BRITISH STANDARD

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Irrigation techniques — Localised irrigation — Hydraulic evaluation

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ICS 65.060.35

National foreword

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A list of organizations represented on AGE/30 can be obtained on request to its secretary.

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Bewässerungsverfahren - Örtliche Bewässerung - Hydraulische Festlegungen

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

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Foreword

This document (EN 15097:2006) has been prepared by Technical Committee CEN/TC 334 “Irrigation Techniques”, the secretariat of which is held by AENOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2007, and conflicting national standards shall be withdrawn at the latest by May 2007.

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1 Scope

The purpose of this Standard is to describe a localised irrigation hydraulic system and to specify a method to determine the uniformity in water distribution for each installation to be evaluated in the field.

This document applies to localised irrigation systems. It does not cover management practices.

This paper defines the methodology to be applied in the farm localised irrigation system evaluation.

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 13635:2001, *Irrigation techniques – Localised irrigation systems – Terminology and data to be supplied by the manufacturer*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 13635:2001 and the following apply.

3.1
emission uniformity
coefficient expressed as a percent relating the minimum rate of discharge to the average rate of discharge per plant

3.2
flow rate uniformity
coefficient expressed as a percent relating to the minimum flow rate of an emitting device to the average flow rate of the emitting device

4 Basic data for the evaluation

4.1 General data of the farm

The following data should be known before the evaluation:

a) situation plan;

b) topographical map;

c) owner;

d) farm name;

e) location;

f) date of evaluation.

4.2 Localised irrigation system data

The following data should be known before the evaluation:

a) manufacturer or installer;

b) age of installation;

c) water supply;

d) pipe installation: diameter and material;

e) emitters: type and point spacing;

f) pump station;

g) filtration system;

h) fertilization equipment;

i) flow-rates and pressures control systems;

j) automatic control systems;

k) design layout.

4.3 Farm-unit features

The following data should be known before the evaluation:

a) geometric characteristics;

b) topographic characteristics: slope.

5 Data to be collected for the evaluation

The following data should be known before the evaluation:

a) water pressure at the control head, filters and pressure regulators;

b) water pressure at the inlet of the irrigation block, sub-mains and laterals;

c) emitters' flow-rate;

d) wetted area;

e) head-losses in the tested laterals;

f) clogging of the emitters;

g) check irrigation control head, filters, other pieces and automatic control systems.

6 Test procedure

The test shall be carried out under usual working conditions. The procedure shall be the following:

— Choose a subunit (S_R) that is typical for conditions over the whole irrigated area and, if it is possible, representative of the installation. Select another subunit if the topographical or hydraulic conditions vary greatly. This subunit should represent the hardest conditions (e.g. steep gradient, gradients exceeding 5% and reverse gradients in case of long laterals).

— Locate four laterals within the test sub-unit (S_R) block.

Laterals shall be located as indicated:

first lateral, near the inlet; the second lateral, at 1/3 of the distance from the inlet; the third lateral, at 2/3; and the last lateral, near the outer end;

four emitters, e_1, $e_{n/3}$, $e_{2n/3}$ and e_n, shall be selected from the n emitters along each lateral, following the same criteria:

first emitter, near the inlet; the second emitter, at 1/3; the third emitter, at 2/3; and the last emitter, near the outer end (see the layout). The total number of specimens shall be 16.

— Measure the volume of water discharged from the emitters for a number of full minutes to obtain a volume between 100 ml and 250 ml for each plant. Measurements shall be carried out using a graduated test tube.

— Take pressure values at the emitters' e_1 and e_n located at the inlet and the outlet of the selected laterals.

— Measure the minimum pressures in the pipes which are connected to the laterals of the subunits.

— Calculate the emission uniformity of the test subunit (CU_{ST}), from the following formula:

$$\mathrm{CU_{ST}}(\%) = \frac{\overline{q_{25\%}}}{\overline{q}} \times 100 \qquad (1)$$

where

$\overline{q_{25\%}}$ is the average low quarter rate of discharge per emitter, in l/h;

$\overline{q}$ is the average rate of discharge per emitter in the test block, in l/h.

— Determine the discharge correction factor (f) of tested block by the following formula:

$$f = \left[\frac{\overline{P_{25\%}}}{\overline{P_{\min}}} \right]^{x} \qquad (2)$$

where

$\overline{P_{25\%}}$ is the average of the lowest quarter rate of minimum pressure measured at the blocks of the irrigated area, in bar;

$\overline{P}_{\min}$ is the average rate of minimum pressure measured at the blocks of the irrigated area, in bar;

x is the emitter discharge exponent.

