Australian Government
Department of Industry, Science and Resources

National Measurement Institute

NATA
WORLD RECOGNISED ACCREDITATION

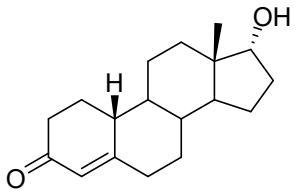
CERTIFIED REFERENCE MATERIAL CERTIFICATE OF ANALYSIS

NMIA D722e: 17α-Nandrolone

Report ID: D722e.2023.02 (Ampouled 180621)

Chemical Formula: $C_{18}H_{26}O_2$

Molecular Weight: 274.4 g/mol



Certified value

Batch No.	CAS No.	Mass per ampoule
18-S-03	4409-34-1	996 ± 14 µg

The uncertainty has been calculated according to ISO 33405 and is stated at the 95% confidence limit (k = 2).

IUPAC name: (17α)-17-Hydroxyestr-4-en-3-one

Expiration of certification: The property values are valid till 1 September 2028, five years from the date of certification provided the **unopened** material is handled and stored in accordance with the recommendations below. The material as issued in the unopened container and stored as recommended below should be suitable for use beyond this date, subject to confirmation of batch stability from the issuing body. The expiry date/shelf life does not apply to ampoules that have been opened. In such cases it is recommended that the end-user conduct their own in-house stability trials. The material will be re-tested periodically to ensure that the property values are still valid. In the event a product fails the stability trial, notification will be sent to all impacted customers.

Description: The compound is supplied as a dried aliquot in a sealed ampoule under an atmosphere of argon. The CRM is intended for a single use to prepare a standard solution containing D722e. This material was prepared by synthesis and certified for identity and purity by NMIA.

Intended use: This certified reference material is suitable for use as a primary calibrator.

Instructions for use: Open the ampoule and carefully rinse the interior at least three times, each time with a minimum of 0.5 mL of a suitable organic solvent (e.g. acetontrile). This process will ensure the transfer of the stated mass per ampoule of anhydrous 17α-nandrolone. The mass of analyte contained in each ampoule has been determined based on the assigned purity of the bulk material and the concentration of that bulk material in the stock solution used during ampoule preparation.

Recommended storage: When not in use, this material should be stored at or below 4 ºC in a closed container in a dry, dark area.

Metrological traceability: The certified purity value is traceable to the SI unit for mass (kg) through Australian national standards via balance calibration. In the mass balance all impurities are quantified as a mass fraction and subtracted from 100%.

Stability: This material has demonstrated stability over a minimum period of three years. The measurement uncertainty at the 95% confidence interval includes a stability component which has been estimated from annual stability trials. The long-term stability of the compound in solution has not been examined.

Homogeneity assessment: The homogeneity of the material was assessed using purity assay by HPLC with UV detection on seven randomly selected ampoules of the material. The material was judged to be sufficiently homogeneous at this level of sampling as the variation in analysis results between samples was not significantly different at a 95% confidence level from that observed on repeat analysis of the same sample.

Safety: Treat as hazardous substance. Use appropriate work practices when handling to avoid skin or eye contact, ingestion or inhalation of dust. Refer to the provided safety data sheet.

S. R. Davies

Dr Stephen R. Davies,
Team Leader,
Chemical Reference Materials, NMI.
16 July 2026

This report supersedes any issued prior to 16 July 2026.

NATA Accreditation No. 198 / Corporate Site No. 14214.

Legal notice: Terms and Conditions associated with the provision of this reference material can be found on the NMIA website.

Characterisation Report:

HPLC:	Instrument:	Shimadzu Binary pump LC-20AB, SIL-20 A HT autosampler or Waters alliance 2695
	Column:	Alltima C-18, 5 μm (4.6 mm x 150 mm)
	Column oven:	40 °C
	Mobile Phase:	A = MilliQ water; B = Acetonitrile 0-12 min 45% B; 12-15 min 45-80% B; 15-19 min 80% B; 19-21 min 80-45% B; 21-30 min 45% B
	Flow rate:	1.0 mL/min
	Detector:	Shimadzu SPD-M20A or Waters 2998 PDA operating at 243 nm
	Relative mass fraction of the main component:	
	Initial analysis:	Mean = 99.5%, s = 0.01% (7 ampoules in duplicate, June 2018)
	Re analysis:	Mean = 99.4%, s = 0.01% (5 ampoules in duplicate, July 2019)
	Re analysis:	Mean = 99.5%, s = 0.01% (5 ampoules in duplicate, July 2020)
	Re analysis:	Mean = 99.4%, s = 0.05% (5 ampoules in duplicate, July 2021)
	Re analysis:	Mean = 99.4%, s = 0.02% (5 ampoules in duplicate, September 2023)

The following analytical data was obtained on the bulk material subsequently used in the preparation of the ampoules.

