



Full wwPDB X-ray Structure Validation Report ⓘ

Jul 31, 2023 – 11:48 PM EDT

PDB ID : 5MDH
Title : CRYSTAL STRUCTURE OF TERNARY COMPLEX OF PORCINE CYTOPLASMIC MALATE DEHYDROGENASE ALPHA-KETOMALONATE AND TNAD AT 2.4 ANGSTROMS RESOLUTION
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Deposited on : 1998-10-08
Resolution : 2.40 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.34

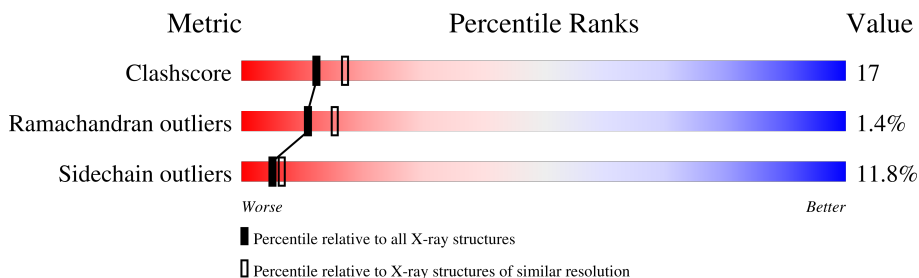
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.40 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
Clashscore	141614	4398 (2.40-2.40)
Ramachandran outliers	138981	4318 (2.40-2.40)
Sidechain outliers	138945	4319 (2.40-2.40)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	333	 64% 29% 5% •
1	B	333	 60% 30% 8% •

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 5558 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called MALATE DEHYDROGENASE.

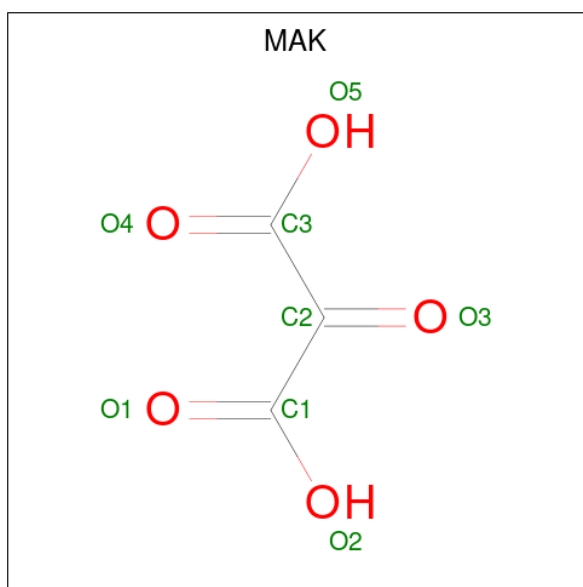
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	333	Total	C	N	O	S	0	0	0
			2550	1623	427	487	13			
1	B	333	Total	C	N	O	S	121	0	0
			2550	1623	427	487	13			

- Molecule 2 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (three-letter code: NAD) (formula: $C_{21}H_{27}N_7O_{14}P_2$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	P		
2	A	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
2	B	1	Total	C	N	O	P	0	0
			44	21	7	14	2		

- Molecule 3 is ALPHA-KETOMALONIC ACID (three-letter code: MAK) (formula: $C_3H_2O_5$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 8 3 5	0	0
3	B	1	Total C O 8 3 5	0	0

- Molecule 4 is water.

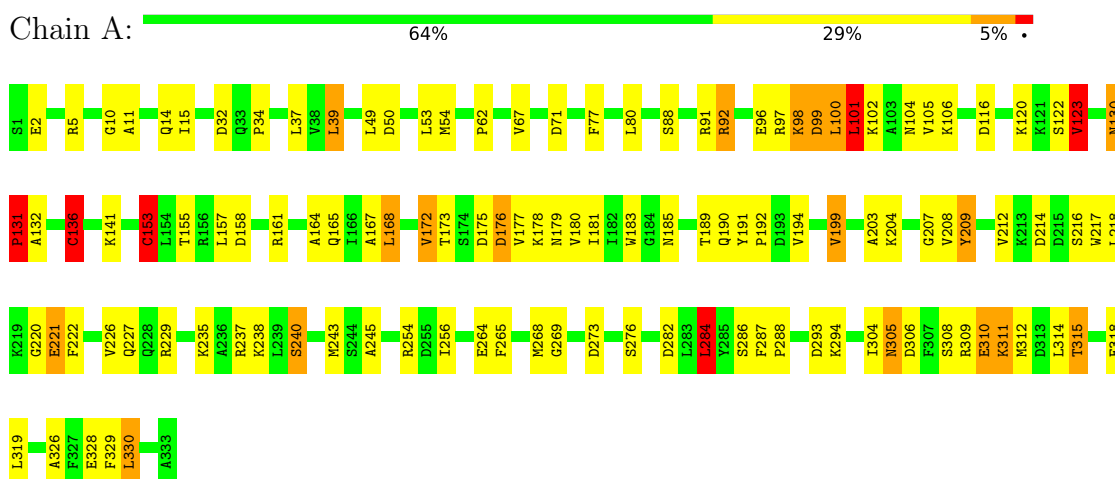
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	189	Total O 189 189	0	0
4	B	165	Total O 165 165	0	0