— Using the measurements of the four emitters previously used, calculate the emitter discharge exponent by the following formula:

$$x = \frac{\log\left(\overline{q_1} / \overline{q_2}\right)}{\log\left(p_1 / p_2\right)} \qquad (3)$$

where

$\overline{q_1}$ is the average of discharge per emitter measured at pressure P_1, in l/h;

$\overline{q}_2$ is the average of discharge per emitter measured at pressure P_2, in l/h;

p_1 and p_2 are enclosed in the working pressure range, in bar.

— The emission uniformity of the irrigation sector (CU) can be approximated by:

$$\mathrm{CU} = \mathrm{CU}_{\mathrm{ST}} \times \mathrm{f} \qquad (4)$$

7 Equipment needed

- Pressure gauge.
- “T” adapters.
- Punch with extractor.
- Collectors.
- Chronometer.
- Funnel.
- Graduated cylinder with 500 ml capacity and 2 ml accuracy.
- Graduated cylinder with 250 ml capacity and 2 ml accuracy.
- Graduated cylinder with 150 ml capacity and 1 ml accuracy.
- Measuring tape.

8 Blank data forms

For the purpose of this standard, the following data sheet may be reproduced.

I. GENERAL DATA OF THE FARM

1. Situation plan

2. Topographical map

3. Owner .....

4. Farm name .....

5. Location .....

6. Evaluation date .....

II. INSTALLATION DATA

1. Manufacturer or installer .....

2. Age of installation .....

3. Water supply

- Farm turnout assembly (FTA) from community network ☐
- Flow rate (l/h) .....
- Wells ☐
- River intake ☐
- Pool ☐
- Others (specify) ☐
- Piezometric level (m).....
- Volume (m^3)……..
- Distance between farm and river, well, ……
- Static pressure (bar)…….
- Dynamic pressure (bar)……...

4. On-farm pumping station

- Is there an on-farm pumping station yes ☐ no ☐
- Number of pumps……..
- Type……..
- Flow rate range.……
- Pressure range.……..
- Power……..
- Type of energy.……..
- Type of engine.……..
- Under shelter yes ☐ no ☐

5. Irrigation control heads

Components	Number	Trademark	Type	Diameter (mm)	Flow-rate (m^3/h)	Observations
Non-return Valve						
Centrifugal Separator						
Filters						
Fertilisation device						
Downstream pressure regulator						
Main valve						
Water meter						
Safety valve						

Pressure gauge						
Air realise valve						
Automation						
Others						

Add sketch and a picture if it is possible

III. FARM-UNIT FEATURES

1. Geometric characteristics

Number of blocks	Shapes	Dimensions	Number of lines

2. Topographic characteristics: slope

Number of blocks	Average value of the slope (%)

IV. DATA OF THE TESTED BLOCK

Lateral	Emitter number	Pressure P (bar)	Volume V (l)	Flow-rate q (l/h)
First	1	$P_{1=}$	$V_{1=}$	$q_{1=}$
	2			
	3			
	4	$P_{4=}$	$V_{4=}$	$q_{4=}$
1/3	5	$P_{5=}$	$V_{5=}$	$q_{5=}$
	6			
	7			
	8	$P_{8=}$	$V_{8=}$	$q_{8=}$
2/3	9	$P_{9=}$	$V_{9=}$	$q_{9=}$
	10			
	11			
	12	$P_{12=}$	$V_{12=}$	$q_{12=}$
Last	13	$P_{13=}$	$V_{13=}$	$q_{13=}$
	14			
	15			
	16	$P_{16=}$	$V_{16=}$	$q_{16=}$

$\overline{q_{25\%}} =$

$\overline{q} =$ CU_{ST} = …… %

$\overline{p_{25\%}} =$

$\overline{p_{\min}} =$

X = f =

$CU = CU_{ST}$ x f = ……. %

V. EMITTER EXPONENT		
Emitter number	Flow-rates	
	To pressure 1	To pressure 2
1 2 3 4		
Mean flow-rate		
	X =	

VI. MINIMUM BLOCK PRESSURE	
Block number	Minimum pressure (bar)

Bibliography

[1] Merriam, J.L. and Keller, J. 1978. Farm irrigation system evaluation: A guide for management.

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