SLOVENSKI STANDARD
SIST EN 12065:1999

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Napeljave in oprema za utekoļ injeni zemeljski plin - Preskuġanje penil za srednjo in lahko peno ter gasilnih praġkov, ki se uporabljajo za gaġenje poġarov utekoļ injenega zemeljskega plina

Installations and equipment for liquefied natural gas - Testing of foam concentrates designed for generation of medium and high expansion foam and of extinguishing powders used on liquefied natural gas fires

Anlagen und Ausrüstung für Flüssigerdgas - Eignungsprüfung von Schaummitteln für das Aufschäumen von Mittelschaum und Hochschaum sowie Löschpulvern zur Bekämpfung von Flüssigerdgasbränden (LNG-Bränden)

Installations et équipements relatifs au gaz naturel liquéfié - Essais d'émulseurs destinés a la production de mousse haut et moyen foisonnement et de poudres extinctrices utilisées sur feux de gaz naturel liquéfié

Ta slovenski standard je istoveten z: **EN 12065:1997**

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13.220.10	Gašenje požara	Fire-fighting
75.180.01	Oprema za industrijo nafte in zemeljskega plina na splošno	Equipment for petroleum and natural gas industries in general

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English version

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Contents

Foreword

This European Standard has been prepared by the Technical Committee CEN/TC 282 "Installation and equipment for LNG" the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by March 1998, and conflicting national standards shall be withdrawn at the latest by March 1998.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies the tests to be carried out in order to assess the suitability of foam concentrates used to produce medium expansion foam (made from foam concentrates conforming to prEN 1568-1) or high expansion foam (made from foam concentrates conforming to prEN 1568-2) and fire extinguishing powder conforming to EN 615 when used alone or in combination on liquefied natural gas (LNG) fires.

This standard does not specify the general requirements for foam concentrates given in prEN 1568-1 and prEN 1568-2 or fire extinguishing powder given in EN 615.

This standard does not apply to foam concentrates used to produce low expansion foam (made from foam concentrates conforming to prEN 1568-3) which are not used on LNG installations.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 615	Fire protection - Fire extinguishing media - Specification for powders (other than class D powders)
EN 1160	Installations and equipment for liquefied natural gas - General characteristics of liquefied natural gas
prEN 1568-1	Fire extinguishing media - Foam concentrates - Part 1 : Specification for medium expansion foam concentrates for surface application to water-immiscible liquids
prEN 1568-2	Fire extinguishing media - Foam concentrates - Part 2 : Specification for high expansion foam concentrates for surface application to water-immiscible liquids
prEN 1866	Mobile fire extinguishers

3 Definitions

For the purposes of this standard, the following definitions, and those given in EN 1160, apply :

NOTE: Other definitions will be given in the document WI 00191043 ("Fixed fire fighting systems - Foam systems - Part 1: Components"), still in preparation.

3.1 liquefied natural gas (LNG) : See EN 1160.

3.2 solution : Liquid formed by mixing foam concentrate and water.

3.3 application rate of solution : The flow rate of application of the solution , per surface unit area on fire, generally expressed in l/(min·m²).

3.4 foam concentrate ratio : Ratio generally expressed in percentage of the foam concentrate volume over the solution volume

3.5 proportioner : A device installed on a pipe to ensure mixing of water with foam concentrate in such a way that the resulting solution presents the desired foam concentrate ratio .

3.6 foam expansion ratio : The ratio between the resulting volume of foam and the volume of solution used.

3.7 initial radiation : The radiation of the LNG fire not covered with foam, burning in free combustion.

3.8 reduced radiation : The radiation of an LNG fire covered with a layer of foam.

NOTE : The value of this radiation varies as a function of the thickness of the foam.

3.9 containment of fire : A fire is contained when its radiation has been changed from the mean initial radiation to a mean reduced radiation that is 10 % of the mean initial radiation under the effect of the foam discharged.

3.10 control of fire : A fire is controlled when its mean reduced radiation is between 10 % and 25 % of the mean initial radiation between two additions of foam.

