TECHNICAL REPORT

ISO/TR 15155-2

First edition
2012-10-01

Agricultural irrigation equipment — Test facilities for agricultural irrigation equipment —

Part 2: Test facility operating manual

Matériel agricole d'irrigation — Installations d'essais pour le matériel agricole d'irrigation —

Partie 2: Mode d'emploi des installations d'essais

Reference number
ISO/TR 15155-2:2012(E)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TR 15155-2 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 18, *Irrigation and drainage equipment and systems*.

ISO/TR 15155 consists of the following parts, under the general title *Agricultural irrigation equipment — Test facilities for agricultural irrigation equipment*:

— *Part 1: Test facilities for agricultural irrigation equipment*

— *Part 2: Test facility operating manual*

Agricultural irrigation equipment — Test facilities for agricultural irrigation equipment —

Part 2: Test facility operating manual

1 Scope

This Technical Report is intended to provide guidance on the operation of basic test facilities for irrigation equipment evaluation. Its purpose is to provide information sufficient to implement the detailed procedures included in ISO 7714, ISO 8026, ISO 9261, ISO 9635-1 to 5, ISO 9644, ISO 9911, ISO 10522 and ISO 15886-3, for the testing of agricultural irrigation system components, specifically emitters, sprinklers and valves. The intent is that the structure of this Technical Report can be modified to be used as the operating manual of a test facility established to test the components referred to in these International Standards.

2 Amendment record

TEST FACILITY OPERATION MANUAL				SECTION: 3 SHEET Number: 1			
TITLE OF SECTION: _____				ISSUE DATE: _____ Authorized by: _____			
AMENDMENT RECORD							
AMENDMENT		DISCARD			INSERT		
No.	Date	Section	Sheet	Issue No.	Section	Sheet	Issue No.

3 Facility description and functions

3.1 General

The facility is intended to be capable of performing the test procedures included in ISO 7714, ISO 8026, ISO 9261, ISO 9635-1 to 5, ISO 9644, ISO 9911, ISO 10522 and ISO 15886-3. (The titles of these International Standards are given in the Bibliography.)

The test bench descriptions needed to complete the test procedures for these International Standards are specified in Annexes F, G, H and I or in the International Standard concerned.

3.2 Test facility name

Along with the test facility name, include the address and contact information.

3.3 Range of testing

The range of testing includes the following:

— measurement of water flow rate through devices;

— measurement of water pressure during testing of devices;

— measurement of differential water pressure during testing of devices;

— determination of water mass;

— measurement of vacuum pressure during testing of devices.

3.4 Organizational structure

The organizational structure should include:

— a Test Facility Manager responsible for the operations of the test facility;

— a Test Facility Engineer and a Technical Assistant to carry out the technical operations.

3.5 Organization structure chart

There should be a chart of job functions and reporting lines.

3.6 Staff

It is suggested that the staff include:

— a Test Facility Manager;

— a Senior Engineer;

— a Test Facility Engineer;

— a Technical Assistant.

4 Test facility operating manual (TFOM)

4.1 Introduction

This manual is produced to provide a central reference for the *(test facility name)* staff on the functions of the test facility.

This manual contains current recommendations for

a) testing,

b) staff,

c) equipment,

d) day-to-day operations,

e) safety.

Detailed test procedures can be found in the International Standards identified in Clause 1 of this Technical Report.

The procedures and requirements set out in this manual are suggestions for all staff members.

4.2 Quality policy

The quality policy for the test facility is a high level of adherence to procedures and methods. This in turn will lead to continued and repeatable standards of test facility practices.

The prime objective of all testing carried out is to produce data based either on a performance or on type or assessment tests which enable the supplier of the test samples to be assured with a high level of confidence that the data reflect how the sample actually performed.

To this end, the staff of the test facility is expected to maintain a high level of competence to achieve this quality.

The Test Facility Manager should provide support and backing for projects; this should actively improve the quality of testing procedures and output.

5 Test facility staff

5.1 Staff responsibilities

5.1.1 General

The areas of responsibility are defined as

a) testing,

b) engineering/design, and

c) administration

5.1.2 Testing

Staff involved with testing should be fully conversant with the requirements of the test procedures before commencing testing.

Any enquiries should be directed to the appropriate technical staff before commencing testing.

Checks of validity of test equipment and data acquisition equipment should be carried out before commencing testing. This may require inspection of equipment and test certification, if applicable, and/or calibrating and setting a baseline on data acquisition equipment.

All sampling operations should be carried out in accordance with the appropriate standard (see Annex B), or as required by the client.

5.1.3 Engineering/design

Staff involved in engineering/design activities should ensure that each activity is authorized before commencing the work.

5.1.4 Administration

Staff involved with test facility administration which does not include testing and engineering/design documentation should be directed by the Test Facility Manager's directives.

5.2 Training and development

Introduction training should include the following:

— safety in the workplace;

— fire prevention;

— evacuation procedures.

Staff should be expected to attend and support:

— field days;

— seminars;

— in-house meetings.

5.3 Job descriptions

5.3.1 General

The suggested job descriptions for the positions within the operating unit are as follows.

5.3.2 Test Facility Manager

5.3.2.1 Duties

The Test Facility Manager's duties include the following:

a) provide general management of the commercial operations of the test facility;

b) make and maintain contact with the client base;

c) develop the business of the test facility;

d) plan and coordinate all business activities of the test facility[1)];

e) maintain a quality control program for the test facility.

5.3.2.2 Responsibilities

The Test Facility Manager is responsible for the following:

a) operation of facility to meet budgets;

b) overall development of facility;

c) operation of the facility;

d) quality control.

5.3.2.3 Preferred qualifications

The preferred qualifications of a Test Facility Manager are the following:

a) professional engineer or applied science graduate with marketing and management experience, at least 15 years experience, 5 years at senior level;

b) alternatively, the preferred qualifications (for example, university degree, years of experience) specified by the test facility.

1) Responsibilities involve developing and executing a business programme which consists of establishing financial and marketing programs.

