



Full wwPDB X-ray Structure Validation Report ⓘ

Apr 25, 2026 – 08:15 PM EDT

PDB ID : 3MR1 / pdb_00003mr1
Title : Crystal structure of methionine aminopeptidase from Rickettsia prowazekii
Authors : Seattle Structural Genomics Center for Infectious Disease (SSGCID)
Deposited on : 2010-04-28
Resolution : 2.00 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 : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

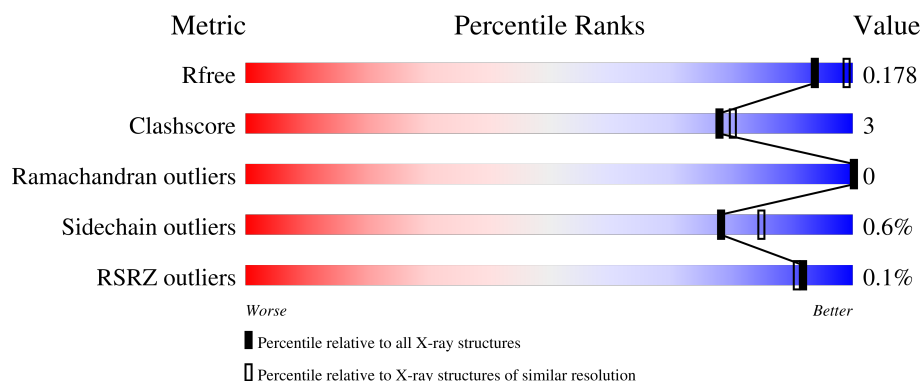
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

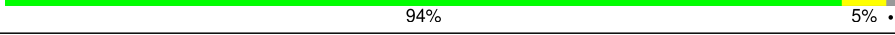
The reported resolution of this entry is 2.00 Å.

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))
R_{free}	180053	10052 (2.00-2.00)
Clashscore	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (2.00-2.00)
RSRZ outliers	180081	10067 (2.00-2.00)

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 $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	252	 92% 7% .
1	B	252	 91% 8% .
1	C	252	 90% 9% .
1	D	252	 94% 5% .

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 8868 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 Methionine aminopeptidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	249	Total	C	N	O	S	0	2	0
			1940	1239	327	364	10			
1	B	248	Total	C	N	O	S	0	3	0
			1928	1230	325	364	9			
1	C	249	Total	C	N	O	S	0	5	0
			1956	1251	330	365	10			
1	D	249	Total	C	N	O	S	0	3	0
			1937	1237	326	365	9			

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-3	GLY	-	expression tag	UNP Q9ZCD3
A	-2	PRO	-	expression tag	UNP Q9ZCD3
A	-1	GLY	-	expression tag	UNP Q9ZCD3
A	0	SER	-	expression tag	UNP Q9ZCD3
A	1	MET	-	expression tag	UNP Q9ZCD3
B	-3	GLY	-	expression tag	UNP Q9ZCD3
B	-2	PRO	-	expression tag	UNP Q9ZCD3
B	-1	GLY	-	expression tag	UNP Q9ZCD3
B	0	SER	-	expression tag	UNP Q9ZCD3
B	1	MET	-	expression tag	UNP Q9ZCD3
C	-3	GLY	-	expression tag	UNP Q9ZCD3
C	-2	PRO	-	expression tag	UNP Q9ZCD3
C	-1	GLY	-	expression tag	UNP Q9ZCD3
C	0	SER	-	expression tag	UNP Q9ZCD3
C	1	MET	-	expression tag	UNP Q9ZCD3
D	-3	GLY	-	expression tag	UNP Q9ZCD3
D	-2	PRO	-	expression tag	UNP Q9ZCD3
D	-1	GLY	-	expression tag	UNP Q9ZCD3
D	0	SER	-	expression tag	UNP Q9ZCD3
D	1	MET	-	expression tag	UNP Q9ZCD3

