DOC CEN TC 165 WG41 N 200 rev1

DRAFT
prEN

EUROPEAN STANDARD

NORME EUROPEENNE

EUROPÄISCHE NORM

March 1997

UDC
Descriptors : Septic tank, domestic wastewater treatment, hydraulic performances, structural behaviour

English version

Small wastewater treatment systems ≤ 50 PE
Part 3 -Packaged and/or Site assembled Domestic Wastewater Treatment Plants

Petites installations de traitement des eaux usées ≤ 50 éq./hab. Partie 3 - Stations d'épuration d'eaux usées domestiques fabriquées en usine et/ou assemblés sur site

Kleinkläranlagen für ≤ 50 egw
Teil 3 - vergefertigte und/oder vor ort montierte reinigungsaulangen für häusliches Abwasser

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C E N
European Committee for Standardisation
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat : rue de Stassart, 36, B-1050 Brussels

FOREWORD

This European Standard was established by CEN/TC 165 "Wastewater engineering".

This European Standard provides the general requirements for packaged and/or site assembled treatment plants used for domestic wastewater treatment ≤ 50 PE (see clause 1 "Scope").

This standard does not contravene the EC-Council Directives 75/440, 79/869 and 80/778.

The standard takes into account the essential requirements of the EC-Council Directive for construction products.

This standard is divised into 3 parts :

Part 1 : Prefabricated septic tanks : Specifies the requirements and test methods for prefabricated septic tanks. No treatment requirements are specified.

Part 2 : Soil systems : Provides information regarding the construction of in-situ constructed soil infiltration systems and sand filters. No treatment requirements are specified.

Part 3 : Packaged and/or Site assembled Domestic Wastewater Treatement Plants : Specifies the requirements and test methods used to evaluate packaged and site assembled domestic wastewater treatement plants which are required to treat sewage to a predetermined standard.

1. SCOPE

This Part of the Standard specifies the requirements for packaged and/or site assembled domestic wastewater treatment plants used for populations up to approximately 50 inhabitants. The Standard specifies the functional requirements, process performance, testing, marking and quality control requirements.

On site construction wastewater treatment plant are excluded.

2. NORMATIVE REFERENCES

prEN 476 : General requirements for components used in discharge pipes, drains and sewers for gravity systems.
pr EN 1085 : Wastewater treatment - Vocabulary

3. DEFINITIONS AND TERMINOLOGY

Packaged domestic wastewater treatment plant : Prefabricated factory-built sewage treatment installation which accepts domestic wastewater and treats it to a predeterminated standard.

Site assembled domestic wastewater treatment plant : a site assembled unit composed of prefabricated components which accepts domestic wastewater and treats it to a predeterminated standard.

User site : an installation sited at a dwelling in use as a family house

4. CLASSIFICATION

Manufacturers' shall state the "treatment capacity" of each treatment plant.
Treatment plant may be classified into preferred sizes.

5. SPECIFICATIONS

5.1 DIMENSIONS

5.1.1 Inlets, outlets and connections

The minimum nominal diameter of inlet and outlet pipes are specified below.

100 mm ND Flows ≤ 4 m^3/day
150 mm ND Flows > 4 m^3/day.

The hydraulic design of the equipement shall ensure that no back flows or surcharging occur during normal operation.

5.1.2 Access

Plants shall be securely covered to prevent unauthorised access and ensure operational safety.

Consideration shall be given by the design to provide an access to the inlet and/or outlet areas for routine maintenance sampling, the removal of sludge, and the cleaning and maintenance of all internal fittings and equipment.

Plants requiring man access for maintenance shall conform to requirements of prEN 476. Access for sampling shall also be provided.

5.1.3 Design basis

Design criteria differ from Country to Country. Each country may define :

1. Population Equivalent loading,
2. A minimum loading that a plant can accept,
3. Minimum sizing criteria including sludge storage capacity.

4. Additional design criteria for domestic wastewater flows from sources such hotels, restaurants or commercial premises.

Guidance on process design may be found in the European Standards listed below. Manufacturers shall ensure that their plants contain adequate sludge storage capacity and that special consideration is given to the high peak flows generated in small plants. (Pr 12566 part 1, 4, 6, 7, 10, 11).

5.2 CONSTRUCTION

Plants shall be stable, durable, watertight and corrosion resistant. Materials of construction may be varied but the design and manufacture of the plants shall conform with appropriate EN Standards.

Electrical installations shall conform to National Regulations. Plants with electrical equipments shall be provided with a failure alarm (ex. : audio/visual system).