3.11 free LNG fire : A fire where LNG is in free combustion, not covered by any foam.

3.12 mitigated LNG fire : A fire where the combustion of LNG is reduced by foam coverage.

4 Description of equipment required for the foam concentrate tests

4.1 Components of the foam production unit

The foam discharge on an ignited LNG pool is obtained by injecting the solution into a foam generator.

4.1.1 Foam generator

The foam generator used for these tests shall be of the same type as the equipment installed on industrial sites. The output rate at its rated operating pressure shall be such that the application rate of the solution during testing is between 3 l/(m²·min) and 10 l/(m²·min).

4.1.2 Equipment used to supply the solution to the foam generator

The foam concentrate ratio of the solution selected for testing shall be defined either by the foam concentrate supplier or the industrial user, or by mutual agreement between both parties.

The solution may be supplied to the foam generator in two different manners :

a) the solution shall be prepared in advance by mixing in a container (open or closed tank or equivalent) the water volume required for testing with the quantity of foam concentrate necessary to obtain the desired foam concentrate ratio.The solution shall be used in a time limit specified by the foam concentrate supplier. The prepared solution shall then be transferred to the foam generator via a pump and transfer pipes ;

b) water shall be supplied to a proportioner by a pump; the resulting solution shall then be transferred to the foam generator via transfer pipes.

Annex A provides the general recommendations on the design of the foam generating facilities required for testing.

4.1.3 Measurements to be carried out to quantify the foam production

In order to quantify the foam production during testing, the following values shall be measured and recorded :

a) the flow rate of the solution ;

b) the solution pressure at the generator inlet ;

c) the quantity of foam concentrate used ;

d) the quantity of water used ;

e) the temperature of the water used.

Annex B provides information on the means and methods that may be used to measure the above parameters.

4.2 Special equipment required to determine the foam expansion ratio

The foam expansion ratio shall be determined by releasing the produced foam into an impounding area with a surface area at least equal to 70 m² and a height at least equal to 1,2 m. In any case, the impounding area filling time shall be greater than 45 s. The impounding area shall be calibrated to measure its volume with a precision at least equal to 1 %.

4.3 Special equipment required to determine the efficiency of the foam on LNG fires

4.3.1 Impounding area

The fire test shall be performed in a circular impounding area, with a surface area at least equal to 50 m² and a height of 1,5 m. When necessary, the bottom of the impounding area shall be lined with insulating concrete in order to reduce LNG evaporation during impounding area filling.

The impounding area shall be fabricated from materials listed in EN 1160.

4.3.2 Measuring equipment

The following measuring devices shall be used to determine the condition of the fire :

a) 8 thermocouples arranged on a vertical mast positioned at the center of the impounding area ;

b) 4 radiometers positioned crosswind on both sides of the impounding area, at a distance from the center of the impounding area equal to twice the diameter of the impounding area.

The values shall be recorded throughout the entire LNG combustion.

Annex C specifies the measuring equipment to be used to determine the fire condition.

4.4 Other equipment required for the foam concentrate tests

Regardless of the test conducted, the following data relative to the test site shall be measured and recorded with appropriate equipment :

a) air temperature ;

b) water temperature ;

c) wind speed and direction ;

d) air humidity.

In addition, video equipment shall be used to record all the tests carried out.

5 Foam concentrate tests

5.1 Measurement of foam expansion ratio

5.1.1 General requirements for performing the test

The quality of the water used for testing purposes shall be defined either by the supplier of the foam concentrate or the industrial user, or by mutual agreement between both parties.

The foam expansion ratio measuring test shall be performed only if the following conditions are met :

a) zero precipitation ;

b) when comparing different foam concentrates, the air and water temperatures between the different tests shall be within 15 °C for each fluid ;

c) the mean wind speed is under 4 m/s, and wind gusts are not exceeding 6 m/s ;

d) the transfer pipes used to supply the foam generator are filled with solution.

5.1.2 Test procedure

The test shall be performed in accordance with the following procedure :

a) start up of the foam generator and discharge the resulting foam outside the test impounding area until nominal operating conditions of the foam generating unit are achieved ;

b) continuously discharge the foam into the test impounding area ;

c) stop the discharge of the foam once the test impounding area is filled.