5.3.3 Test Facility Engineer

5.3.3.1 Duties

The test facilityengineer's duties include the following:

a) carry out standard test procedures;

b) develop new test procedures as required;

c) maintain test facility calibration standards to test facility requirements;

d) develop and maintain test facility quality manuals;

e) develop and maintain test facility reporting documentation;

f) provide technical support for the Test Facility Manager in marketing effort;

g) conduct field trials as needed;

h) develop appropriate software for efficient use of facilities;

5.3.3.2 Responsibilities

The Test Facility Engineer is responsible for the following:

a) technical standards of test facility;

b) efficient organization and conduct of testing work;

c) development of test facility capabilities.

5.3.3.3 Preferred qualifications

The preferred qualifications of a Test Facility Engineer are the following:

a) professional engineer, with good computer literacy, with at least 5 years professional experience, preferably in test/design environment;

b) alternatively, the preferred qualifications (for example, university degree, years of experience) specified by the test facility.

5.3.4 Technical Assistant

5.3.4.1 Duties

The Technical Assistant's duties include the following:

a) carry out standard test procedures;

b) carry out non-standard testing as directed by the test facility engineer.

5.3.4.2 Responsibilities

The Technical Assistant is responsible for maintaining the standard of personal work procedures to meet the test facility requirements.

6 Test facility review and audits

6.1 Test facility audits

The aim of the test facility is to provide accurate and understandable data in the form of test reports.

The test facility audit is a formal examination and verification that the detailed tests procedures as specified are followed. The audit should be carried out by an auditor independent of the test facility activities being audited.

Audits should be carried out routinely on an annual basis prior to the annual test facility reassessment and in addition when organizational changes or reported deficiencies arise.

The audit should include the points stated in the Test Facility Audit Checklist (see Annex E). Generally, audits should be made on representative samples of procedures or methods.

The purpose of auditing is to determine the effectiveness of the overall system of operations during all testing stages. Audit findings (including specific examples of non-compliance or deficiencies), conclusions and recommendations should be documented and submitted for consideration by the Test Facility Manager, Test Facility Engineer and Technical Assistant.

Audit reports should be analysed to identify specific areas which call for further investigation and any amendment or improvement to procedures or operations should be made after notifying the Test Facility Manager. Any clients whose work may have been affected by nonconformities should be notified.

The review and amendment procedures for ISO International Standards are established by the international representative of the ISO committee and should be adhered to.

A report should be made on the results of the annual audit.

6.2 Reviewing the quality system

Reviews should be carried out by competent independent personnel as decided by the Test Facility Manager in consultation with the engineering staff once every 12 months. Reviews should consist of evaluations which include:

— findings of test facility audits;

— effectiveness of the quality management system in achieving stated quality objectives;

— considerations for updating the quality management system in relation to changes brought about by new technologies, market strategies and social or environmental conditions.

6.3 Upgrading the test facility operating manual (TFOM)

Staff who see a need for amendments to the TFOM should advise the Test Facility Engineer. Amendments to the TFOM should be authorized only after consultation with the Test Facility Manager. When new or revised entries are issued:

— insert each new/revised entry in its proper section in the TFOM;

— remove any superseded entries;

— annotate the Amendment Record to indicate completion of the amendment (Annex A);

— retain the superseded entries on file. (Superseded entries are retained for 2 years and then destroyed.)

6.4 Updating documents

All standards and test procedures should be checked at least once every 12 months, and updated as appropriate. If updating is necessary, the TFOM should be amended accordingly.

Each new or revised standard or amendment should be retained on file. Superseded entries should be retained for at least 2 years.

6.5 Standards and procedures

All standards and procedures, including international and research documents should be held in the technical area. They should not be loaned out at any time. The test facility should develop a policy about providing copies. If copies are permitted, they should be marked “unofficial”.

7 Equipment

Each piece of equipment should be identified with an inventory code. An equipment inventory should be maintained with all the information about each item (see 6.1). When appropriate, equipment should be labelled with relevant information including inventory code, next calibration and serviceable status.

The equipment inventory should be updated by the technical staff person assigned the responsibility of inventory control whenever test facility equipment is commissioned or decommissioned.

Technical staff should check that calibrations done by an external agency have been well done – if the test facility has the capability to verify the calibration.

7.1 Equipment inventory (example list)

Table 1 — Example of an equipment inventory

Item, inventory code, make, model, serial no.	Calibration status		Comments
	Last test	Next test	
Pumps 2 x multistage (nameplate data) 1 x (nameplate data) 1 phase (nameplate data) 1 phase (nameplate data) (dripper test bench 3 phase centrifugal pump 80 x 50 x 200	 N/A N/A N/A N/A N/A		
Flowmeter - (specifications) Power supply: Flow sensor (specifications) Calibration tee fitting (specifications)	N/A		unserviceable
1 Turbine flow meter - 1” (nameplate data)	2008-10-11	Calibration in progress	2 year calibration
Differential pressure gauge (specifications)	2009-08-20	Calibration in progress	annual calibration
Bourdon pressure gauges (specifications) 0 to 1 600 kPa (specifications) 0 to 800 kPa (specifications) 0 to 150 kPa (specifications) 0 to 1 000 kPa (specifications)	 2009-07-22 2009-03-27 2009-03-22 2009-07-22	Calibrations in progress	annual calibration 6 month check
Weighing scales (specifications)	2009-07-27	Calibration in progress	annual calibration 1 month check or before use
1 Computer (specifications) 2 Laptop (specifications) 1 Printer (specifications) 1 laser printer (specifications)	N/A		
Venturi meter 150 mm Power supply (specifications)			2 year calibration Calibration check before use. Tested by Civil Engineering Hydraulic Laboratory
Flowmeter - 80 mm (specifications) Flow sensor (specifications)	2009-01-29	Calibration in progress	2 year calibration
Stopwatch (specifications)	2009-01-17		3 month check
Mercury-filled thermometer	N/A	Before use	missing

7.2 Equipment assurance program

The various stages of the equipment assurance program should be: commissioning, calibration, maintenance, alterations and decommissioning. The technical staff should be responsible for all aspects of the testing equipment except calibration of some equipment where the test facility is not suitably equipped.

7.2.1 Commissioning

The person who initiated the equipment selection should supervise the commissioning stage, unless the equipment supplier has a requirement to commission the equipment.

7.2.2 Calibration

7.2.2.1 Mechanical equipment

Technical staff should be responsible for ensuring that the calibration status of equipment is current prior to usage. The Test Facility Engineer should take this responsibility for the Technical Assistant when directing the Technical Assistant to carry out test procedures.