5.3 WASTEWATER PROCESSING EFFICIENCY

The equipment shall be tested to determine its wastewater treatment capacity. Methods for testing the treatment capacity of small wastewater treatment plants are specified in Annex B.
Test Reports shall specify the performance data monitored measured for the following determinants.

a) BOD or COD
b) Suspended Solids
c) Temperature
d) Power Consumption

Note : National Regulations may require other determinants to be monitored and specify treatment capacity requirements in percentage and/or in absolute terms.

5.4 WATERTIGHTNESS

A plant shall be watertight up to the outlet level after installation as specified in prEN 12566 - Part 1 after testing in accordance with the water test described in Annex A.

After testing in accordance with Annex A the water loss measured after 30 minutes shall be ;

1) Concrete

   $\leq 0{,}1$ l/m^2 of the internal wet surface of the external walls.

2) Plastics Materials

   No leakage shall occur.

5.5 STRUCTURAL REQUIREMENTS

5.5.1 General

The plants shall resist the loads and stresses applied by handling, installation conditions and use, including desludging, for their design life. Appropriate safety factors shall be used to calculate the loadings for which they are designed. The following loads shall be considered :

- backfill load
- water load
- dynamic actions
- loads imposed by the fittings and equipment within the plant.

National regulations or standards may specify test or calculation methods to ensure compliance with the loading specifications stated above.

For determination of actions, use the following parameters :

5.5.2 Backfill load

Vertical component : H x 18 (kN/m^2).
18 kN/m^3 : specific weight of the soil.
Where H is the distance from ground level to the top of the tank.

Horizontal component : K x h x 18 (kN/m^2)
Calculation of backfill loads shall take account of the effect of ground conditions, backfill materials and tank shape factors.

Note : More information on backfilling is given in the Part 2 of this Standard.

For sand : 0,33 x h x 18 (kN/m^2).
For gravel : 0,27 x h x 18 (kN/m^2)
For other backfill materials : 0,50 x h x 18 (kN/m^2).

Where h is the height of the tank up to the ground level, corresponding to the maximal moment.

5.5.3 Water load

Vertical component : H x 10 (kN/m^2).
10 kN/m^3 : action resulting from the specific mass of water.

Max. horizontal component : h x 10 (kN/m^2).

NOTE : In presence of a groundwater table, the stability conditions of the product in relation with the water pressure shall be indicated in the manufacturer's selling instructions.
In this case, the specific load of soil is 10 kN/m^3 and should be added to the water load.

Where Hs is the distance from invert to tank base.

5.5.4 Dynamic actions

a) Pedestrian loading

A value of 2,5 kN/m^2 shall be considered only when the height of the backfill is less than 1,00 m. Over 1,00 m pedestrian loading is assumed to be negligible against other actions.

b) Vehicle loading

Plants subject to vehicle loadings shall be individually designed in accordance with National requirements.

5.6 DURABILITY

Plants shall be constructed from materials with physical characteristics and corrosion resistant properties that make them suitable for use in sewage environment. Plant shall be designed to have a service life in in complying with National Regulation. Manufacturers should state in the technical data submitted to the Third Party Body the expected life of the mechanical equipments fitted to their plants (e.g. pumps, motors and blowers).

6. TEST METHODS

Compliance with the requirements of this Standard shall be verified. Treatment capacity, structural stability, water tightness shall be demonstrated.

6.1 TREATMENT CAPACITY TESTING PROCEDURE

Plants shall be subjected to a test of one year's duration. The purpose of the test is to demonstrate whether the plant meets the operational requirements corresponding to its nominal size and intented purpose. Testing shall be managed by Third Party Body. Details of the testing procedure are contained in Normative Annex B of this Standard.

6.2 STRUCTURAL LOAD BEARING CAPACITY

The plants should be assessed to verify their load bearing capacity. Manufacturers shall demonstrate Third Party Body that their equipment fulfils the structural requirements of this Standard.

6.3 WATERTIGHTNESS

See Annex A for test details.

7. MARKING

Plants shall be marked with the following information :

- Manufacturer identification mark
- EN number
- Treatment capacity
- Date of manufacture
- CE marking
- Name of the Testing Organization.

8. QUALITY CONTROL

Procedures for Quality Control will comply with those specified in Part 1 of this Standard -(to be determined, at our June 1997 Meeting).

9. INSTALLATION INSTRUCTIONS

The Manufacturer shall supply installation instructions with each plant. These instructions shall contain data upon - plant installation - pipe connections - electrical connections - commissioning and start-up procedures.

10. OPERATING AND MAINTENANCE INSTRUCTIONS

The Manufacturer shall provide with each plant comprehnsive operation and maintenance instructions. It is strongly recommended that a Maintenance Contract is taken out with a competent Maintenance Contractor.

