UDC 628.1/.3:620.113:628.113 DEUTSCHE NORM June 1991

German standard methods for the examination of water, waste water and sludge

General information (group A)

Sampling of cooling water for industrial use (A 22)

DIN 38 402 Part 22

Deutsche Einheitsverfahren zur Wasser-, Abwasser- und Schlammuntersuchung; allgemeine Angaben (Gruppe A); Probenahme von Kühlwasser für den industriellen Gebrauch (A 22)

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

This standard has been prepared jointly with Study Group *Wasserchemie* (Water Chemistry) of the *Gesellschaft Deutscher Chemiker* (German Chemists' Society) (see Explanatory notes).

Expert assistance and specialized laboratories will be required to perform the analysis specified in this standard.

Depending on the objective of the analysis, a check shall be made in each individual case on whether and to what extent additional boundary conditions will have to be specified.

1 Field of application

This standard deals with the sampling of cooling water for industrial use (except for power station cooling water) to determine physical, chemical and microbiological parameters.

General information on sampling is provided in ISO 5667-1: 1980, ISO 5667-2:1982 and ISO 5667-3:1985. DIN 38 411 Part 1 is to be taken into account when preparing samples for subsequent microbiological examination.

2 Scope

This standard describes a method used of collecting, preserving and transporting samples of cooling water from industrial cooling systems so to obtain representative samples for analysis purposes. The objectives of cooling water analysis may include:

a) checking compliance with limiting and guideline values, including those relating to the protection of streams, rivers and lakes from pollution with hazardous substances in cooling water;
b) monitoring the bacterial concentration and microbial growth;
c) checking the chemical treatment condition and monitoring stability of water as regards precipitation of solutes and other substances;
d) monitoring corrosiveness and the performance of processing equipment, such as supplementary water treatment systems.

3 Concepts

3.1 Industrial cooling methods using water as coolant

3.1.1 Single- or multi-pass cooling system

In single- or multi-pass cooling systems, fresh water (groundwater, bank-filtered water, surface water) is used once or repeatedly.

3.1.2 Primary and secondary circuit cooling systems

This cooling system uses two coolant circuits, a closed secondary circuit being cooled by a primary circuit. The primary circuit may consist of a single- or multi-pass cooling system (cf. subclause 3.1.1), an open or closed water recooling tower (cf. subclause 3.1.3) or a refrigeration system (e.g. brine cooling).

3.1.3 Open or closed water recooling towers

In an open recooling tower, heated water is cooled by evaporation, water loss as a result of evaporation, spraying and blowdown demineralization being compensated for by the addition of fresh water. In a closed water recooling tower, the cooling water flows through tubes which are cooled externally by air or water. Both systems may be combined.

3.1.4 Special cooling methods

Use of special cooling methods is mostly required if the medium to be cooled is very hot (e.g. waste heat plants, heat pumps) or where the feed temperatures are to be very low (e.g. brine cooling).

3.2 Sample

3.2.1 Sample

One or more units taken at random from a population or subpopulation (as defined in DIN 55 350 Part 14), the population being represented here by the cooling water.

3.2.2 Composite sample

Sample prepared by mixing samples manually or collected continuously or discretely using automatic sampling apparatus over a given period (quoted from DIN 38 402 Part 11).

4 Designation

Designation of the method of sampling cooling water for industrial use (A 22):

Sampling DIN 38 402 – A 22

Continued on pages 2 to 5

Beuth Verlag GmbH, Berlin, has the exclusive right of sale for German Standards *(DIN-Normen)*.
10.92

DIN 38 402 Part 22 Engl. Price group 6
Sales No. 0106

5 Sampling equipment and containers

Sampling equipment and containers shall be carefully cleaned. The choice of equipment and containers, the material and the cleaning method is a function of the parameters to be determined analytically and of the examination programme. Both equipment and containers shall be rinsed thoroughly with the water to be examined prior to checking the bacterial concentration and microbial growth.

5.1 Materials

The materials used shall preferably be glass and plastic, or stainless steel and aluminium. The use of hose connections shall be kept to a minimum. Bottles or containers made of glass, borosilicate glass, suitable metals (cf. ISO 5667-3: 1985) or plastics shall be used as sample containers. If there is the risk of changes to the water as a result of diffusion, only glass or brosilicate glass bottles or metal containers shall be used.