The identity was confirmed by a range of spectroscopic techniques, NMR, IR and MS. The certified purity value was obtained by mass balance from a combination of traditional analytical techniques, including HPLC with UV detection, thermogravimetric analysis, Karl Fischer analysis and ^{1}H NMR spectroscopy. The purity value is calculated as per Equation 1.

$$\text{Purity} = (100\ \% - I_{ORG}) \times (100\ \% - I_{VOL} - I_{NVR}) \qquad \text{Equation 1}$$

I_{ORG} = Organic impurities of related structure, I_{VOL} = volatile impurities, I_{NVR} = non-volatile residue.

Supporting evidence is provided by qualitative headspace GC-MS analysis of occluded solvents and elemental microanalysis.

HPLC:	Instrument:	Shimadzu Binary pump LC-20AB, SIL-20 A HT autosampler
	Column:	Alltima C-18, 5 μm (4.6 mm x 150 mm)
	Column oven:	40 °C
	Mobile Phase:	A = MilliQ water; B = Acetonitrile 0-12 min 45% B; 12-15 min 45-80% B; 15-19 min 80% B; 19-21 min 80-45% B; 21-30 min 45% B.
	Flow rate:	1.0 mL/min
	Detector:	Shimadzu SPD-M20A PDA operating at 243 nm
	Relative mass fraction of the main component:	
	Initial analysis:	Mean = 99.6%, s = 0.03% (10 sub samples in duplicate, June 2018)
Karl Fischer analysis:		Moisture content ≤ 0.1% mass fraction (April 2018)
Thermogravimetric analysis:		Volatiles content 0.2% and non-volatile residue < 0.2% mass fraction (April 2018)

Spectroscopic and other characterisation data

GC-MS:	Instrument:	HP6890/5973
	Column:	TG-1MS, 30 m x 0.25 mm I.D. x 0.25 μm
	Program:	180 °C (1 min), 15 °C/min to 300 °C (3 min)
	Injector:	250 °C
	Split ratio:	20/1
	Transfer line temp:	280 °C
	Carrier:	Helium
	Scan range:	50-550 *m/z*
	The retention time of the parent compound isreported with the major peaks in the mass spectra. The latter are reported as mass/charge ratios and (in brackets) as a percentage relative to the base peak.	
	Parent (10.4 min):	274 (M^+, 53), 256 (26), 231 (21), 207 (24), 160 (21), 147 (21), 110 (100), 105 (33), 93 (21), 91 (55), 79 (46), 77 (21) *m/z*
HS-GC-MS:	Instrument:	Agilent 6890/5973/G1888
	Column:	DB-624, 30 m x 0.25 mm I.D. x 1.4 μm
	Program:	50 °C (5 min), 7 °C/min to 120 °C, 15 °C/min to 220 °C (8.3 min)
	Injector:	150 °C
	Transfer line temp:	280 °C
	Carrier:	Helium, 1.2 mL/min
	Split ratio:	50/1
	Solvents detected:	Ethyl acetate, hexane
TLC:	Conditions:	Kieselgel 60F_{254}. Hexane/ethyl acetate (3:2) Single spot observed, R_f = 0.4.
IR:	Instrument:	Biorad FTS3000 MX FT-IR
	Range:	4000-400 cm^{-1}, KBr powder
	Peaks:	3426, 2965, 2937, 2897, 2860, 1663, 1610, 1447, 1336, 1263, 1202, 1102, 1050, 969, 874 cm^{-1}
^{1}H NMR:	Instrument:	Bruker Avance III-500
	Field strength:	500 MHz
	Solvent:	Benzene-d_6 (7.16 ppm)
	Spectral data:	δ 0.48 (1H, m), 0.51 (3H, s), 0.74-1.02 (5H, m), 1.11 (1H, m), 1.26 (1H, m), 1.32-1.54 (6H, m), 1.60 (1H, m), 1.69-1.82 (2H, m), 1.94-2.05 (3H, m), 2.32 (1H, dt, *J* = 16.0, 4.5 Hz), 3.51 (1H, dd, *J* = 3.5, 5.5 Hz), 5.91 (1H, s) ppm
	Ethyl acetate estimated at 0.1% mass fraction was observed in the ^{1}H NMR.	
^{13}C NMR:	Instrument:	Bruker Avance III-500
	Field strength:	126 MHz
	Solvent:	Benzene-d_6 (128.1 ppm)
	Spectral data:	δ 17.2, 24.7, 26.2, 26.8, 31.4, 31.8, 32.9, 35.5, 36.9, 40.9, 42.4, 45.5, 47.5, 49.3, 79.5, 125.1, 164.7, 197.9 ppm
Melting point:		150-151 °C
Microanalysis:	Found:	C = 78.9%; H = 9.9% (November 2015)
	Calculated:	C = 78.8%; H = 9.6% (Calculated for $C_{18}H_{26}O_2$)