ANNEX A

WATERTIGHTNESS TEST

The watertightness test shall be carried out on a complete plant after installations.

A.1 WATER TEST

A.1.1. Procedure

The plant shall be installed according to manufacturer's requirements.

The plant shall be filled with clean water at a temperature 15 ± 10°C, up to the outlet level. The volume of water admitted into the tank up to overflowing shall be measured with a volumeter. The volume in excess collected is measured and deducted from the volume indicated by the volumeter. The volume shall be expressed with an accuracy of 0,5 % of nominal capacity.

For concrete plants, water shall be kept in the plant for a minimum of 24 hours to take account of the possible porosity of concrete. After this period, an addition of clean water up to the outlet level may be necessary before the test proceeds.

Plastics plants shall not be allowed to soak for 24 hours before the 30 minutes test.

A.1.2. Expression of results

After a period of 30 minutes, the additional amount of clean water necessary to adjust the level of water up to the outlet level shall be measured according to the rquirements described in 5.4.This additional amount shall be expressed in litres and in litre per m^2 on internal wet surface of the external walls.

ANNEX B

1. TREATMENT CAPACITY PROCEDURE

1.1 Testing Locations

Plant shall be tested either at a test center or at user site.

1.2 Plant selection and preliminary evaluation

1.2.1 General

Before testing begins, the Manufacturer shall provide the Testing Organization with plant and process design specifications including a complete set of drawings and supporting calculations. Full information concerning the installation and operation and maintenance requirements of the plant shall also be provided.

The Testing Organization shall select the size of plant to be tested from the range submitted by the Manufacturer for approval. The smallest size will normally be selected to test for worst case conditions.

The Manufacturer shall provide the Testing Organization with information detailing on the mechanical, electrical and structural safety of the plant installation to be tested.

The electrical specification of the installed plant shall conform to national standards.

1.2.2 Installation and commissioning

The Manufacturer shall install and commission all items of the plant prior to handing over to the Testing Organization.

1.2.3 Operation and maintenance procedures during testing

The plant(s) shall be operated in accordance with the Manufacturer's operating instructions by a person appointed by the Testing Organization. Routine maintenance shall be carried out in strict accordance to the Manufacturer's maintenance instructions. Sludge will only be removed from the plant when specified by the Manufacturer in his Operating & Maintenance Instructions. All maintenance shall be carried out under the supervision of the Testing Organization. Any service work or repairs carried out in addition to that specified in the O & M Manual must be approved in advance by the Testing Organization.

During the test period no unauthorized access shall be permitted to the test site. Authorized access shall be supervised by the Testing Organization.

1.2.4 Data to be monitored

The following parameters shall be monitored in all plants tested unless National Regulations specify a different requirement :

- discharge of 5-day biochemical oxygen demand, BOD_5 or COD
- suspended solids (SS) ;
- temperature ;
- power consumption ;
- daily flow

The following determinants may also be measured if required ;

- Phosphate (PO4 - P)
- Ammonia (NH4 - N)
- Nitrate
- NHA or KN
- pH

1.3 Testing Procedure at a Test Centre

The Testing Organization will be required to test one plant from the range submitted for assessment by the Manufacturer in accordance with the testing procedure set out in this Standard.

1.3.1 A Time for establishment

period of 4 weeks shall be allowed for the process to be established, during which the plant shall operate under the steady-state conditions given in table 1 and 7.

1.3.2 Influents characteristics

Where National Regulations do not specify influent characteristics, it is recommended that the values tabulated below are used.

Raw domestic wastewater shall be used, it may be coarse screened and grit removed prior to use :

- BOD_5 (ATU) : 300 mg/l
  or
  COD : 600 mg/l
- SS : 375 mg/l ;
- KN : 50 mg/l
  or
  NH_4 - N: 45 mg/l ;
- PO_4 - P: 10 mg/l

1.3.3 Daily flow pattern for testing

Each Country shall decide the daily flow pattern to be used for testing to ensure that it accurately reflects National practice.

Table 1. Typical daily flow pattern (Example)

Time of day	Percentage of daily flow
6 am to 9 am	30 %
9 am to 12 am	15
12 am to 2 pm	20
2 pm to 6 pm	0
6 pm to 8 pm	20
8 pm to 11 pm	15
11 pm to 6 am	0

1.3.4 Timetable for test procedure

Routine monitoring shall take place throughout the period of the test procedure. Steady-state performance shall be monitored for 16 weeks to establish baseline performance before stress testing begins.