7.2.2.2 Electronic equipment

Each technical staff member should be responsible for ensuring that electronic equipment is calibrated before being used in accordance with the manufacturers/suppliers set-up procedures.

The equipment inventory should be updated by the technical staff whenever test facility equipment is commissioned or decommissioned.

8 Test methods

8.1 Electronic equipment test procedures

Refer to appropriate ISO Standard operating procedures for relevant information.

Data logging refers to the collection of data from analog or digital sensors.

8.2 Mechanical equipment test procedures

All mechanical equipment test procedures are defined in the relevant standards; these should be listed in Annex B.

8.3 Selection of test methods

Procedures for the selection of relevant test methods are defined in each of the standards; these should be listed in Annex B.

8.4 Departures from standard test methods

Where departures are necessary, details of the departures should be recorded and acknowledged on test documents.

9 Normal work procedures

9.1 Requests for testing

Requests for testing can come from manufacturers, distributors, installers, consultants and the general public.

A quotation for all standard tests should be provided by the Test Facility Manager or the Test Facility Engineer after consultation with the technical staff.

A quotation for all non-standard tests should be provided only after a review of the testing required by the technical staff.

The Test Facility Manager, Test Facility Engineer or a delegated officer may provide a quotation for testing to the client.

9.2 Recording job instructions

On the provision of a quote to the client, a job number should be allocated. This number should be taken from the job record sheet held on file, each number being sequential.

EXAMPLE T05001 where T = Test facility, 05 = year, 001 = first number in the sequence.

A job sheet should be created, documenting relevant information including the number of tests, pressures and other requirements.

This job sheet should then filed in the job file, with the job number clearly displayed.

9.3 Identification and marking of test samples

Because of the nature of the appearance of irrigation equipment, very few samples of various job numbers are alike. In the unlikely event of this occurring, samples should be numbered with the job number, for example, T05001. Each test sample would then be allocated a number.

EXAMPLE Project T05001 with two pop-up sprinkler samples, Number 1 and Number 2.

9.4 Test data

Manual reading of the test results may be required in many cases. Most tests require the compilation of data recording sheets; these sheets should be kept on file.

Each test procedure or test requirement details the data that should be recorded. When recording the data, the tester should check the values for inconsistencies against typical values from previous tests or manufacturer's performance data.

Electronically gathered data should also be checked for inconsistencies.

9.5 Access to test area

Access to the test area should be restricted in accordance with local safety regulations.

Demonstrations to outside groups do not include "Client Only" samples. General access should be restricted during "Client Only" testing. Clients for whom the testing is being done may be granted access by contacting the Test Facility Manager or the delegated officer.

9.6 Safety

Occasionally, a test is destructive. All precautions should be taken prior to this type of testing and other staff advised of the hazards. The three tests which expose the test facility to the most prevalent hazards are

— hydrostatic testing (valves and filters),

— burst testing (pipe and fittings), and

— high pressure testing.

Prior to any testing of this nature, the technical staff should be satisfied that all precautions have been taken. Due to the amount of water, full electrical safety should be exercised at all times.

9.7 Housekeeping

On completion of daily testing, all tools and documentation should be returned for overnight storage. Test areas should be cleaned and tidied where necessary. "Client Only" samples should be stored and locked in a cupboard prior to vacating the test area.

9.8 Improper influence

Any occurrences where a client attempts to influence the results of the test should be reported to the Test Facility Manager or the delegated officer.

10 Control of test samples

10.1 Receipt, storage and disposal

All client test samples should be itemized on the job sheet and held on file by the technical staff responsible for testing.

At the completion of tests, the clients should be required to remove their samples within 14 working days or issue instructions for forwarding, storage or disposal. Any instructions of this nature should be included in the original test request and any associated costs should fall to the client.

10.2 Security of samples

All incoming samples should be stored in either lockable steel cupboards, or if too large, in a lockable workshop area. Security should be maintained when personnel are not in attendance. This should apply particularly during after hours and scheduled test facility closures.

11 Test records

11.1 Filing of original test results

The tester should have the responsibility of ensuring that all original test results are filed as appropriate.

Test results should be as neat as possible, recorded on standard forms, or direct through a computer interface and stored on disk and on a backup device.

11.2 Verification of data

Test results should be calculated from raw data using a computer, and printed and stored on a computer file identified by the job number. Data typed into the computer should be checked by the technical officer responsible for the job to ensure accurate data reproduction. A second member of the technical staff may be called upon to verify and initial the test results sheet.

11.3 Confidentiality and security

Each test file should be confidential and only shown to the client. The client may choose to waive this agreement by notifying the test facility, naming persons who may have access to the client's data file.

Test files should remain in a lockable filing cabinet when the test facility is unmanned.

Electronic data files and databases should be protected when the test facility is unmanned.

12 Diagnostic and corrective actions

12.1 Internal feedback

When new tests are conducted, the client should be made aware of the results through the test report. If these results seem incorrect, repeat tests may be done, at the client's expense, to confirm the original findings.

When familiar tests are conducted and unusual or abnormal results occur, the client should be informed. Any repeat tests should be at the client's discretion and expense.

If a test sample is sub-standard, this should be reported to the client before the test.

If operator error is proven in the test, it should be repeated at the expense of the test facility.

12.2 External feedback

Client enquiries of a technical nature should be directed to the Test Facility Engineer.

Client complaints should be directed to the Test Facility Manager, who may choose to involve the technical staff.

12.3 Verification procedures

The reliability of test facility testing should be monitored during ongoing operations, through checks between different operators.

For instance, a sprinkler or emitter may be used as a reference sample. They may be tested for mean discharge rate by one operator and then by the one who is carrying out the testing. As different operators perform identical tests at different times for the same client, all results should be cross-checked.

13 Test reports

13.1 Format of test reports

A test report is a formal record of results, without interpretation. A test report normally contains the following sections:

— Report Identity;

— Title Page;

— List of Contents;

— Test Methodology;

— Summary of Results;

— Performance Tables;

— Performance Graphs/Patterns where applicable;

— Appendices containing references and/or additional information.

Additional observations made during testing should be included in the summary of results section. This should not to be used as a vehicle for the interpretation of the results.

The formats of various standard reports should be prepared and kept on file for reference purposes.