3 Residue-property plots [i](#)

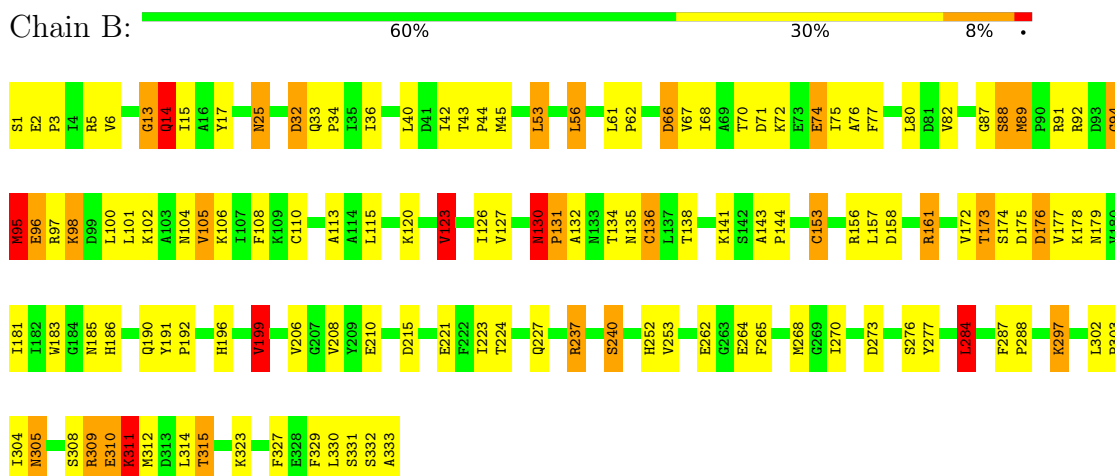
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

Note EDS was not executed.

• Molecule 1: MALATE DEHYDROGENASE



• Molecule 1: MALATE DEHYDROGENASE



4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	85.70Å 144.43Å 59.23Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	15.00 – 2.40	Depositor
% Data completeness (in resolution range)	84.3 (15.00-2.40)	Depositor
R_{merge}	0.09	Depositor
R_{sym}	0.09	Depositor
Refinement program	REFMAC	Depositor
R, R_{free}	0.199 , 0.253	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	5558	wwPDB-VP
Average B, all atoms (Å ²)	46.0	wwPDB-VP

5 Model quality i

5.1 Standard geometry i

Bond lengths and bond angles in the following residue types are not validated in this section: NAD, MAK

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
1	A	0.55	0/2592	1.46	34/3503 (1.0%)
1	B	0.90	4/2592 (0.2%)	1.65	35/3503 (1.0%)
All	All	0.75	4/5184 (0.1%)	1.56	69/7006 (1.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	2
1	B	0	7
All	All	0	9

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	96	GLU	C-N	-29.23	0.66	1.34
1	B	104	ASN	C-N	19.55	1.79	1.34
1	B	94	GLY	C-N	-5.26	1.22	1.34
1	B	136	CYS	CB-SG	-5.26	1.73	1.81

All (69) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	96	GLU	O-C-N	-36.77	63.88	122.70
1	B	96	GLU	CA-C-N	19.38	159.84	117.20
1	A	92	ARG	NE-CZ-NH1	17.43	129.02	120.30
1	B	94	GLY	O-C-N	-16.48	96.32	122.70
1	B	5	ARG	NE-CZ-NH2	-12.07	114.26	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	95	MET	O-C-N	-11.02	105.07	122.70
1	B	98	LYS	CG-CD-CE	-10.64	79.97	111.90
1	B	131	PRO	CA-N-CD	-10.50	96.80	111.50
1	B	104	ASN	C-N-CA	-10.27	96.03	121.70
1	A	92	ARG	CD-NE-CZ	9.68	137.15	123.60
1	A	97	ARG	CD-NE-CZ	9.62	137.07	123.60
1	B	136	CYS	CA-CB-SG	9.39	130.91	114.00
1	A	130	ASN	CA-C-O	-9.21	100.76	120.10
1	A	136	CYS	CA-CB-SG	8.88	129.99	114.00
1	A	99	ASP	N-CA-CB	8.88	126.58	110.60
1	B	13	GLY	N-CA-C	8.70	134.85	113.10
1	B	95	MET	C-N-CA	-8.64	100.10	121.70
1	B	96	GLU	C-N-CA	8.55	143.07	121.70
1	B	89	MET	O-C-N	-8.27	105.39	121.10
1	A	254	ARG	NE-CZ-NH1	7.90	124.25	120.30
1	B	309	ARG	CD-NE-CZ	7.78	134.49	123.60
1	A	123	VAL	CB-CA-C	-7.75	96.67	111.40
1	A	92	ARG	NE-CZ-NH2	-7.70	116.45	120.30
1	B	123	VAL	CB-CA-C	-7.39	97.36	111.40
1	B	175	ASP	CB-CG-OD1	7.27	124.84	118.30
1	B	131	PRO	N-CA-CB	7.26	112.01	103.30
1	A	176	ASP	CB-CG-OD1	7.23	124.81	118.30
1	B	156	ARG	NE-CZ-NH1	-7.17	116.71	120.30
1	B	66	ASP	CB-CG-OD1	7.15	124.73	118.30
1	B	130	ASN	CA-C-O	-7.09	105.20	120.10
1	A	309	ARG	NE-CZ-NH1	6.97	123.79	120.30
1	B	199	VAL	CB-CA-C	-6.83	98.43	111.40
1	B	273	ASP	CB-CG-OD1	6.55	124.20	118.30
1	A	131	PRO	CA-N-CD	-6.40	102.54	111.50
1	A	284	LEU	CB-CA-C	6.35	122.26	110.20
1	B	25	ASN	CB-CA-C	-6.35	97.71	110.40
1	B	309	ARG	NE-CZ-NH1	6.24	123.42	120.30
1	B	96	GLU	CA-C-O	6.21	133.15	120.10
1	B	161	ARG	CD-NE-CZ	-6.21	114.90	123.60
1	A	254	ARG	NE-CZ-NH2	-6.02	117.29	120.30
1	B	237	ARG	NE-CZ-NH1	-5.97	117.31	120.30
1	A	96	GLU	OE1-CD-OE2	-5.90	116.22	123.30
1	A	153	CYS	N-CA-CB	5.87	121.16	110.60
1	A	229	ARG	CD-NE-CZ	5.84	131.78	123.60
1	A	328	GLU	OE1-CD-OE2	-5.83	116.30	123.30
1	A	71	ASP	CB-CG-OD1	5.83	123.55	118.30
1	A	183	TRP	CA-CB-CG	5.68	124.50	113.70