The Test schedules listed in Table 2 shall apply.

Table 2 : Test Schedules

		Period	Total time elapsed (weeks)
1	No sampling Biomass establishment	4 weeks	4
2	Routine sampling Steady state performance	16 weeks	20
3	Power breakdown stress test	2 weeks	22
4	Routine sampling 50 % loading 125 % loading	2 weeks	26
5	Holiday stress test	2 weeks	28
6	Routine sampling	12 weeks	40
7	Power breakdown stress test	2 weeks	42
8	Holiday stress	2 weeks	44
9	Routine sampling	8 weeks	52

After desludging as stated in the Operation & Maintenance manual, a period of 1 day shall be allowed for recovery before the programme of tests and sampling is continued.

Note : Power breakdown has a 24 hours duration.

1.3.5 Plant loading

The load for which the plant is designed shall be delivered to the plant. Monitoring of wastewater composition and flow rates shall be carried out.If the conditions specified in 1.3.2 and 1.3.3 are not met the effluent quality shall not be used to determine treatment capacity.

1.3.6 Stress tests

1.3.6.1 Holiday period

A holiday period stress test shall be carried twice a year, according to the conditions given in Table 4. Each Country shall determine a suitable timing for the holiday stess test which simulates their National holiday patterns.

Table 3 : Holiday period stress test

Household	Stress conditions
1 or 2	No flow for 14 days
> 2	25 % Flow for 14 days

1.3.6.2 Simulated washing machine test

The Testing Organization shall select a suitable domestic laundry machine using normal domestic detergents and conditioners to carry out this test.

A laundry machine discharge cycle shall be carried out twice a week according to the conditions given in Table 4. It shall commence at 10.00 a.m.

Table 4 : Washing machine discharge cycle

Households	Machines discharging within 1 hour
1	1 (Single household)
2 - 3	2
4 to 6	3
> 6	4

Note. Concentrations of detergent and fabric conditioner should be as recommended by manufacturers of those products. Dishwasher cycles may be included in the stress test if required. Stress tests are not required in holiday period or during 24 hours power breakdown.

1.3.6.3 Bath water discharge

A bath water shall be discharged once a week according to the conditions given in Table 6. The test effluent for each bath shall be 200 l of cold water. The volume of each bath shall be discharged over a period of 3 minutes.

Immediately the bath has finished discharging four samples shall be taken at 15 minute intervals. COD and Suspended Solids shall be measured.

Table 5 : Bath water discharge

Households	Baths discharging within 1 hour
1	1 (Single household)
2	2
3	3
> 6	4

Bath water discharge cannot made during holiday period or 24 hours power breakdown.

1.3.6.4 Power breakdown / Machine breakdown

A power breakdown test shall simulate loss of electric power for 24 hours but shall allow continued hydraulic flow.

1.3.7 Sampling

1.3.7.1 Routine influent sampling

The Test Organization shall collect and analyse influent samples to determine compliance with the plant loading criteria (see 1.3.3). Samples shall be flow based composite over 24 hours taken at 15 day intervals.

It is not required to measure influent criteria for user site installations unless required by National Regulations.

1.3.7.2 Routine effluent sampling

Effluent samples shall be collected after the 4-week establishment period has expired to determine plant performance. A 24 hour composite sample shall be taken every 15 days.The core determinants specified in Section 1.3.6 shall be measured for all plants. National Regulations may require other determinants to be measured.

1.3.7.3 Stress test sampling

Stress test sampling shall be carried out on the effluent. The samples shall be 24 hour composite taken as specified in Table 6. The bath emptying stress test samples shall be grab samples.

Table 6 : Effluent sampling periods following stress

Test condition	Sampling period following stress days
Holiday	2nd ans 5th day test
Power breakdown	2nd and 5th day after test
Bath discharge	4 samples at 15 minutes intervals immediately the bath has emptied

1.4 Test procedure for user site

1.4.1 Site Selection

At User Site a minimum of two plants of the same size shall be tested. One plant shall be tested at a load of approximately 50 % of the nominal loading, the others at a load ≥ 75 % of the nominal loading.

The Testing Organization shall be responsible for ensuring that the user sites selected are representative of the loadings and stresses specified for the testing procedure (see Table 7 in Section.1.4.3). Particular attention shall be paid to performing the holiday and power cut stress tests. Households should use normal domestic appliances -particularly the laundry machine- and use normal household cleaning product. Storm water shall be excluded from test flows. A minimum of 5 sites shall be offered to the Testing Organization by the Manufacturer.