13.2 Compliance testing

When testing is undertaken to determine compliance with a numerical statement of requirements and, with regard to the range of uncertainty of measurement, one or more results are not unequivocally acceptable or unacceptable, the endorsed report should state the numerical value and the range of uncertainty. It may also state whether or not the item is considered to conform to the statement of requirements.

13.3 Checking of reports

The report writer, normally a member of the technical staff, should check the accuracy of the report against the original results.

13.4 Revision of reports

Where an issued report needs to be extended, corrected or withdrawn, the writer should carry out the required action. When, after issuing of a report, test data are found to be invalid, the original report should be withdrawn and replaced by one marked “Replacement of Report No....”

The client should be notified promptly in writing of any event that casts doubt on a test result.

13.5 Retention of reports

Three copies of a report should be issued. Two copies should be sent to the client and one copy filed by the writer.

All reports should be kept on an electronic backup device in compressed backup form. Manual filing should be performed in the test facility according to the report number.

14 Subcontracting responsibilities

Where the test facility procures outside services which directly affect the outcome of tests, only those services shown by documented procedures to comply with specified requirements should be used.

15 Occupational health and safety

15.1 Responsibilities

Management should be responsible for health and safety and may assign a staff member to coordinate operational activities. Every staff member should be conversant with the requirements of local health and safety regulations and other relevant documentation.

A health and safety manual should be provided to each staff member. The manual should be reviewed annually.

15.2 Staff safety

The test facility area in general may not present any immediate safety problems that staff should be aware of.

15.3 First aid and fire-fighting equipment

15.3.1 First aid kit

A standard first aid kit should be located in the test facility office.

Staff using the kit should be responsible for ensuring that their injury is recorded in the ‘Injuries Record’.

The kit should be maintained by the Test Facility Engineer or the delegated officer. Kits may be available from local agencies.

15.3.2 Fire-fighting equipment

Every staff member should familiarize himself or herself with the location and capability of the fire extinguishers in the building. A floor plan should be provided in Annex C to show their possible locations.

15.3.3 Reporting of accidents

All accidents should be reported as soon as possible to the Test Facility Manager or the delegated officer. Two accident report forms should be submitted to the Test Facility Manager within 24 h of the accident. These forms should be held on file. A copy should be provided in Annex D.

The 24-h rule, coupled with the careful reporting of accidents and injuries, should be required for the following reasons:

a) to protect the workers compensation rights of the individual;

b) to help the test facility eliminate hazards that may endanger others;

c) to satisfy other local regulations (specify which ones).

15.3.4 Building safety maintenance

All safety maintenance should be directed to the Test Facility Manager who makes the necessary arrangements for safety maintenance tasks to be carried out.

In an emergency, the delegated officer can make requests for maintenance, in the absence of the Test Facility Manager.

16 Accreditation: Test facility registration

The terms of test facility registration should be given in the Test Facility Annual Directory.

The approved signatories for the test facility should be:

— Signor 1 - all registered tests;

— Signor 2 - all registered tests.

Test facility registered test certificates issued by the test facility should comply *with any local guidelines or requirements*.

Annex A
(informative)

Typical amendment record

Test Facility Operating Manual (TFOM)

Section	Sheet	Issue No.	Issue Date	Authorized by

On receipt of this amendment record and the accompanying new or revised entries for your copy of the TFOM, you should:

a) insert each new or revised entry in its proper sequence in the manual;

b) take out any superseded entries;

c) insert this amendment record immediately behind the Table of Contents;

d) retain all superseded entries on file for at least 2 years.

Amendment		Discard			Insert		
No.	Date	Section	Sheet	Issue #	Section	Sheet	Issue #

Annex B
(informative)

List of reference documents

Standard Year Part Description

(Provide a list of ISO International Standards and any other standards used by the test facility.)

Annex C
(informative)

Facility floor plan

(Provide a floor plan of the facility identifying fire exits and other information required by local regulations.)

Annex D
(informative)

Accident reporting form

(Provide an accident reporting form to meet the requirements of local regulations.)

Annex E
(informative)

Test facility audit topics

E.1 Organization

Test facility staff should have the competence, authority and time to achieve administrative and technical control over the operations covered by the registration.

E.2 Staff

Test facility staff should have the competence, authority and time to achieve administrative and technical control over operations covered by the registration. Subordinate staff should be suitably qualified and trained for their assigned functions.

Test facility-endorsed test documents should only be signed by an officer who has the authority to sign.

E.3 Testing environment

The test facility should provide a testing environment that satisfies the conditions specified in the test methods and suitable housing for test equipment and records. Provision should be made for secure storage of samples, equipment, files and reports.

When a test method specifies features of a testing environment, management should be able to demonstrate compliance by means of records of monitoring with calibrated measuring equipment.

Access to areas affecting the outcome of tests and the security of information should be controlled.

E.4 Equipment and test materials

The test facility should have, in good working order, equipment and reference materials necessary to undertake tests carried out in the test facility.

When equipment outside the permanent control of the test facility is used, it should meet the calibration requirements of the relevant reference standard.

E.5 Measurement, traceability and calibration

Testing equipment having an effect on accuracy should be calibrated in terms of national standards of measurement and calibration documents should be retained in association with the equipment register.

E.6 Test methods

Where departures from standard test methods are necessary, details of such departures should be recorded and acknowledged on test documents.

E.7 Management of test items

Each sample to be tested should be uniquely identifiable.

E.8 Records

The records system should allow the retrieval of original test data, for at least 3 years.

The records system should include the following:

— sample identification;

— test document identification;

— identity of the test method;

— identity of the test equipment;

— original observations and calculations;

— identity of the person performing the test;

— any other information specified in the test method.

E.9 Reports and certificates

Test documents should provide a clear, unambiguous statement of test results and include suitable units of measurement and any other information necessary to understand the results.

Documents reporting the results of tests within the terms of registration may carry the test facility endorsement. Endorsed documents should include the following:

— a title;

— the name in which the registration is held;

— identification of the facility;

— the date of issue of the document;

— unique identification of the document;

— characterization and unique identification of the test item;

— the identity of the test method and any deviations from it;

— the test results, reported either in the manner specified in the test method, accompanied by a statement of uncertainty, with the last figure of a numerical value adopted as a significant figure, and/or a statement of compliance or non-compliance with a specification;

— any other information specified by the test method;

— a statement of conditions pertaining to reproduction;

— the signature of an approved signatory.