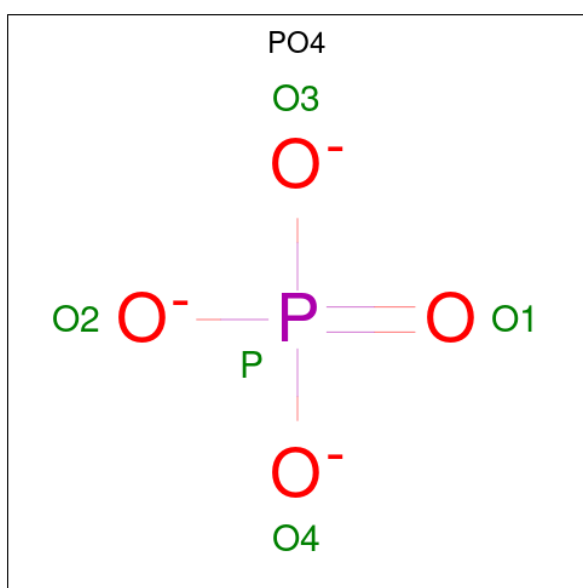
- Molecule 2 is MANGANESE (II) ION (CCD ID: MN) (formula: Mn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	2	Total	Mn	0	0
			2	2		
2	B	2	Total	Mn	0	0
			2	2		
2	C	2	Total	Mn	0	0
			2	2		
2	D	2	Total	Mn	0	0
			2	2		

- Molecule 3 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Na	0	0
			1	1		
3	B	1	Total	Na	0	0
			1	1		
3	C	1	Total	Na	0	0
			1	1		
3	D	1	Total	Na	0	0
			1	1		

- Molecule 4 is PHOSPHATE ION (CCD ID: PO4) (formula: O₄P).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	P	0	0
			5	4	1		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	B	1	Total	O	P	0	0
			5	4	1		
4	C	1	Total	O	P	0	0
			5	4	1		
4	D	1	Total	O	P	0	0
			5	4	1		

- Molecule 5 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	D	2	Total	Cl	0	0
			2	2		

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	274	Total	O	0	0
			274	274		
6	B	257	Total	O	0	0
			257	257		
6	C	284	Total	O	0	0
			284	284		
6	D	258	Total	O	0	0
			258	258		

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 and electron density. 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. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). 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.

- Molecule 1: Methionine aminopeptidase

Chain A: 



- Molecule 1: Methionine aminopeptidase

Chain B: 

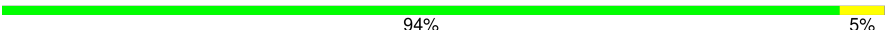


- Molecule 1: Methionine aminopeptidase

Chain C: 



- Molecule 1: Methionine aminopeptidase

Chain D: 



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	42.48Å 114.85Å 115.80Å 90.00° 92.66° 90.00°	Depositor
Resolution (Å)	42.40 – 2.00 42.40 – 2.00	Depositor EDS
% Data completeness (in resolution range)	98.0 (42.40-2.00) 98.0 (42.40-2.00)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.23 (at 2.00Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.171 , 0.212 0.173 , 0.178	Depositor DCC
R_{free} test set	3706 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å ²)	14.5	Xtriage
Anisotropy	0.121	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 41.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.000 for -h,l,k 0.000 for -h,-l,-k 0.108 for h,-k,-l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	8868	wwPDB-VP
Average B, all atoms (Å ²)	15.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 38.72 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 3.5345e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: MN, PO4, NA, CL

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	0.87	1/1990 (0.1%)	0.91	0/2700
1	B	0.86	0/1981	0.88	1/2690 (0.0%)
1	C	0.85	0/2015	0.91	4/2734 (0.1%)
1	D	0.86	0/1990	0.90	0/2704
All	All	0.86	1/7976 (0.0%)	0.90	5/10828 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	31	VAL	CA-CB	5.25	1.59	1.53

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	63	PHE	CA-C-N	-5.89	114.17	121.00
1	C	63	PHE	C-N-CA	-5.89	114.17	121.00
1	B	117	ILE	N-CA-C	5.82	116.56	110.62
1	C	83	LYS	CA-C-N	-5.44	114.19	119.90
1	C	83	LYS	C-N-CA	-5.44	114.19	119.90

There are no chirality outliers.

There are no planarity outliers.

