



Designation: D8083 – 16 (Reapproved 2023)

Standard Test Method for Total Nitrogen, and Total Kjeldahl Nitrogen (TKN) by Calculation, in Water by High Temperature Catalytic Combustion and Chemiluminescence Detection¹

This standard is issued under the fixed designation D8083; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the determination of total nitrogen (TN) and total dissolved nitrogen (TDN) in surface water, seawater, groundwater, wastewater, and wastewater effluents in the range from 0.2 mg/L N to 10 mg/L N. Concentrations from 10 mg/L to 500 mg/L are possible when used in conjunction with manual or automatic dilution, or automatic injection of less sample volume. The EPA 40 CFR Part 136 Appendix B Method Detection Limit (MDL) is 0.05 mg/L N. Higher concentrations may be determined by sample dilution. Lower concentrations may be possible by injecting larger sample volumes. Follow the manufacturer's instructions.

1.2 The sample is injected onto a platinum catalyst heated at $\geq 720^\circ\text{C}$. The sample converts into a gaseous phase and is forced through a layer of catalyst ensuring conversion of all nitrogen containing compounds to nitrogen oxide (NO). Reaction with ozone converts the NO to an excited NO_2^* . As the excited NO_2^* returns to the ground state, it emits radiation that is measured photo-electrically.

1.3 Total and dissolved organic carbon analysis by Test Method [D7573](#) can be analyzed at the same time on the same sample simultaneously using a properly equipped analyzer. (See [Appendix X1](#) for an example of simultaneous TOC data.)

1.4 This test method quantitatively recovers nitrogen from a large range of organic and inorganic nitrogen compounds (see [Table 1](#) and [Table 2](#)). The test method does not measure nitrogen gas (N_2). It is the user's responsibility to ensure the validity of this test method for waters of untested matrices.

1.5 This test method is applicable only to nitrogenous matter in the sample that can be introduced into the reaction zone. The syringe needle or injector opening size generally

limits the maximum size of particles that can be so introduced. Optional automatic sample homogenization may be used.

1.6 This test method is performance based. You may make modifications that improve the test method's performance but do not change the oxidation or detection technique.

1.7 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.9 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

- [D1129 Terminology Relating to Water](#)
- [D1193 Specification for Reagent Water](#)
- [D1426 Test Methods for Ammonia Nitrogen in Water](#)
- [D2777 Practice for Determination of Precision and Bias of Applicable Test Methods of Committee D19 on Water](#)
- [D3370 Practices for Sampling Water from Flowing Process Streams](#)
- [D3590 Test Methods for Total Kjeldahl Nitrogen in Water](#)
- [D3867 Test Methods for Nitrite-Nitrate in Water](#)
- [D4327 Test Method for Anions in Water by Suppressed Ion Chromatography](#)
- [D4448 Guide for Sampling Ground-Water Monitoring Wells](#)
- [D5847 Practice for Writing Quality Control Specifications](#)

¹ This test method is under the jurisdiction of ASTM Committee [D19](#) on Water and is the direct responsibility of Subcommittee [D19.06](#) on Methods for Analysis for Organic Substances in Water.

Current edition approved Jan. 1, 2023. Published February 2023. Originally approved in 2016. Last previous edition approved in 2016 as D8083 – 16. DOI: 10.1520/D8083-16R23.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

TABLE 1 Nitrogen Recoveries from Various Compounds in Presence of Organic Carbon

Compound	Nitrogen	ppm Carbon
Potassium Nitrate (100 ppm N)	100 %	0
Potassium Hydrogen Phthalate (0 ppm)	ND	100
Acetonitrile (58.6 ppm N)	104 %	100
Caffeine (58.9 ppm N)	90 %	100
Nicotinic Acid (20 ppm N)	99 %	100
Urea (233 ppm)	91 %	100
Nicotinic Acid (100 ppm N)	97 %	98 %