Each page of a multi-page document should bear a page number.

E.10 Complaints

A record should be maintained of all complaints and the corresponding action. All properly authenticated complaints should be investigated and resolved.

Annex F
(informative)

Sprayer test bench[2)]

F.1 Building

F.1.1 Test area: 6 m x 6 m. The length of the test area will determine the size of the largest sprayer that can be tested. A test building should be large enough to allow a diameter of coverage of a sprayer with a radius of throw of 6 m.

F.1.2 Test bench: 2 m x 2 m.

F.1.3 Ambient temperature: The value should be known to use it in the data results (10 °C to 35 °C). Relative humidity and ambient temperature should be measured at the start, midpoint and end of the test. For indoor testing, changes in temperature and humidity during the test should not exceed ±5 % of the pre-test ambient.

F.1.4 Perform the tests indoors, in drift-free conditions, or in an outdoor area under no wind conditions (maximum allowable wind speed less than 0,5 m/s).

F.1.5 Draught-free conditions.

F.1.6 Surface: The test area should be a level surface.

F.2 Pump

Depending on the range of sprayers to be tested it may be appropriate to have more than one pump. It is better to use more than one pump if a large range of sprayers is to be tested since flow rates may range from 0,12 m^3/h to 30 m^3/h. The number of pumps required will depend on the testing frequency for each type of sprayers.

F.2.1 Type: Centrifugal (flat curve) or turbine with a variable frequency drive.

F.2.2 Range: Maximum flow rate of 0,77 m^3/h, and pressure of 5,5 bar.

F.3 Test bench

F.3.1 Steel, PVC or PE piping.

F.3.2 Sprayer connection: upright supply line with a nominal diameter of 12 mm. Attach test sprayers to the supply line according to the field assembly recommendations of the manufacturer. Install the sprayers vertically ±2 %.

F.3.3 The sprayer nozzle should be at least 0,20 m above the openings of the collectors, or at a height as specified by the manufacturer.

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2) Alternatively, refer to ISO 8026.

F.3.4 Filtration: 75 microns.

F.3.5 The water supply to the pump should be controlled using a globe valve.

F.4 Water tank

F.4.1 Capacity: 600 l.

F.4.2 Temperature regulation device, maintaining water at a test temperature of 23 °C ± 3 °C.

F.4.3 Level control valve.

F.4.4 Manual discharge valve.

F.5 Pressure regulation

F.5.1 Manually controlled valves: Two needle valves.

F.6 Pressure gauges

F.6.1 Type: Mechanical or electronic manometer.

F.6.2 Placed in the same plane as the main nozzle.

F.6.3 Accuracy: ± 0,5 % of reading.

F.7 Flow measurement

F.7.1 Accuracy: 0,25 % of reading.

F.8 Collector design

F.8.1 Collectors should be identical.

F.8.2 Cylindrical or conical collectors, with side walls < 45° from the horizontal.

F.8.3 The height of each collector should be at least twice the maximum depth of the water collected during the test, but not less than 150 mm.

F.8.4 Round opening with diameter from one half to one times the height, but should not be less than 85 mm.

F.8.5 The opening of all collectors should be in a common horizontal plane, with a slope not exceeding 2 % in any direction.

F.9 Application measurement

F.9.1 Weighing method.

F.9.1.1 Type: Digital scale.

F.9.1.2 Accuracy: ± 1 g.

F.9.2 Volumetric method.

F.9.2.1 Probes

F.9.2.2 Accuracy: ± 1 % of reading

F.10 Temperature measurement

F.10.1 Type: Mechanical or electronic.

F.10.2 Range: 0 °C to 45 °C.

F.10.3 Accuracy: ± 0,1 °C

F.11 Other measurement devices

F.11.1 Stop watch (accuracy 1 s).

F.12 Facility data sheet

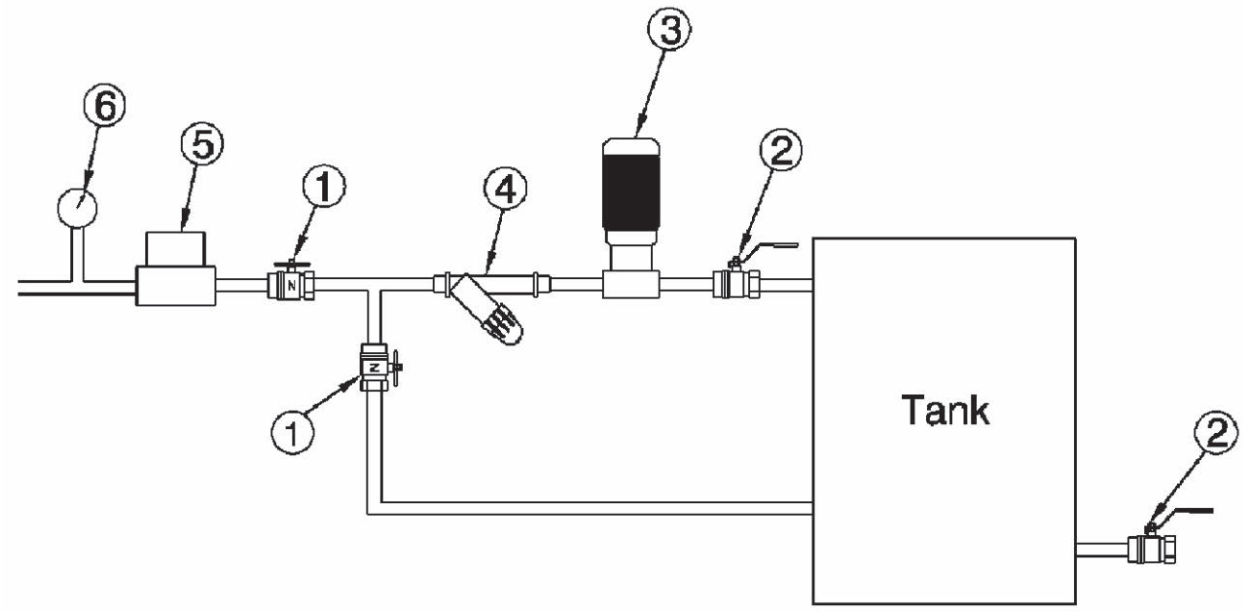
F.12.1 It is highly recommended to keep a hard copy of test results and to design a standard datasheet.