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	99	ASP	CB-CG-OD2	5.62	123.36	118.30
1	A	318	GLU	OE1-CD-OE2	-5.50	116.70	123.30
1	A	214	ASP	CB-CG-OD2	5.48	123.23	118.30
1	A	116	ASP	CB-CG-OD1	5.46	123.22	118.30
1	A	99	ASP	N-CA-C	-5.45	96.28	111.00
1	B	176	ASP	CB-CG-OD2	5.43	123.19	118.30
1	A	5	ARG	CB-CA-C	5.41	121.22	110.40
1	A	98	LYS	CA-CB-CG	5.38	125.23	113.40
1	B	284	LEU	CA-CB-CG	-5.36	102.97	115.30
1	B	215	ASP	CB-CG-OD1	5.33	123.10	118.30
1	A	161	ARG	NE-CZ-NH2	-5.32	117.64	120.30
1	A	273	ASP	CB-CG-OD2	5.31	123.08	118.30
1	B	5	ARG	NE-CZ-NH1	5.28	122.94	120.30
1	A	50	ASP	CB-CG-OD1	5.16	122.94	118.30
1	B	183	TRP	CA-CB-CG	5.14	123.48	113.70
1	B	134	THR	CA-CB-CG2	-5.13	105.22	112.40
1	A	101	LEU	CA-CB-CG	5.11	127.05	115.30
1	A	97	ARG	NE-CZ-NH2	5.11	122.85	120.30
1	A	306	ASP	CB-CG-OD1	5.10	122.89	118.30
1	B	161	ARG	NE-CZ-NH1	5.07	122.83	120.30
1	B	13	GLY	O-C-N	-5.05	114.62	122.70
1	A	209	TYR	CB-CG-CD2	-5.02	117.99	121.00

There are no chirality outliers.

All (9) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	130	ASN	Mainchain,Peptide
1	B	130	ASN	Mainchain,Peptide
1	B	89	MET	Mainchain
1	B	94	GLY	Mainchain
1	B	95	MET	Mainchain,Peptide
1	B	96	GLU	Mainchain

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2550	0	2615	82	0
1	B	2550	0	2609	90	0
2	A	44	0	26	3	0
2	B	44	0	26	4	0
3	A	8	0	2	1	0
3	B	8	0	1	2	0
4	A	189	0	0	10	0
4	B	165	0	0	13	0
All	All	5558	0	5279	173	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 17.

All (173) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:136:CYS:SG	4:B:499:HOH:O	2.07	1.12
1:A:14:GLN:HE22	1:A:237:ARG:NH2	1.56	1.03
1:A:153:CYS:SG	4:A:521:HOH:O	2.21	0.98
1:B:153:CYS:SG	4:B:500:HOH:O	2.21	0.97
1:A:14:GLN:HE22	1:A:237:ARG:HH22	0.92	0.92
1:A:14:GLN:NE2	1:A:237:ARG:HH22	1.67	0.90
1:A:167:ALA:HA	1:A:172:VAL:HG12	1.53	0.89
1:B:14:GLN:HG2	1:B:240:SER:HB2	1.57	0.87
1:B:310:GLU:O	1:B:311:LYS:HB2	1.76	0.85
1:B:77:PHE:HA	1:B:80:LEU:HD11	1.59	0.85
1:A:185:ASN:H	1:A:315:THR:HG21	1.46	0.80
1:B:186:HIS:HE1	3:B:335:MAK:O5	1.64	0.80
1:A:305:ASN:ND2	1:A:308:SER:H	1.81	0.78
1:B:158:ASP:HB3	1:B:190:GLN:HE22	1.48	0.78
1:A:153:CYS:SG	1:A:284:LEU:HD22	2.23	0.78
1:B:153:CYS:SG	1:B:284:LEU:HD22	2.26	0.76
1:B:126:ILE:HD12	1:B:252:HIS:CE1	2.21	0.76
1:A:237:ARG:O	1:A:238:LYS:HB2	1.88	0.74
1:A:132:ALA:O	1:A:136:CYS:HB2	1.87	0.74
1:A:256:ILE:HD11	1:A:268:MET:HE3	1.67	0.74
1:A:15:ILE:HD12	2:A:334:NAD:H51N	1.71	0.72
1:A:305:ASN:HD22	1:A:308:SER:H	1.40	0.69
1:A:310:GLU:O	1:A:311:LYS:HB2	1.92	0.69
1:A:185:ASN:H	1:A:315:THR:CG2	2.08	0.66
1:B:186:HIS:CE1	3:B:335:MAK:O5	2.48	0.66
1:B:323:LYS:HG2	1:B:327:PHE:CE2	2.31	0.66