1.4.2 Time for establishement

A period of 4 weeks shall be allowed for the process to be established, during which the plant shall operate under the steady-state conditions given in table 1 and 7.

1.4.3 Timetable for test procedure at User Site

Routine monitoring shall take place throughout the period of the test procedure. Steady-state performance shall be monitored for 16 weeks before stress testing begins to establish baseline performance.

The Test schedules listed in Table 7 shall apply.

Table 7 : Test Schedules for User Sites

	Test Schedules	Period (weeks)	Total time elapsed
1	No sampling Biomass Establishment	4	4
2	Routine sampling Steady state performance	22	26
3	Holiday stress test	2	28
4	Routine sampling	12	40
5	Power breakdown stress	2	42
6	Routine sampling	10	52

Note : Power breakdown has a 24 hours duration.
Variations to the test schedules shall be approved by the Testing Organization.

After desludging as stated in the O&M Manual, a period of 1 day shall be allowed for recovery before the programme of tests and sampling is continued.

1.4.4 The Holiday and Power Brakdown Stress Tests

1.4.4.1 Holiday period

The specification for the Holiday Stress Test is given Subclause B 1.3.6.1.

1.4.5 Bath water discharge test

Test described in 1.3.6.3 is carried out once during the test period (routine sampling n° 4).

1.4.6 Sampling

1.4.6.1 Routine influent sampling

The Testing Organization shall collect and analyse influent samples to determine compliance with the plant loading criteria (see 1.3.3). Samples shall be flow based composite over 24 hours taken at 30 day intervals.

National Regulations may require to measure influent criteria.

1.4.6.2 Routine effluent sampling

Effluent samples shall be collected after the 4 weeks establishment period has expired to determine plant performance. A 24 hour composite sample shall be taken every 15 days. The core determinants specified in Section 1.3.6 shall be measured for all plants. National Regulations may require other determinants to be measured.

1.4.6.3 Stress test sampling

Stress test sampling shall be carried out on the effluent. The samples shall be 24 hour composite taken as specified in Table 8.

Table 8 : Effluent sampling periods following stress

Test condition	Sampling period following stress (days)
Holiday	2nd day and 5th day after testing
Power breakdown	2nd day and 5th day after testing

1.5 Sample analysis

The determinants specified in Subclause B 1.2.4 shall be analysed using the standard methods specified in the Standards listed below. These determinations shall be carried out by a Nationally credited Laboratory.

B.O.D.	ISO	5818	1990
C.O.D.	ISO	6060	1988
S.S.	EN	872	1996
Ammonium	ISO	5664	1984
	ISO	6778	1984
	ISO	7150 P.I.	1984
	ISO	7150 P.II	1986
	EN ISO	11732	
Kejdal Nitrogen	EN ISO	11905 P.I.	
	ENV	12260	1996
Nitrate	ISO	7890 P.III	1988
Phosphorus	EN	1189	1996

2. TREATMENT CAPACITY REQUIREMENTS

Each Country shall specify the treatment capacity requirements and the determinants (in any) to be measured in addition to the core requirements stated in 1.2.4.

3. TEST REPORT

The report shall contain, but not be limited to the data specified below :

a) details of the plant(s) tested including information regarding the households served (where appropriate).

b) a report on the conformity of the plant(s) tested with the specification information provided prior to testing.

c) the data monitored obtained including an overall assessment of compliance with the stated treatment capacity of the plant(s).

d) a report an all maintenance and repairs carried out during the test period, including details of desludging frequency.

e) report on the electrical energy absorbed during the test period.

f) report on any problems, physical or environmental, occurring during the test period. Deviations from the manufacturers' maintenance instructions should be reported in this section.

g) a report detailing any physical deterioration (eg : corrosion) of the plant that has occurred during the test period.

h) a report reviewing the operating and maintenance instruction and commenting the suitability for users .shall be made.

4. DESIGN CHANGES

Plants shall be retested if the process design parameters originally specified are changed. Minor specification change shall be authorized by the Testing Organization if they occur.

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DOC CEN TC 165 WG 41 N 302 E rev3

FINAL DRAFT

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prEN12566-3

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November 2000

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C E N

European Committee for Standardisation
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat : rue de Stassart, 36, B-1050 Brussels

Annexe C (normative) : CALCULATION AND TEST METHODS FOR STRUCTURAL BEHAVIOUR

To determinate the structural behaviour of a plant, one or more method(s) described below and mentioned in Table C.1 shall be used.