F.13 Data analysis

F.13.1 Computerize the results with the appropriate software.

F.14 Typical sprayer bench configuration

See Figures F.1 and F.2.



Key

1 globe valve
2 needle valve
3 pump
4 filter
5 flow measurement
6 manometer

Figure F.1 — Sprayer test bench water supply system

Dimensions in centimetres

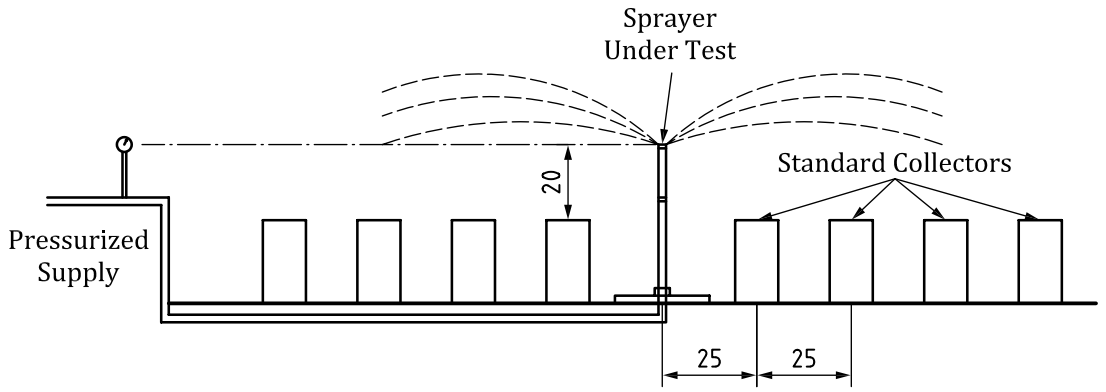


Figure F.2 — Sprayer test bench collector layout

Annex G
(informative)

Valve test bench[3)]

G.1 Test benches

G.1.1 Valve size range: 25 to 80 mm, 100 to 250 mm, 250 to 600 mm.

G.1.2 Pressure rating: 1 600 kPa and 2 500 kPa.

G.2 Test equipment

G.2.1 Pressure gauges.

G.2.1.1 Type: Bourdon or electronic pressure transmitters.

— Range: 0 to 6 bar, 0 to 10 bar, 0 to 16 bar, 0 to 40 bar.

— Dial:150 mm minimum.

— Accuracy: ± 1 % of reading.

G.2.1.2 Type: Differential pressure gauge.

— Range: 0 to 1,6 bar.

— Accuracy: ± 1 % of reading.

G.2.2 Flow meters.

— Type: Electromagnetic or turbine.

— Accuracy: ± 0,25 % of reading.

G.2.3 Thermometer.

— Type: Mechanical or Electronic.

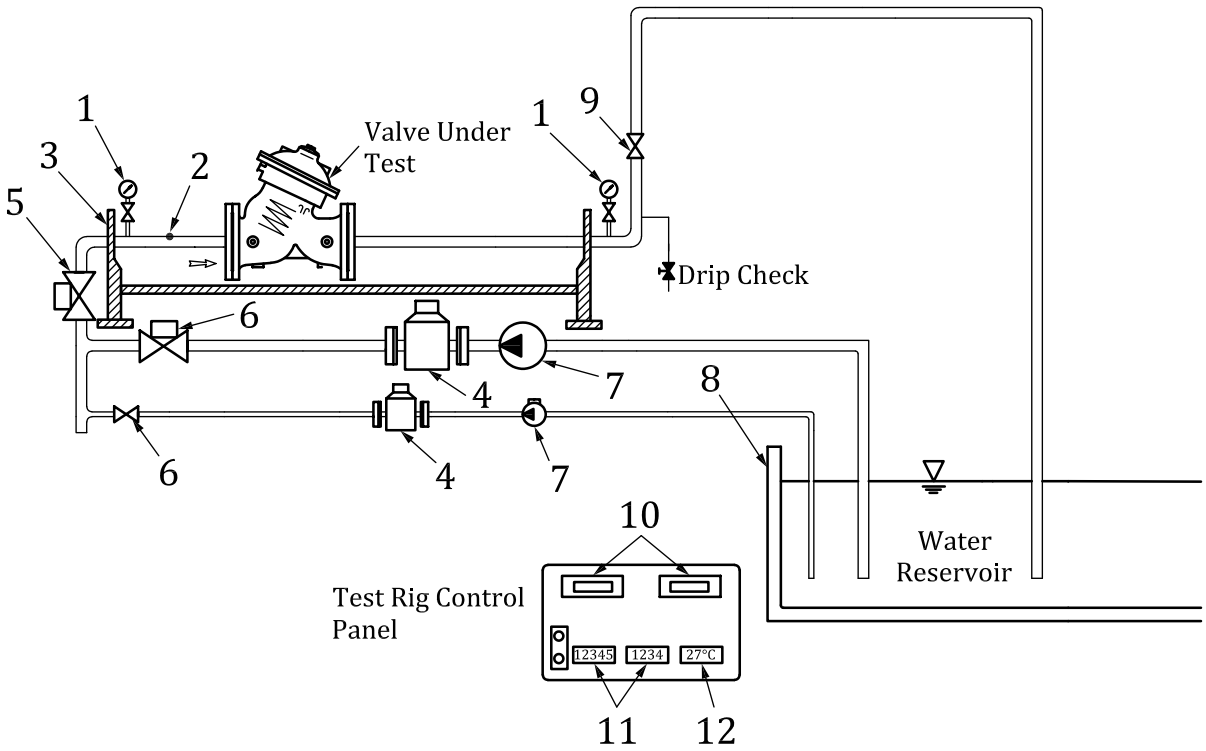
— Accuracy: ± 1° C.

The testing equipment should be periodically calibrated by a certified laboratory with traceability to the national standards.

3) Alternatively, refer to ISO 7714, ISO 9635-1 to -5, ISO 9644, ISO 9911 and ISO 10522.

G.3 Typical valve test bench configuration

See Figure G.1.