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:120:LYS:O	1:B:123:VAL:HG22	1.95	0.65
1:A:99:ASP:OD1	1:A:100:LEU:N	2.30	0.64
1:B:223:ILE:O	1:B:227:GLN:HG3	1.97	0.64
1:B:14:GLN:HE21	1:B:240:SER:H	1.43	0.64
1:A:14:GLN:NE2	1:A:237:ARG:NH2	2.36	0.63
1:B:130:ASN:HD22	1:B:132:ALA:H	1.46	0.63
1:A:155:THR:HG21	1:A:286:SER:HB2	1.82	0.62
1:A:153:CYS:SG	1:A:284:LEU:CD2	2.87	0.62
1:A:310:GLU:O	1:A:311:LYS:CB	2.47	0.62
1:A:157:LEU:HD22	1:A:245:ALA:HA	1.80	0.61
1:B:181:ILE:HG12	1:B:288:PRO:HB3	1.83	0.60
1:B:136:CYS:SG	1:B:284:LEU:HD22	2.41	0.60
1:B:77:PHE:HA	1:B:80:LEU:CD1	2.31	0.59
1:B:130:ASN:HD21	1:B:186:HIS:HD2	1.50	0.59
1:B:331:SER:HB3	4:B:495:HOH:O	2.02	0.59
1:B:179:ASN:HD21	1:B:264:GLU:HA	1.68	0.58
1:B:332:SER:O	1:B:333:ALA:HB3	2.03	0.58
1:A:101:LEU:HD11	1:A:326:ALA:HB2	1.86	0.57
1:A:173:THR:HB	1:A:176:ASP:OD2	2.05	0.56
1:B:153:CYS:SG	1:B:284:LEU:CD2	2.93	0.56
1:A:269:GLY:HA2	1:A:286:SER:HA	1.86	0.56
1:B:77:PHE:CD1	1:B:115:LEU:HG	2.40	0.56
1:A:179:ASN:HD21	1:A:264:GLU:HA	1.70	0.56
1:A:158:ASP:HB3	1:A:190:GLN:NE2	2.21	0.55
1:B:40:LEU:HD13	1:B:76:ALA:HB2	1.87	0.55
1:B:304:ILE:HD12	1:B:312:MET:CE	2.38	0.54
1:B:179:ASN:ND2	1:B:265:PHE:H	2.05	0.54
1:A:164:ALA:O	1:A:168:LEU:HD12	2.07	0.54
1:B:132:ALA:O	1:B:136:CYS:HB2	2.06	0.54
1:B:87:GLY:O	1:B:88:SER:HB3	2.06	0.53
1:A:101:LEU:HD22	1:A:131:PRO:HG3	1.91	0.53
1:A:310:GLU:OE2	1:A:314:LEU:HD11	2.09	0.53
1:A:53:LEU:HD22	1:A:67:VAL:HG11	1.90	0.52
1:B:305:ASN:ND2	1:B:308:SER:H	2.08	0.52
1:A:207:GLY:HA3	4:A:468:HOH:O	2.10	0.52
1:A:240:SER:HB2	4:A:412:HOH:O	2.09	0.52
1:B:323:LYS:HE2	1:B:327:PHE:HE2	1.75	0.52
1:A:179:ASN:ND2	1:A:265:PHE:H	2.08	0.52
1:B:177:VAL:HG22	1:B:199:VAL:HG13	1.92	0.52
2:B:334:NAD:H2B	4:B:421:HOH:O	2.09	0.52
1:B:45:MET:HE2	4:B:451:HOH:O	2.10	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:243:MET:CE	1:B:56:LEU:HD13	2.40	0.51
1:B:196:HIS:HE1	4:B:366:HOH:O	1.93	0.51
1:A:11:ALA:HB1	1:A:39:LEU:HG	1.92	0.51
1:A:217:TRP:CE3	1:A:218:LEU:HD23	2.46	0.51
1:A:153:CYS:CB	4:A:521:HOH:O	2.54	0.51
1:B:36:ILE:HG23	1:B:66:ASP:HB3	1.93	0.51
1:B:287:PHE:HB3	1:B:288:PRO:HD2	1.93	0.51
1:B:308:SER:HB3	1:B:312:MET:HE3	1.93	0.50
1:B:126:ILE:HD12	1:B:252:HIS:HE1	1.73	0.50
1:A:181:ILE:HG12	1:A:288:PRO:HB3	1.92	0.50
1:A:120:LYS:O	1:A:123:VAL:HG22	2.12	0.50
1:B:53:LEU:HD13	1:B:67:VAL:HB	1.94	0.49
1:B:173:THR:HG23	4:B:363:HOH:O	2.10	0.49
1:A:54:MET:HE2	4:B:416:HOH:O	2.12	0.49
1:B:206:VAL:O	1:B:210:GLU:OE1	2.30	0.49
1:A:100:LEU:O	1:A:104:ASN:HB2	2.12	0.49
1:A:217:TRP:NE1	1:A:221:GLU:OE1	2.44	0.49
1:B:126:ILE:HG13	1:B:253:VAL:HG22	1.95	0.48
1:A:172:VAL:HG22	1:A:176:ASP:OD2	2.13	0.48
1:A:99:ASP:O	1:A:100:LEU:CB	2.62	0.48
1:B:185:ASN:H	1:B:315:THR:HG21	1.78	0.48
1:B:17:TYR:HB2	4:B:493:HOH:O	2.14	0.47
1:A:141:LYS:NZ	1:A:282:ASP:OD1	2.47	0.47
1:B:6:VAL:HG22	1:B:82:VAL:HB	1.96	0.47
1:A:177:VAL:HG22	1:A:199:VAL:HG12	1.95	0.47
1:A:158:ASP:HB3	1:A:190:GLN:HE22	1.80	0.47
1:A:208:VAL:O	1:A:212:VAL:HG23	2.14	0.47
1:A:153:CYS:HB2	4:A:521:HOH:O	2.14	0.47
1:A:102:LYS:HD3	1:A:329:PHE:CD1	2.50	0.47
1:A:10:GLY:HA2	2:A:334:NAD:H1B	1.96	0.46
1:B:191:TYR:CD1	1:B:311:LYS:HG2	2.50	0.46
1:A:304:ILE:HD12	1:A:312:MET:CE	2.45	0.46
1:B:173:THR:HB	1:B:176:ASP:OD2	2.16	0.46