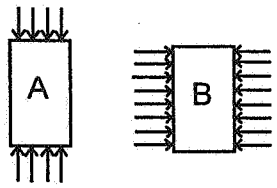
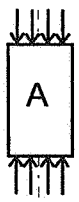
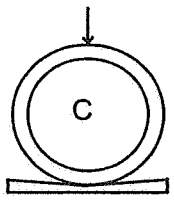
	CONCRETE		GRP		PE		STEEL	
Dry condition	C. 1.2.1 or C.1.2.3				C.2			
Wet conditions	C.1.2.1. + C.1.2.2. or C.1.2.3	C.3.1 or C.5	C.4	C.3.2 or C.5	-	C.5	C.4	C.5

Table C.1: Methods for the determination of the structural behaviour

C.1 Concrete plant

C.1.1 Crushing test methods

This table indicates the crushing test method to be performed according to the shape of the plant being tested.

Rectangular or trapezoidal shape	Vertical cylinder shape	Horizontal cylinder shape
		

Letters A, B, C correspond to the test method

C.1.2 Test procedures

C.1.2.1 Type A test (vertical load)

C.1.2.1.1 Sample

The test shall be carried out on an empty plant equipped with its cover(s) without any extension and/or maintenance shaft.

C.1.2.1.2 Procedure

The plant shall be placed on a sand bed of granulometry 0-5 mm, water content approximately 7 % and thickness of 6 cm ± 1. This sand bed shall be levelled before the installation of the plant.

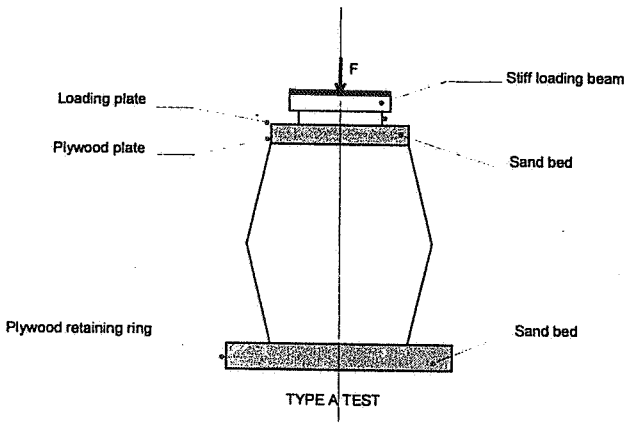
A similar sand bed shall be placed on the upper part in order to compensate for the thickness of the cover(s) and the geometry of the inner sides of the plant. The stress shall be equally distributed on the upper part of the plant using a loading plate. The stress shall be applied regularly and the maximum loading time shall not be less than 5 minutes. The tolerance on the load shall be ± 3 %.

The stress shall be applied up to failure.

C.1.2.1.3 Expression of results

The load F corresponding to the failure shall be noted and expressed in kN/m^2 of the surface submitted to the load, excluding the cover.

C.1.2.1.4 Scheme of the principle



C.1.2.2 Type B test (horizontal load)

C.1.2.2.1 Sample

The test shall be carried out on an empty plant without its cover(s) and any extension and/or maintenance shaft.

C.1.2.2.2 Procedure

The plant shall be placed so that the upper surface (supporting the cover(s)) is in a vertical position.

The plant shall be placed on a sand bed as defined in C.1.2.1.2.

The stress shall be equally distributed on the plant using a loading plate or placed on a sand bed with the same characteristics. The sand bed shall be levelled to take into account the geometry of the sides of the plant (see scheme of principle in C.1.2.1.4).

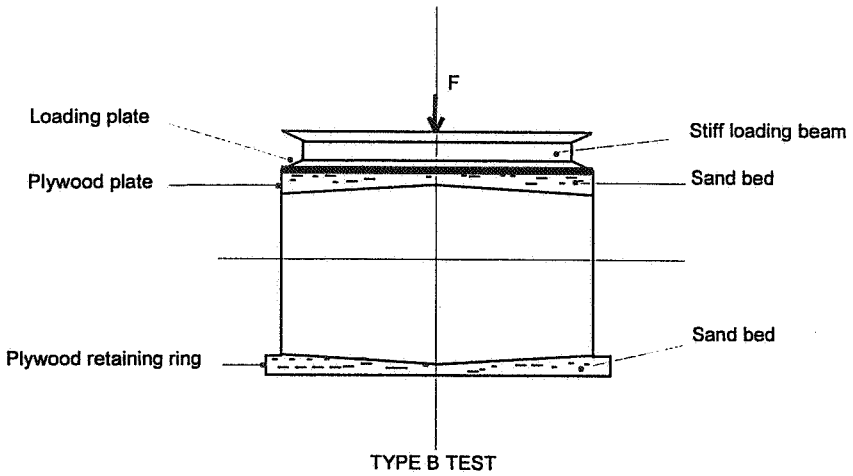
The stress shall be applied regularly and the maximum loading time shall not be less than 5 minutes. The tolerance on the load shall be ± 3 %.