Key

1 pressure gauge
2 temperature sensor
3 test rig body
4 electromagnetic flow meters
5 inlet valve
6 flow control valve
7 water pump
8 water reservoir
9 main outlet valve
10 pressure display
11 flow display
12 temperature display

Figure G.1 — Typical valve test bench configuration

Annex H
(informative)

Emitter test bench[4)]

(25 emitter, manually operated online emitter flow test bench)

H.1 Test bench details

H.1.1 Pump: 800 l/h at 500 kPa.

H.1.2 Temperature monitor.

H.1.3 Timer accuracy: ±1 s.

H.1.4 Measuring cylinder: 0 to 500 ml. Accuracy: ± 5 ml.

H.1.5 Pressure gauge: 0 to 400 kPa. Accuracy: 1 kPa, 200 mm dial.

H.1.6 Pneumatically actuated hydraulic cylinder.

H.1.7 Air release valve.

H.1.8 Filter: 75 to 100 micron.

H.1.9 Bypass assembly.

H.1.10 Isolation valve.

H.1.11 Pressure regulator.

H.2 Procedure

a) A representative of the test laboratory should select 25 test specimens at random from a lot of at least 500 units.

b) Connect 25 fully assembled emitters on the test bench.

c) Ensure that there is no water in the measuring cylinder.

d) Set the timer for the required test duration specified in ISO 9261.

e) The test should be carried out at the water temperature of 23 ±3 °C

f) Start the pump and set the required test pressure by using the bypass valve.

g) During the test the pressure should not vary by more than 2 kPa.

h) Start the test by actuating the pneumatic cylinder.

---

4) Alternatively, refer to ISO 9261.

i) After the required test duration, measure the flow rate of the individual emitters and calculate the standard deviation (S_d) and coefficient of variation (C_V).

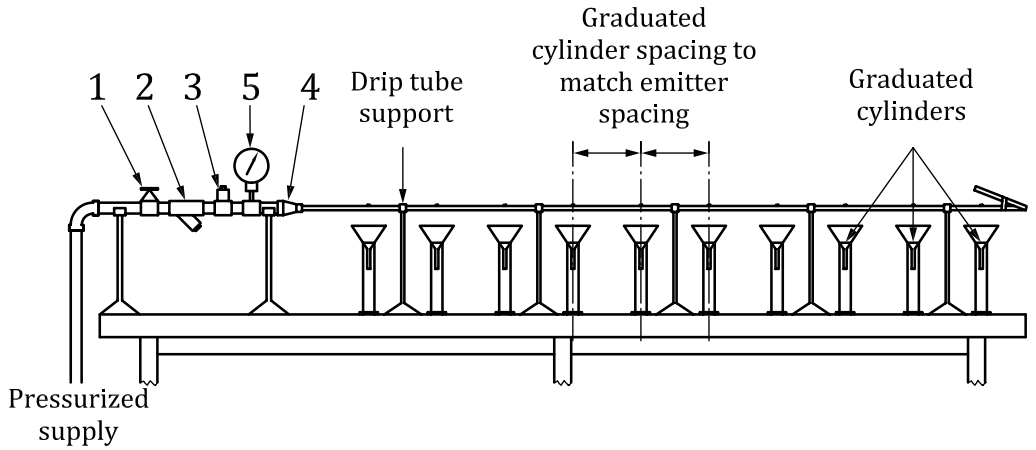
S_d is the standard deviation of the emission rates for the sample (l/h);

$C_V = \frac{S_d}{\bar{q}} \times 100$ where $\bar{q}$ is the mean emission rate of the sample (l/h).

H.3 Regulated emitters

Condition the emitters in the test sample by operating them for 1 h minimum at an emitter inlet pressure equal to the pressure at the middle of the working pressure range. To condition the emitters, operate them three times at P_{max} and three times at P_{min}. Each operation should be maintained for at least 3 min. During the last 10 min of conditioning, the pressure should be maintained at the midpoint of the regulation range. Test the emitter as mentioned above immediately after the conditioning period and without altering the inlet pressure.

See Figure H.1.



Key

1 isolation valve
2 Y stainer - mesh to meet manufacturer's specifications
3 pressure regulator
4 union
5 pressure gauge selected to operate in middle third of its range

Figure H.1 — Emitter test bench

Annex I
(informative)

Sprinkler test bench[5)]

I.1 Building

I.1.1 Test area: 5 m x ≥15 m. The length of the test area will determine the size of the largest sprinkler that can be tested. A test building should be large enough to allow a single radial test of a sprinkler with a radius of throw of 15 m.

I.1.2 Ambient temperature: All sprinkler testing carried out in accordance with ISO 15886-3 should be completed at an ambient temperature of 27°C ± 2°. Temperatures in excess of this may result in excessive evaporation.

I.1.3 No wind conditions (maximum allowable wind speed lower than 0,5 m/s).

I.1.4 The surface should be impervious and be sloped or shaped to facilitate capture of all, or as much as is practical, the water used in the test for recycling.

I.2 Pump

Depending on the range of sprinklers to be tested, it may be appropriate to have more than one pump. It is better to use more than one pump if a large range of sprinklers is to be tested since flow rates may range from 0,12 m^3/h to 30 m^3/h. The number of pumps required will depend on the testing frequency for each type of sprinkler.

I.2.1 Type: Centrifugal or turbine with a variable speed drive.

I.2.2 Flow range: Flow rate of 0,12 m^3/h to 30 m^3/h.

I.2.3 Pressure range: 75 kPa to 700 kPa.

I.3 Test bench

Sprinklers for testing should be mounted on a stand with adjustable height and in a water proof area. The test assembly to which the sprinkler is attached is placed in a structure so that a small arc of the total distance of rotation of the sprinkler distributes water beyond the structure for the full distance of the radius of throw of the sprinkler. The arc may vary in size from 10° to 15°. The minimum size of the arc should be sufficient to ensure that no splash from the flow diverters placed on each side of the aperture from which the sprinkler stream is ejected will fall into any collector being used to measure the discharge from the sprinkler.

I.3.1 Steel, PVC or PE piping.

I.3.2 Sprinkler connection: upright supply line of DN 15.

5) Alternatively, refer to ISO 15886-3.