1:A:179:ASN:HD21	1:A:265:PHE:H	1.61	0.46
1:A:189:THR:OG1	1:A:315:THR:HG23	2.16	0.46
1:A:319:LEU:HD22	4:A:385:HOH:O	2.16	0.46
1:B:61:LEU:HA	1:B:62:PRO:HD2	1.85	0.46
1:B:210:GLU:HB2	4:B:349:HOH:O	2.15	0.46
1:B:153:CYS:CB	4:B:500:HOH:O	2.61	0.46
1:B:179:ASN:HD21	1:B:265:PHE:H	1.63	0.46
1:B:43:THR:OG1	1:B:71:ASP:OD2	2.31	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:74:GLU:H	1:B:74:GLU:HG3	1.63	0.45
1:A:293:ASP:O	1:A:294:LYS:HB2	2.16	0.45
1:B:305:ASN:C	1:B:305:ASN:HD22	2.19	0.45
1:B:141:LYS:HE3	1:B:327:PHE:CZ	2.52	0.45
1:B:157:LEU:O	1:B:161:ARG:HG3	2.17	0.45
1:A:173:THR:HG22	1:A:175:ASP:N	2.32	0.45
1:B:329:PHE:O	1:B:332:SER:HB2	2.17	0.45
1:A:136:CYS:SG	1:A:284:LEU:HD22	2.58	0.44
1:A:287:PHE:HB3	1:A:288:PRO:HD2	1.99	0.44
1:A:32:ASP:O	1:A:34:PRO:HD3	2.17	0.44
1:A:190:GLN:NE2	1:A:226:VAL:HG12	2.32	0.44
1:B:70:THR:HB	1:B:72:LYS:H	1.82	0.44
1:B:72:LYS:HB2	1:B:75:ILE:HG12	2.00	0.44
1:A:190:GLN:HG2	1:A:227:GLN:HG2	1.98	0.44
1:A:77:PHE:HA	1:A:80:LEU:HD11	1.99	0.44
1:B:15:ILE:HD12	2:B:334:NAD:H51N	1.99	0.44
1:B:70:THR:HG21	1:B:75:ILE:HB	1.99	0.44
1:A:308:SER:HB3	1:A:312:MET:HE3	2.00	0.44
1:B:15:ILE:HD11	2:B:334:NAD:C6N	2.48	0.43
1:B:179:ASN:HB3	1:B:265:PHE:CZ	2.53	0.43
1:B:332:SER:O	1:B:333:ALA:CB	2.66	0.43
1:A:217:TRP:HE3	1:A:218:LEU:HD23	1.83	0.43
1:B:127:VAL:HB	1:B:153:CYS:HB3	2.00	0.43
1:B:224:THR:HA	1:B:227:GLN:HE21	1.83	0.43
1:A:209:TYR:HD1	4:A:376:HOH:O	2.02	0.43
2:A:334:NAD:C4N	3:A:335:MAK:C3	2.96	0.43
1:B:110:CYS:O	1:B:113:ALA:HB3	2.19	0.43
1:B:53:LEU:HD13	1:B:67:VAL:CG1	2.49	0.43
1:B:105:VAL:HG22	1:B:138:THR:OG1	2.18	0.42
1:A:62:PRO:HD2	4:A:351:HOH:O	2.18	0.42
1:A:155:THR:HG21	1:A:286:SER:CB	2.49	0.42
1:B:42:ILE:HG13	1:B:44:PRO:HD2	2.00	0.42
1:B:143:ALA:N	1:B:144:PRO:HD3	2.33	0.42
1:B:277:TYR:O	1:B:309:ARG:NH2	2.46	0.42
1:A:237:ARG:NH1	4:A:362:HOH:O	2.52	0.42
1:B:136:CYS:SG	1:B:284:LEU:CD2	3.07	0.42
1:B:70:THR:HG21	1:B:75:ILE:CB	2.49	0.42
1:A:212:VAL:HG21	1:A:218:LEU:HD21	2.01	0.42
1:B:191:TYR:HA	1:B:192:PRO:HD3	1.88	0.42
1:A:209:TYR:CD2	1:A:218:LEU:HD12	2.55	0.42
1:A:311:LYS:H	1:A:314:LEU:HG	1.84	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:32:ASP:O	1:B:34:PRO:HD3	2.20	0.42
1:B:33:GLN:HA	1:B:34:PRO:HD3	1.91	0.42
1:B:53:LEU:CD1	1:B:67:VAL:HB	2.49	0.42
1:B:108:PHE:CD2	1:B:135:ASN:HB3	2.55	0.42
1:B:237:ARG:HH11	1:B:237:ARG:HD3	1.70	0.41
1:B:108:PHE:CG	1:B:135:ASN:HB3	2.55	0.41
1:B:2:GLU:HB3	1:B:3:PRO:HD2	2.02	0.41
1:B:13:GLY:O	2:B:334:NAD:O2N	2.38	0.41
1:A:91:ARG:N	1:A:100:LEU:HD11	2.36	0.41
1:A:180:VAL:HG12	1:A:194:VAL:HG12	2.02	0.41
1:A:240:SER:HB3	4:A:479:HOH:O	2.21	0.41
1:A:329:PHE:CD2	1:A:330:LEU:HD13	2.55	0.41
1:B:153:CYS:HB2	4:B:500:HOH:O	2.21	0.41
1:B:297:LYS:HG2	4:B:371:HOH:O	2.21	0.41
1:A:216:SER:O	1:A:220:GLY:N	2.54	0.41
1:B:127:VAL:HG21	1:B:136:CYS:HA	2.02	0.41
1:A:203:ALA:O	1:A:204:LYS:HB2	2.21	0.41
1:A:304:ILE:HD12	1:A:312:MET:HE3	2.02	0.41
1:A:191:TYR:HA	1:A:192:PRO:HD3	1.88	0.40
1:A:329:PHE:HD2	1:A:330:LEU:HD13	1.86	0.40
1:B:302:LEU:HA	1:B:303:PRO:HD3	1.93	0.40
1:B:53:LEU:O	1:B:53:LEU:HD12	2.22	0.40
1:B:304:ILE:HD12	1:B:312:MET:HE1	2.03	0.40
1:A:165:GLN:HB2	1:A:222:PHE:HE1	1.85	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	331/333 (99%)	310 (94%)	18 (5%)	3 (1%)	17 25