To determine solvents and other volatile constituents in water, it is essential that glass bottles with sealed ground-glass stopper or solid ground-glass stopper be used.

5.2 Type of sampling equipment

5.2.1 Sampling ladles

Sampling ladles are open containers, which have a nominal capacity of between 0,5 and 2 l and are secured to rods or lines. They are suitable for collecting samples from cooling water pools.

5.2.2 Sampling pipes

Sampling pipes are pipes of small size which may either be installed as dead lines, fitted with a draw-off device (tap), or as bypasses through which the cooling water flows continuously.

6 Procedure

The sample collected shall be representative of the cooling water to be examined. In cases where special analytical methods are involved, due attention shall be paid to the information given in the relevant standards.

The collection of samples from cooling water circuits shall be in accordance with the accident prevention regulations issued by the employers' liability insurance associations and with any local bye-laws (e.g. permits to enter pits or shafts).

It should be noted that Legionella bacteria may be present in water which is constantly at a temperature of about 25 °C to 45 °C (risk of infection if aerosols are formed).

Coordinated action between the person taking the sample and the laboratory carrying out the analysis shall be ensured prior to sampling. Only skilled personnel (staff or persons assigned by the laboratory) shall be employed for sampling.

6.1 Points of sample collection

The points of sample collection should be clearly marked so as to identify to which cooling water system they belong and be easily accessible at any time.

6.1.1 Single- or multi-pass cooling

In the case of single- or multi-pass cooling systems, the points of sample collection shall be located both upstream and downstream of the units to be cooled.

6.1.2 Primary and/or secondary circuit cooling

In the case of primary and/or secondary circuit cooling, the points of sample collection shall be situated on the return side of the circuits, at a location with adequate flow.

6.1.3 Water recooling towers

In the case of water recooling towers, the samples shall be taken on the return side of the system.

6.1.4 Wet cooling towers

In the case of wet cooling towers, samples shall be taken from the basin.

Note. An International Standard dealing with the sampling of water in steam and boiler plant (currently, ISO/DIS 5667-7) is being prepared.

6.2 Frequency of sampling

The frequency of sampling, which is a function of the programme and scope of examination, may be governed by the following factors:

a) legal requirements;
b) source of cooling water (well water, surface water, etc.);
c) variations in the constituents of the fresh water used;
d) bacterial concentration and microbial growth;
e) type of conditioning agents added;
f) leakage monitoring in the case of products to be cooled;
g) Monitoring of limiting values.

Fresh water is usually monitored by taking discrete samples, while processing equipment and limiting values are often assessed by making continuous measurements (e.g. pH value, temperature, electrical conductivity, etc.). Owing to the mode of operation, water should only be drawn from closed systems in exceptional cases, monitoring usually being carried out by continuous measurement.

6.3 Sampling technique

The sample shall be collected directly from bypass piepes or sampling taps or using ladles. For microbiological examinations the taps shall be capable of being flame-sterilized. To determine the bacterial concentration, it will be sufficient to allow an adequate sample volume to run off.

The sample volume will depend on the programme and scope of examination. Large sample volumes intended for the examination for different parameters shall be subdivided on site and transferred to several bottles, taking into account the relevant regulations relating to homogenization.

To determine the gas content quantitatively and to avoid the water quality being altered due to air entrapment, care shall be taken when filling the containers to ensure freedom from air bubbles (e.g. by using the submerged funnel method, or filling by means of a hose extending to the bottom of the bottle until overflow occurs). Such measures are, however, only effective if the prior handling of the sample was in compliance with the relevant requirements.

6.4 Sampling for determination of filterable substances

Particular care is required when sampling water for the determination of filterable substances. The samples are best collected from vertical pipes, at linear velocities high enough to maintain turbulent flow. Long horizontal runs should be avoided when installing sampling pipes. In order to ensure that the sample is collected from an area where there is complete mixing, the length of the sampling pipes shall be at least equal to five times the pipe diameter downstream of the bend.

6.5 Pretreatment, transport and preservation of samples

The samples shall be subdivided on site and transferred to several sample containers, depending on the purpose of the examination and any specific preservation required.