3.7 Supply

It is important to ensure that all appurtenances are on site in time for their installation, because the lack of even one part could affect the workmanship of the construction,hamper the progress of the work, and delay its completion.

3.8 Modified and as-built drawings

Sometimes it may not be possible to place certain appurtenances according to drawings, because of special site or construction problems. If this happens the installation should be made only after a modified drawing has been prepared, agreed upon or approved. These drawings should be kept for the preparation of as-built drawings, as should all records of the installations.

3.9 Checking and testing

Installed parts should be checked and tested at each stage.

4. Examples

The dimensions mentioned in some of the examples are given to indicate an order of magnitude; actual construction should be carried out as detailed in the drawings and described in the specifications. Furthermore the manufacturers' instructions for the installation should be followed, where appropriate.

4.1 Pipes through walls and slabs

To prevent loss and contamination of water, the passages of pipes through walls and slabs must be watertight.

If the pipe joints cannot safely transmit the longitudinal stresses, the unit must be constructed to resist the resulting forces or,where appropriate, anchor-blocks have to be provided to take the loads. In a pipeline where logitudinal stresses are transmitted from pipe to pipe, the structure must enable the necessary movement.

4.2 Inlet

The inlet which should be large enough to deliver the supply from the source, is placed 20 cm above the highest water level.

4.3 Outlet

The screened outlet which should be adequately dimensioned, is placed 20 cm above the floor.

4.4 Overflow and wash-out

The overflow and wash-out pipes should be large enough to carry the flows. They could conveniently be connected to one another and the waste water led to a soakaway.

4.5 By-pass

The by-pass connects the inlet and outlet pipes and enables an uninterrupted supply at times when the water tank has to be cleaned or maintained. Under normal operations of the water tank the by-pass remains closed.

4.6 Vents

The vents should be constructed so as to prevent surface- or rainwater from entering, and to minimize the risk of dust getting into the tank. Further they should be provided with screens strong enough to prevent entry of small animals such as rats, birds and bats or mosquitoes and other insects.

4.7 Screens

Screens are provided to keep out mosquitoes, other insects, and small animals. They are firmly installed on inlet, pipes outlet,

pipes, overflow pipes, and vents.

4.8 Manhole covers

The roof slab should have an access hole for cleaning and maintenance work. The access hole should have a raised edge above ground or roof level to prevent surface- and rainwater from running into the unit and a lockable manhole cover to prevent access to unauthorized persons. The manhole covers should be light, robust, corrosion-resistant and watertight.

4.9 Ladders or climbing irons

Access can be by means of ladder or climbing irons. However, a ladder is preferable to climbing irons. To provide safe and easy access, the ladder must be rigidly, but not too closely fixed to the wall. A clear distance of at least 15 cm must be made available to ensure good holding for the feet.

In cases where only a single access opening has to be provided for a wellhead chamber, particular care should be taken in the location of the ladder. It should be possible to use the ladder to the floor of the chamber without treading on, and thereby damaging a pipe bend, manometer or watermeter.

Ladders and climbing irons must be of corrosion-resistant materials, or adequately protected against corrosion.

4.10 Anchor bolts

Anchor bolts must be placed for the installation of pipe supports.

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The government-owned GTZ operates in the field of Technical Cooperation. Some 4,500 German experts are working together with partners from some 100 countries in Africa, Asia and Latin America in projects covering practically every sector of agriculture, forestry, economic development, social services and institutional and physical infrastructure. – The GTZ is commissioned to do this work by the Government of the Federal Republic of Germany and by other national and international organizations.

GTZ activities encompass:

- appraisal, technical planning, control and supervision of technical cooperation projects commissioned by the Government of the Federal Republic of Germany or by other authorities
- advisory services to other agencies implementing development projects
- the recruitment, selection, briefing and assignment of expert personnel and assuring their welfare and technical backstopping during their period of assignment
- provision of materials and equipment for projects, planning work, selection, purchasing and shipment to the developing countries
- management of all financial obligations to the partnercountry.

The series **"Sonderpublikationen der GTZ"** includes more than 190 publications. A list detailing the subjects covered can be obtained from the GTZ-Unit 02: Press and Public Relations, or from the TZ-Verlagsgesellschaft mbH, Postfach 36, D 6101 Roßdorf 1, Federal Republic of Germany.

TRAINING MODULES FOR WATERWORKS PERSONNEL

List of training modules:

Basic Knowledge

0.1 Basic and applied arithmetic
0.2 Basic concepts of physics
0.3 Basic concepts of water chemistry
0.4 Basic principles of water transport
1.1 The function and technical composition of a watersupply system
1.2 Organisation and administration of waterworks

Special Knowledge

2.1 Engineering, building and auxiliary materials
2.2 Hygienic standards of drinking water
2.3a Maintenance and repair of diesel engines and petrol engines
2.3b Maintenance and repair of electric motors
2.3c Maintenance and repair of simple driven systems
2.3d Design, functioning, operation, maintenance and repair of power transmission mechanisms
2.3e Maintenance and repair of pumps
2.3f Maintenance and repair of blowers and compressors
2.3g Design, functioning, operation, maintenance and repair of pipe fittings
2.3h Design, functioning, operation, maintenance and repair of hoisting gear
2.3i Maintenance and repair of electrical motor controls and protective equipment
2.4 Process control and instrumentation
2.5 Principal components of water-treatment systems (definition and description)
2.6 Pipe laying procedures and testing of water mains
2.7 General operation of water main systems
2.8 Construction of water supply units
2.9 Maintenance of water supply units Principles and general procedures
2.10 Industrial safety and accident prevention
2.11 Simple surveying and technical drawing

Special Skills

3.1 Basic skills in workshop technology
3.2 Performance of simple water analysis
3.3a Design and working principles of diesel engines and petrol engines
3.3b Design and working principles of electric motors
3.3c –
3.3d Design and working principle of power transmission mechanisms
3.3e Installation, operation, maintenance and repair of pumps
3.3f Handling, maintenance and repair of blowers and compressors
3.3g Handling, maintenance and repair of pipe fittings
3.3h Handling, maintenance and repair of hoisting gear
3.3i Servicing and maintaining electrical equipment
3.4 Servicing and maintaining process controls and instrumentation
3.5 Water-treatment systems: construction and operation of principal components: Part I - Part II
3.6 Pipe-laying procedures and testing of water mains
3.7 Inspection, maintenance and repair of water mains
3.8a Construction in concrete and masonry
3.8b Installation of appurtenances
3.9 Maintenance of water supply units Inspection and action guide
3.10 –
3.11 Simple surveying and drawing work

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