I.3.3 Height regulation device, such that sprinkler nozzle can be set at any height from 0,0 m, i.e. level with the opening of the collectors to 0,5 m above the opening of the catch can. There should also be provision within the test facility to suspend the sprinkler in an upside down position to heights up to 2,0 m above the opening of the collection vessels.

I.3.4 Filtration: Any type of filtration is permissible provided that the filter is specified so that the maximum potential diameter of any particle passing through the filter is less than half the diameter of the smallest discharge nozzle on the sprinkler.

I.3.5 Globe valve which controls the water supply to the pump.

I.4 Water tank

I.4.1 Capacity: 600 l.

I.4.2 Temperature regulation device, maintaining water at a test temperature of 23 ± 3°C.

I.4.3 Level control valve.

I.4.4 Manual discharge valve.

I.5 Pressure regulation

I.5.1 Manually controlled valves: two needle valves.

I.6 Pressure gauges

I.6.1 Type: Glycerine manometer.

I.6.2 Placed in the same plane as the main nozzle.

I.6.3 Accuracy: ± 0,5 % of reading.

I.7 Flow measurement

I.7.1 Type: Not specified.

I.7.2 Accuracy: 0,25 % of reading.

I.8 Collector design

I.8.1 Cylindrical or conical collectors, with side walls ≥ 45° from the horizontal.

I.8.2 Round opening from 100 mm to 150 mm in diameter, free from deformities.

I.8.3 Collectors must be identical.

I.9 Application measurement

I.9.1 Weighing method:

I.9.1.1 Type: Digital scale.

I.9.1.2 Accuracy: ± 1 g.

I.9.2 Volumetric method:

I.9.2.1 Probes.

I.9.2.2 Accuracy: ± 1 % of reading.

I.10 Temperature measurement

I.10.1 Type: Mechanical or electronic.

I.10.2 Range: 0 to 45 °C.

I.10.3 Accuracy: ± 0,1 °C.

I.11 Other measurement devices

I.11.1 Chronometer (accuracy 1 s).

I.12 Facility data sheet

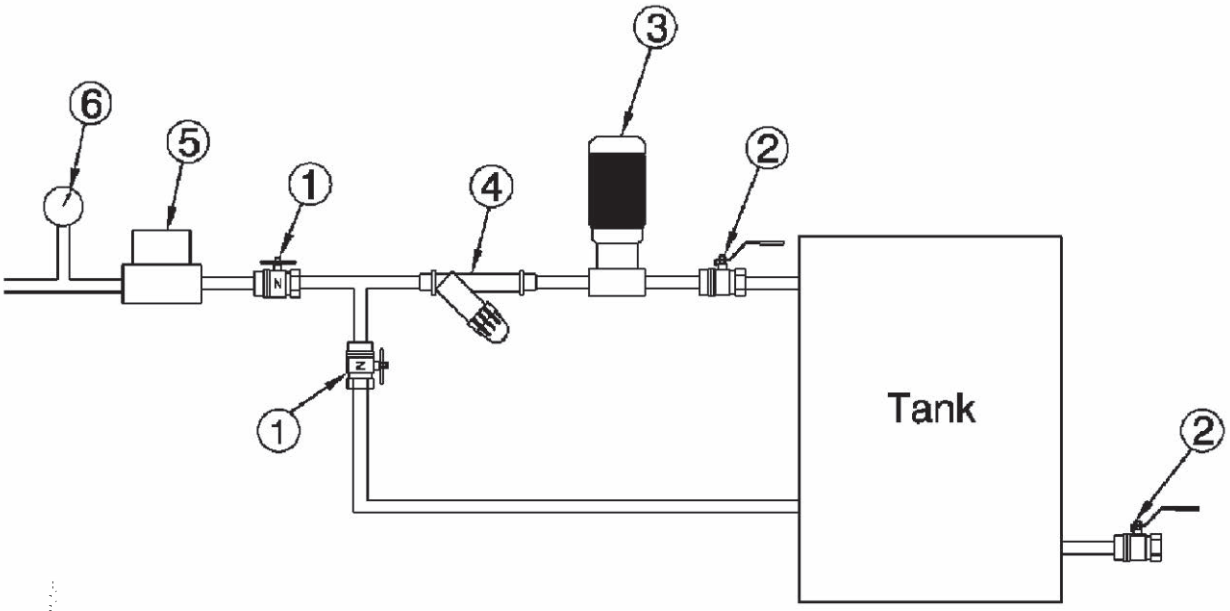
I.12.1 It is highly recommended to keep a hard copy of the test results and to design a stylized datasheet.

I.13 Data analysis

I.13.1 Computerized results with appropriate software.

I.14 Typical sprinkler test bench configuration

See Figures I.1 and I.2.



Key

1 globe valve
2 needle valve
3 pump
4 filter
5 flow measurement
6 manometer

Figure I — 1 — Sprinkler test bench water supply system

Dimensions in centimetres

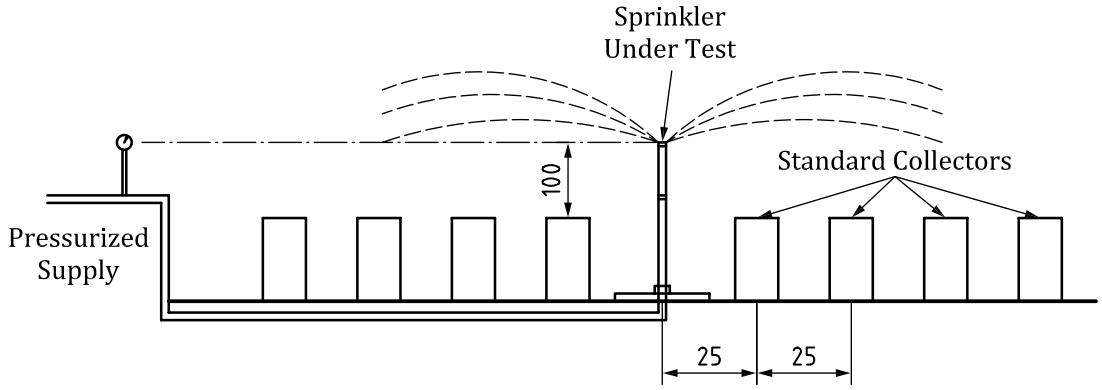


Figure I — 2 — Sprinkler test bench collector layout

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