The stress shall be applied up to failure.

C.1.2.2.3 Expression of results

The load F corresponding to the failure shall be noted and expressed in kN/m^2 of the surface submitted to the load.

C.1.2.2.4 Scheme of the principle



C.1.2.3 Type C test (Vertical load)

C.1.2.3.1 Sample

The test shall be carried out on an empty plant without its cover(s) and any extension and/or maintenance shaft.

C.1.2.3.2 Procedure

The plant shall be placed on the whole length on a "V" support forming a 150° angle and covered with a rubber strip of 50 mm wide and 10 to 20 mm thick.

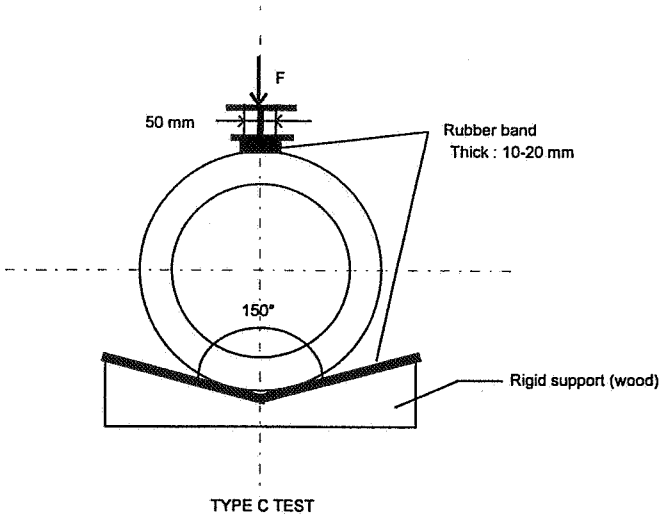
The stress shall be applied regularly and the maximum loading time shall not be less than 5 minutes. The tolerance on the load shall be ± 3 %.

The stress shall be applied up to failure.

C.1.2.3.3 Expression of results

The load F corresponding to the failure shall be noted and expressed in kN.

C.1.2.3.4 Scheme of the principle



C.2 Polyethylene plant

This test method is applicable for use in dry conditions only.

C.2.1 Vertical load test

C.2.1.1 Sample

The test shall be carried out on an empty plant equipped with its cover(s) without any extension and/or possible maintenance shafts.

C.2.1.2 Procedure

Testing shall be carried out at the temperature of 25 ± 5°C.

The plant shall be placed in using conditions on a sand bed of granulometry 0-5 mm, water content less than 15 %. This sand bed shall be levelled to a thickness of 6 cm ± 1 cm before the installation of the tank.

A vertical stress shall be equally distributed on the upper part of the plant. This loading plate shall be adjusted to the centre of the upper part of the plant and shall be placed on 1 cm thick soft plywood plate. If the upper part of the plant in contact with the loading plate is not plane (covers, particular points), level differences shall be compensated.

The stress shall be applied regularly and the maximum loading time shall not be less than 5 minutes.

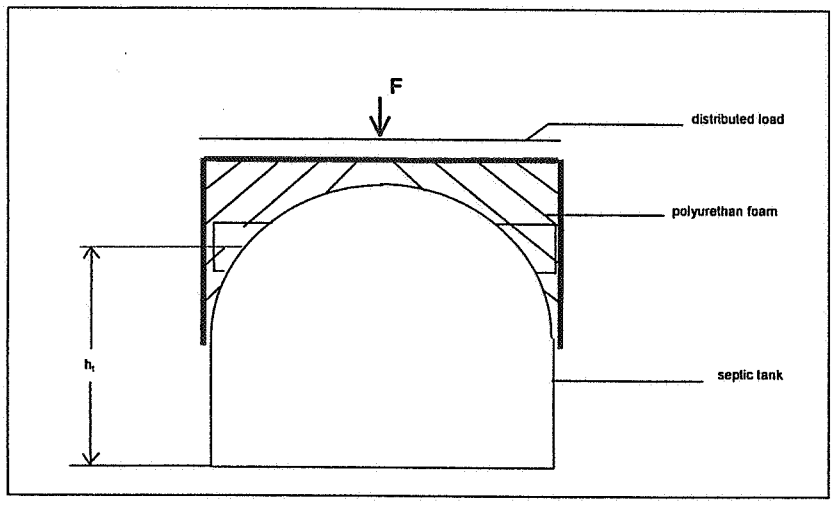
The tolerance on the load is ± 3 %.