TABLE 2 Nitrogen Recoveries for a Range of Nitrogen Sources

Compound	TN (mg/L)	Recovery (%)
Ammonium Chloride	0.01	102
Ammonium Sulfate	2	102
Ammonium Sulfate	100	100
Aniline	0.014	101
Arginine	0.007	99
Calcium Nitrate	10	99
Glutamic Acid	0.013	98
Glycine	0.016	103
L-glutamic Acid	2	102
1,6-Hexanediamine	50	101
Imidazole	0.011	100
Nitro aniline	50	100
Nitro phenol	50	102
Potassium Nitrate	10	99
Potassium Nitrate	0.009	99
Potassium Nitrate	50	105
Proline	0.01	99
RNA	0.018	103
Sodium Nitrite	0.009	101
Tri-peptide (Glu-Cys-Gly)	0.014	99
Tryptophan	0.009	103
Urea	0.013	99

for Standard Test Methods for Water Analysis

[D6089](#) Guide for Documenting a Groundwater Sampling Event

[D6538](#) Guide for Sampling Wastewater With Automatic Samplers

[D6759](#) Practice for Sampling Liquids Using Grab and Discrete Depth Samplers

[D6919](#) Test Method for Determination of Dissolved Alkali and Alkaline Earth Cations and Ammonium in Water and Wastewater by Ion Chromatography

[D7573](#) Test Method for Total Carbon and Organic Carbon in Water by High Temperature Catalytic Combustion and Infrared Detection

[D7781](#) Test Method for Nitrite-Nitrate in Water by Nitrate Reductase (Withdrawn 2023)³

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this standard, refer to Terminology [D1129](#).

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *dissolved inorganic nitrogen (DIN)*, *n*—nitrogen in the form of ammonium, nitrate ion, or nitrite ion determined in a filtered sample.

3.2.2 *dissolved nitrogen (DN)*, *n*—nitrogen determined in a filtered sample.

3.2.3 *dissolved organic nitrogen (DON)*, *n*—organic nitrogen determined in a filtered sample.

3.2.4 *particulate nitrogen (PN)*, *n*—nitrogen bound to particulate materials that do not pass through a filter.

3.2.5 *refractory material*, *n*—that which cannot be completely oxidized under the test method conditions.

3.2.6 *total inorganic nitrogen (TIN)*, *n*—nitrogen in the form of ammonium ion, nitrite ion, or nitrate ion.

3.2.7 *total Kjeldahl nitrogen (TKN)*, *n*—the sum of nitrogen contained in free ammonia and other nitrogen compounds which are converted to ammonium sulfate [(NH₄)₂SO₄] under the conditions of Test Method [D3590](#).

3.2.8 *total nitrogen (TN)*, *n*—the sum of TIN and TON.

3.2.9 *total organic nitrogen (TON)*, *n*—nitrogen in the form of organic compounds.

4. Summary of Test Method

4.1 *Fundamentals*—Nitrogen can occur in water as inorganic or organic compounds, or both. This test method can be used to measure TN, and can also determine TON by the difference of TN and TIN measured by other methods, such as Test Method [D4327](#) plus Test Method [D6919](#), Test Method [D1426](#) plus Test Method [D7781](#), or Test Methods [D1426](#) plus Test Method [D3867](#). DON is determined on samples that have been filtered through a quartz fiber filter.

4.2 TON and DON procedures require that samples have been preserved with acid before it is analyzed for organic nitrogen content.

4.3 TN minus nitrate nitrite nitrogen is equivalent to TKN in most samples.

5. Significance and Use

5.1 This test method is used for determination of the total or dissolved nitrogen content of water from a variety of natural, domestic, and industrial sources. In its most common form, this test method is used to measure nitrogen as a means of monitoring nutrient pollutant in industrial wastewater, domestic wastewater, and ambient water. These measurements may also be used in monitoring waste treatment processes.

5.2 This test method measures oxidized ammonia and organic nitrogen (as nitrate) and soluble nitrate simultaneously, subtracting the nitrate + nitrite value from a non-digested sample gives total Kjeldahl nitrogen (TKN).

$$\begin{aligned} \text{TN} &= \text{TKN} + (\text{NO}_3 - \text{N}) + (\text{NO}_2 - \text{N}) \\ \text{TKN} &= \text{NH}_3 - \text{N} + \text{Organic N} \end{aligned}$$

When using this test method:

$$\begin{aligned} \text{TN} &= \text{Digested Sample} - \text{Non-Digested Sample} \\ \text{TKN} &= \text{TN} - [\text{NO}_3 - \text{N} + \text{NO}_2 - \text{N}] \end{aligned}$$

where:

TKN = total Kjeldahl nitrogen.

³ The last approved version of this historical standard is referenced on www.astm.org.