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	331/333 (99%)	305 (92%)	20 (6%)	6 (2%)	8	10
All	All	662/666 (99%)	615 (93%)	38 (6%)	9 (1%)	11	15

All (9) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	311	LYS
1	B	95	MET
1	B	311	LYS
1	A	100	LEU
1	B	100	LEU
1	B	88	SER
1	B	131	PRO
1	B	14	GLN
1	A	131	PRO

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	280/280 (100%)	253 (90%)	27 (10%)	8	12
1	B	280/280 (100%)	241 (86%)	39 (14%)	3	4
All	All	560/560 (100%)	494 (88%)	66 (12%)	5	7

All (66) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	2	GLU
1	A	37	LEU
1	A	39	LEU
1	A	49	LEU
1	A	88	SER
1	A	92	ARG
1	A	98	LYS

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Mol	Chain	Res	Type
1	A	101	LEU
1	A	105	VAL
1	A	106	LYS
1	A	122	SER
1	A	123	VAL
1	A	136	CYS
1	A	153	CYS
1	A	168	LEU
1	A	172	VAL
1	A	178	LYS
1	A	199	VAL
1	A	221	GLU
1	A	235	LYS
1	A	240	SER
1	A	276	SER
1	A	284	LEU
1	A	305	ASN
1	A	310	GLU
1	A	315	THR
1	A	330	LEU
1	B	1	SER
1	B	14	GLN
1	B	25	ASN
1	B	32	ASP
1	B	53	LEU
1	B	56	LEU
1	B	68	ILE
1	B	74	GLU
1	B	91	ARG
1	B	92	ARG
1	B	95	MET
1	B	97	ARG
1	B	98	LYS
1	B	101	LEU
1	B	102	LYS
1	B	105	VAL
1	B	106	LYS
1	B	123	VAL
1	B	153	CYS
1	B	172	VAL
1	B	173	THR
1	B	174	SER

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Mol	Chain	Res	Type
1	B	178	LYS
1	B	199	VAL
1	B	208	VAL
1	B	221	GLU
1	B	240	SER
1	B	262	GLU
1	B	268	MET
1	B	270	ILE
1	B	276	SER
1	B	284	LEU
1	B	297	LYS
1	B	305	ASN
1	B	310	GLU
1	B	311	LYS
1	B	314	LEU
1	B	315	THR
1	B	330	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (17) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	14	GLN
1	A	135	ASN
1	A	150	ASN
1	A	179	ASN
1	A	190	GLN
1	A	305	ASN
1	B	14	GLN
1	B	25	ASN
1	B	130	ASN
1	B	135	ASN
1	B	150	ASN
1	B	179	ASN
1	B	186	HIS
1	B	190	GLN
1	B	227	GLN
1	B	252	HIS
1	B	305	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

4 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	NAD	B	334	-	42,48,48	1.16	5 (11%)	50,73,73	2.14	12 (24%)
2	NAD	A	334	-	42,48,48	1.05	2 (4%)	50,73,73	2.04	10 (20%)
3	MAK	B	335	1	7,7,7	1.57	2 (28%)	8,9,9	0.64	0
3	MAK	A	335	-	7,7,7	1.59	2 (28%)	8,9,9	0.65	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NAD	B	334	-	-	7/26/62/62	0/5/5/5
2	NAD	A	334	-	-	14/26/62/62	0/5/5/5
3	MAK	B	335	1	-	0/8/8/8	-
3	MAK	A	335	-	-	0/8/8/8	-

All (11) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	334	NAD	C3N-C7N	3.85	1.56	1.50
2	B	334	NAD	C3N-C7N	3.81	1.56	1.50
2	A	334	NAD	C6N-N1N	2.60	1.41	1.35
3	B	335	MAK	O5-C3	2.45	1.37	1.30
3	A	335	MAK	O5-C3	2.45	1.37	1.30
3	A	335	MAK	O2-C1	2.45	1.37	1.30
2	B	334	NAD	C6N-N1N	2.45	1.41	1.35
3	B	335	MAK	O2-C1	2.41	1.37	1.30
2	B	334	NAD	C4N-C3N	2.10	1.42	1.39
2	B	334	NAD	O4B-C1B	2.08	1.44	1.41
2	B	334	NAD	O4D-C1D	2.02	1.43	1.41