- The stress on the tank shall be increased to the collapse.
- Variation of h_t shall be noted, step by step
- The maximum load F shall be noted and converted by dividing by the loaded section.

C.2.1.3 Expression of results

The surfacic load corresponding to the collapse shall be noted and expressed in kN/m^2.

C.2.1.4 Scheme of the principle



h_t : distance between the bottom of the plant and the axis of the inlet pipe

C.3 Determination of mechanical characteristics of test samples used for calculation

C.3.1 Concrete

The preparation and the construction of the 150 mm x 300 mm cylindrical test samples shall be carried out in accordance with ISO 2736. The cylinders shall be in accordance with ISO 1920. The crushing resistance shall be determined according to ISO 4012.

C.3.2 Glass Reinforced Plastic

Specimen samples of laminate from the plant shall be prepared. The exposed edges shall be coated with the resin used in the manufacture of the plant. The samples shall be postcured in air at (50 ± 2)°C for a minimum of 72 hours. These specimen samples shall be immersed in water for 1000 hours at (50 ± 2)°C. Identical samples shall be stored as above in controlled conditions with air for 1000 hours at (20 ± 2)°C. Flexural modulus and strength of the samples shall be measured on all samples as determined by the method in EN 63.

C.4 Vacuum test for Glass Reinforced Plastic or steel plant

The plant shall be designed to withstand an external pressure P, as calculated by the following formula. The plant shall be tested for the designed external load in any conditions, using the following formula:

$$P = L \times f \quad (kPa)$$

where P is the external pressure expressed in kPa
L is the load expressed

f is a factor ($f \geq 1,5$)
L = Greater of the vertical or horizontal load due to backfill + hydrostatic load, where applicable.
f = Factor to take into account of long term physical property of G.R.P. material or steel.

C.5 Pit test

C.5.1 Sample

The test shall be carried out on an empty plant equipped with pipe connections (inlet, outlet and interconnection pipes), its cover(s) and any extension and/or maintenance shaft(s).

The plant shall be installed in a watertight test excavation. The size of the testing excavation shall be calculated to avoid side effects. The plant shall be fixed on the base of the excavation, according to manufacturer's installation instructions.

The excavation shall be backfilled with preferably rounded gravel (3 to 8 mm).

To test in wet ground conditions, add water to the top of the plant, as defined in C.5.4.

C.5.2 Procedure

Step 1: Measure the initial internal dimensions of the plant.

Step 2: Place the plant in the test excavation.

Step.3: Backfill with gravel up to the level of pipe connections and simultaneously fill the plant with water up to the top, after sealing the inlet and outlet pipe works. The volume of water shall be measured. After that, discharge the plant.

Step 4: Check the position of the inlet and outlet pipe works.

Step 5: Complete the backfill up to the maximum permitted depth, including the pedestrian load (2,5 kN/m2) converted in uniformed backfill load and for a wet ground test, seal the inlet and outlet pipe works and add water in the excavation to the level of the top of the plant.

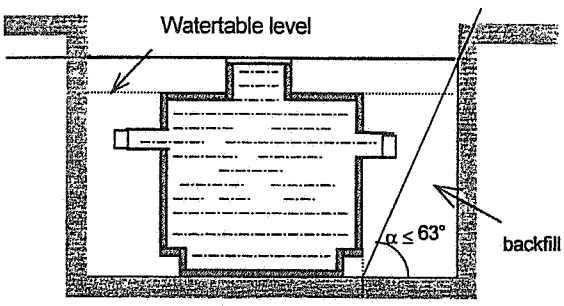
Step 6: For a plant with a rigid behaviour, maintain the test conditions for 24 hours. For a plant with a flexible behaviour, maintain the test conditions for 3 weeks.

Step 7: Check the position of inlet and outlet pipe works and the internal dimensions of the plant. Examine the inside of the plant to show the watertightness is maintained. If the plant is watertight, refill with the volume of water required to fill the plant before the test and measure any change in the capacity of the plant.

C.5.3 Expression of results

The watertightness of the plant shall be confirmet as follows:
The variation of internal dimensions of the plant shall be expressed in millimetres.
The variation of the volume of the plant shall be expressed in litres.
The movement of inlet, outlet and interconnecting pipe works shall be expressed in millimetres.

C.5.4 Scheme of the principle



Where $\alpha = \frac{\pi}{4} + \frac{\phi}{2} = 63°$ With $\frac{\pi}{4} = 45°$ and

ϕ = Angle of repose for gravel (3 to 8 mm) = 36°