5.1.3 Parameters derived from the measurements

The foam expansion ratio, f shall be calculated as follows :

$$f = \frac{V}{V_{sol}} \qquad \ldots(1)$$

where :

V is the volume of the impounding area that is filled with foam ;

V_{sol} is the volume of solution required to produce a volume, V, of foam.

If a proportioner is used, the foam concentrate ratio, τ, shall be calculated as follows :

$$\tau = \frac{V_{em}}{V_{sol}} \qquad \ldots(2)$$

where :

V_{em} is the volume of the foam concentrate.

5.2 Evaluation of the efficiency of the foam on LNG fires

5.2.1 General requirements for performing the test

The quality of the water used for testing purposes shall be defined either by the supplier of the foam concentrate or the industrial user, or by mutual agreement between both parties.

The test shall be regarded as valid only if the following conditions are met :

a) the methane content of the LNG discharged into the impounding area is greater than 85 % ;

b) the methane content of the LNG at the end of the impounding area filling is greater than 60 % ;

c) the LNG level in the impounding area is at least equal to 0,15 m within 2 min before the start of the ignition ;

d) zero precipitation ;

e) the mean wind speed is under 4 m/s, and wind gusts are not exceeding 6 m/s ;

f) the foam generator is positioned upwind of the impounding area ;

g) the transfer pipes used to supply the foam generator are filled with solution.

5.2.2 Test procedure

The test shall be performed in accordance with the following procedure :

a) fill the impounding area with LNG ;

b) ignite the LNG ;

c) leave as a free LNG fire for 45 s, obtaining the mean initial radiation by averaging the radiation values measured by the 4 radiometers positioned crosswind during the last 30 s ;

d) start the foam generator to operate under nominal operating conditions ;

e) stop the foam discharge as soon as the mean reduced radiation measured over a period of 10 s is equal to or lower than 10 % of the mean initial radiation ;

f) add foam when the mean reduced radiation measured over a period of 10 s reaches 25 % of the mean initial radiation ;

g) stop the foam discharge as soon as the mean reduced radiation measured over a period of 10 s is equal to or lower than 10 % of the mean initial radiation ;

h) repeat the last two steps (f and g) at least twice ;

i) monitor the foam destruction until the end of combustion.

5.2.3 Parameters derived from measurements

The efficiency of each foam concentrate shall be determined by calculating the following parameters, in accordance with Annex D :

a) the time for LNG fire containment ;

b) the volume of foam concentrate required to contain the LNG fire ;

c) the height of foam required for containment of fire ;

d) the foam concentrate consumption required to control the LNG fire ;

e) the rate of foam destruction.

6 The foam concentrate test report

The measurement of the foam expansion ratio and the evaluation of the foam efficiency on LNG fires shall be recorded in a test report containing the following information :

a) the date and time of the tests ;

b) data concerning the test site (location, address) ;

c) the name of the testing company ;

d) the technical data sheet for the foam concentrate under test, specifying the physico-chemical parameters as defined by prEN 1568-1 and prEN 1568-2 ;

e) the performance specification of the foam generator (flow rate and rated operating pressure) ;

f) the dimensions and volume of the impounding areas used in the foam expansion ratio measuring test and in the foam efficiency evaluation measuring test ;

g) the quality of the water used (salt, brackish or fresh water) ;

h) technical data sheets of the measuring and recording devices ;

i) the conditions of the foam expansion ratio measuring test as follows :

1) ambient temperature ;

2) wind speed and direction ;

3) air humidity ;

4) water temperature ;

5) flowrate and pressure of the foam generator ;

6) foam concentrate ratio ;

j) the results from the foam expansion ratio measuring test as follows :

1) time for filling the impounding area ;

2) volume of solution ;

3) foam expansion ratio ;

k) the conditions of the evaluation of the foam efficiency on LNG fires as follows :

1) the LNG level in the impounding area at ignition time ;

2) methane content of the LNG measured at the end of the impounding area ;