All (22) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	334	NAD	C5N-C4N-C3N	-6.92	112.16	120.34
2	A	334	NAD	C5N-C4N-C3N	-6.15	113.07	120.34
2	A	334	NAD	C6N-C5N-C4N	5.89	128.00	119.44
2	B	334	NAD	C6N-C5N-C4N	5.65	127.65	119.44
2	B	334	NAD	C2N-C3N-C4N	4.73	123.62	118.26
2	A	334	NAD	C5N-C6N-N1N	-4.73	113.62	120.40
2	A	334	NAD	C4N-C3N-C7N	-4.33	109.45	121.04
2	B	334	NAD	O4D-C1D-C2D	-4.19	100.80	106.93
2	A	334	NAD	C2N-C3N-C4N	4.02	122.82	118.26
2	B	334	NAD	C5N-C6N-N1N	-3.82	114.92	120.40
2	B	334	NAD	O7N-C7N-N7N	3.73	127.88	122.58
2	B	334	NAD	C4N-C3N-C7N	-3.68	111.18	121.04
2	B	334	NAD	O4B-C1B-C2B	-3.44	101.90	106.93
2	A	334	NAD	O4B-C1B-C2B	-3.23	102.20	106.93
2	A	334	NAD	O7N-C7N-C3N	-3.15	115.86	119.63
2	A	334	NAD	C2N-C3N-C7N	2.85	127.73	119.46
2	A	334	NAD	O7N-C7N-N7N	2.68	126.38	122.58
2	B	334	NAD	C3N-C7N-N7N	-2.59	114.64	117.75
2	A	334	NAD	O4D-C1D-C2D	-2.57	103.16	106.93
2	B	334	NAD	PN-O3-PA	-2.28	125.00	132.83
2	B	334	NAD	O3D-C3D-C4D	-2.21	104.67	111.05
2	B	334	NAD	C5A-C6A-N6A	2.16	123.63	120.35

There are no chirality outliers.

All (21) torsion outliers are listed below:

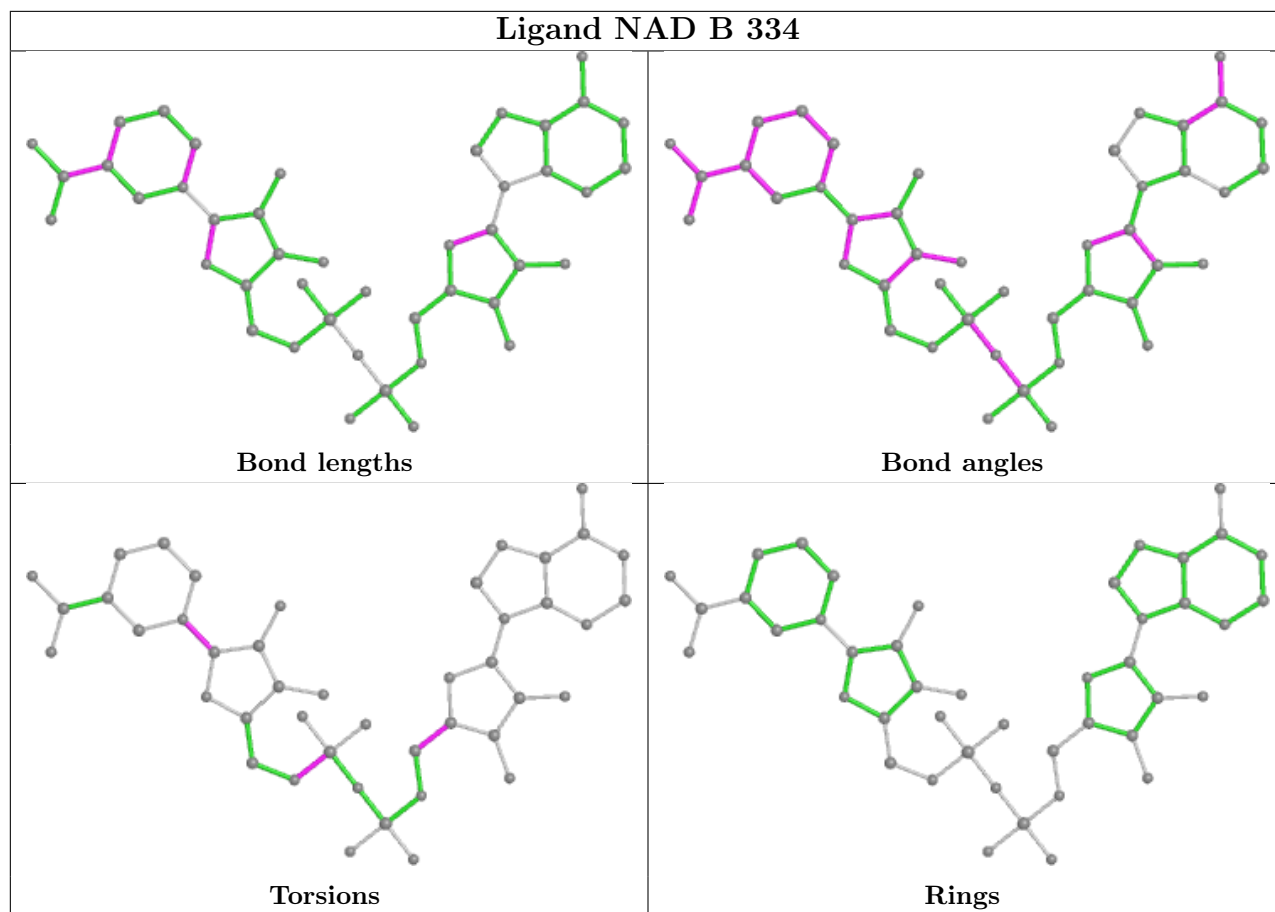
Mol	Chain	Res	Type	Atoms
2	A	334	NAD	PN-O3-PA-O5B
2	A	334	NAD	C5D-O5D-PN-O1N
2	A	334	NAD	O4D-C1D-N1N-C2N
2	A	334	NAD	O4D-C1D-N1N-C6N
2	A	334	NAD	C2D-C1D-N1N-C2N
2	A	334	NAD	C2D-C1D-N1N-C6N
2	B	334	NAD	O4D-C1D-N1N-C2N
2	B	334	NAD	O4D-C1D-N1N-C6N
2	B	334	NAD	C2D-C1D-N1N-C2N
2	B	334	NAD	C2D-C1D-N1N-C6N
2	A	334	NAD	O4D-C4D-C5D-O5D
2	A	334	NAD	C3D-C4D-C5D-O5D
2	A	334	NAD	C5D-O5D-PN-O3
2	A	334	NAD	C5B-O5B-PA-O1A
2	A	334	NAD	C5B-O5B-PA-O3
2	B	334	NAD	C5D-O5D-PN-O3
2	A	334	NAD	C4D-C5D-O5D-PN
2	B	334	NAD	O4B-C4B-C5B-O5B
2	A	334	NAD	PN-O3-PA-O1A
2	B	334	NAD	C5D-O5D-PN-O1N
2	A	334	NAD	O4B-C4B-C5B-O5B

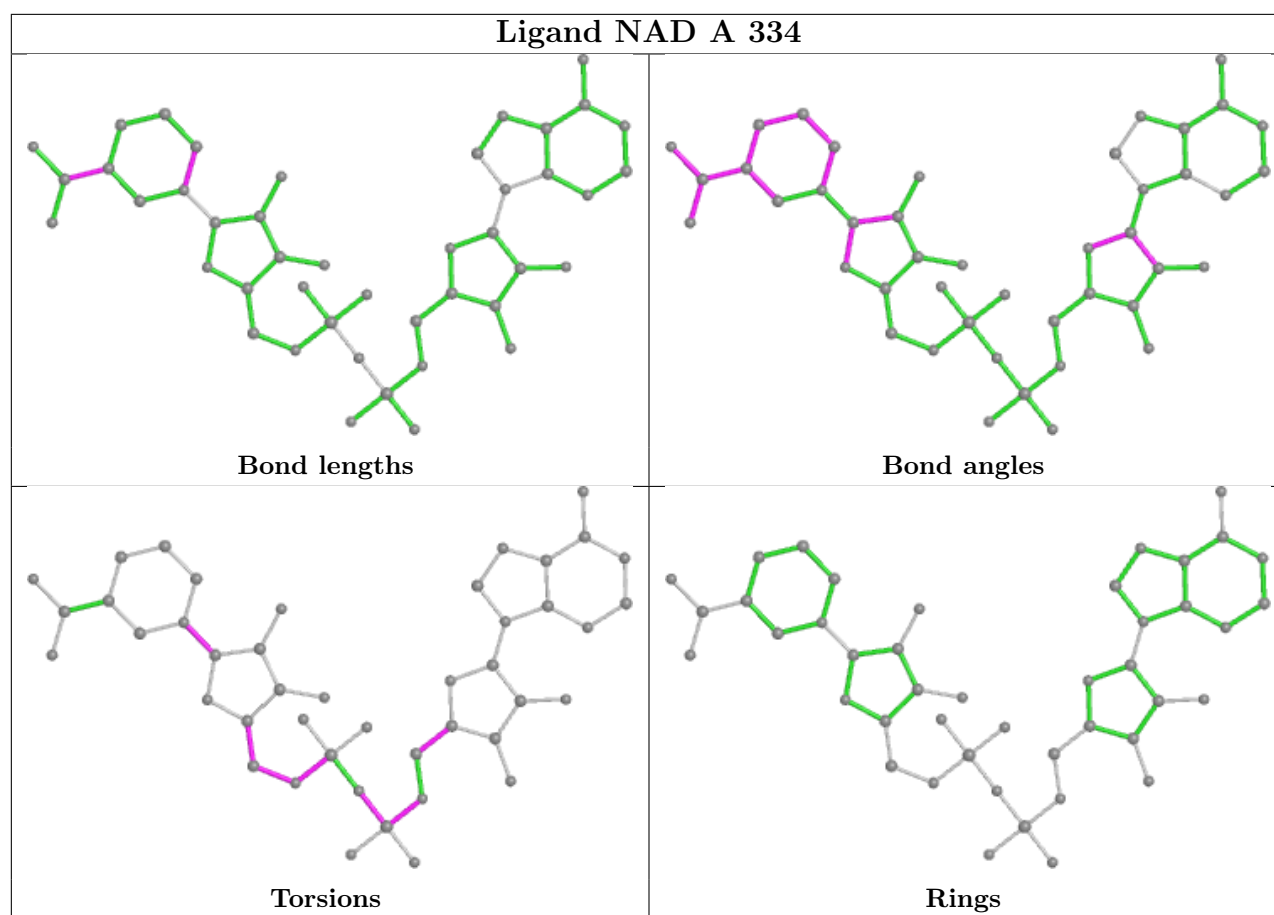
There are no ring outliers.

4 monomers are involved in 9 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	334	NAD	4	0
2	A	334	NAD	3	0
3	B	335	MAK	2	0
3	A	335	MAK	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.





5.7 Other polymers [\(i\)](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [\(i\)](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	B	2

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	B	104:ASN	C	105:VAL	N	1.79
1	B	96:GLU	C	97:ARG	N	0.66

6 Fit of model and data

6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.