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	1940	0	1923	11	0
1	B	1928	0	1899	12	0
1	C	1956	0	1952	12	0
1	D	1937	0	1906	8	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
2	C	2	0	0	0	0
2	D	2	0	0	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
4	A	5	0	0	0	0
4	B	5	0	0	0	0
4	C	5	0	0	0	0
4	D	5	0	0	0	0
5	D	2	0	0	1	0
6	A	274	0	0	2	0
6	B	257	0	0	3	0
6	C	284	0	0	1	0
6	D	258	0	0	1	0
All	All	8868	0	7680	43	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 3.

All (43) 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:212:ILE:HD11	1:B:224[A]:ARG:HG3	1.49	0.94
1:C:156[B]:LYS:HD2	1:C:157:HIS:CE1	2.24	0.73
1:C:137:VAL:HG22	1:C:146[B]:ILE:HD11	1.90	0.53
1:B:201:GLU:HB3	1:B:233:GLU:HG3	1.90	0.53
1:C:2:ILE:HD13	1:C:177:LYS:HG3	1.91	0.52
1:C:184:GLY:HA3	6:C:333:HOH:O	2.10	0.52
6:A:446:HOH:O	1:D:3:LYS:HE2	2.11	0.51
1:A:210:ASP:OD2	1:A:224[A]:ARG:HD3	2.12	0.50
1:B:138:ARG:HB3	1:B:242:GLY:HA2	1.93	0.50
1:A:11[A]:ILE:HD13	1:A:14:ARG:HH11	1.77	0.49
1:D:63:PHE:CE2	1:D:79[A]:ILE:CD1	2.96	0.49
1:D:118:LYS:HB2	1:D:119:PRO:HD3	1.94	0.48
1:C:68:CYS:HB2	1:C:94:ASP:HB3	1.96	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:153:TYR:O	1:C:156[B]:LYS:HG3	2.13	0.48
1:B:241:ASP:HB2	6:B:458:HOH:O	2.13	0.47
1:A:143:LEU:HD22	1:A:190:LEU:HG	1.95	0.47
1:B:143:LEU:HD13	1:B:190:LEU:HD11	1.97	0.47
1:C:152:SER:O	1:C:156[A]:LYS:HG3	2.15	0.47
1:A:13:MET:HG3	1:A:197:PHE:CE2	2.50	0.47
1:A:212:ILE:HD11	1:A:224[A]:ARG:HG3	1.97	0.46
1:D:63:PHE:CE2	1:D:79[A]:ILE:HD13	2.51	0.45
1:A:193:LYS:HB2	1:A:196:MET:HE3	1.98	0.45
1:B:201:GLU:HB3	1:B:233:GLU:CG	2.47	0.45
1:C:96:THR:HA	1:C:104:GLY:O	2.17	0.45
1:D:5:HIS:HE1	5:D:254:CL:CL	2.37	0.45
1:C:210:ASP:OD2	1:C:224[A]:ARG:HD3	2.16	0.44
1:D:189:GLY:HA3	6:D:991:HOH:O	2.16	0.44
1:B:10:PHE:O	1:B:14:ARG:HG3	2.18	0.44
1:B:13:MET:HG3	1:B:197:PHE:CE2	2.52	0.44
1:B:224[A]:ARG:NH1	6:B:826:HOH:O	2.51	0.44
1:A:190:LEU:C	1:A:190:LEU:HD12	2.43	0.43
1:A:151:GLN:HA	1:A:161:VAL:HG21	2.01	0.42
1:C:12:LYS:NZ	1:C:100:ASP:OD2	2.53	0.41
1:C:136:VAL:HG22	1:C:146[B]:ILE:HD13	2.02	0.41
1:D:106:THR:HB	1:D:247:THR:HG21	2.02	0.41
1:B:125:VAL:HG21	1:B:159:TYR:HE2	1.84	0.41
1:B:24:LEU:HD13	1:B:108:ARG:HB2	2.01	0.41
1:B:224[A]:ARG:CZ	6:B:826:HOH:O	2.69	0.41
1:D:33:PRO:O	1:D:34:ASN:HB2	2.20	0.41
1:C:13:MET:HG3	1:C:197:PHE:CE2	2.56	0.40
1:A:115:VAL:CG1	1:A:119:PRO:HB2	2.51	0.40
1:A:0:SER:HB2	6:A:693:HOH:O	2.20	0.40
1:A:2:ILE:HG21	1:A:196:MET:HE2	2.04	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

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	249/252 (99%)	243 (98%)	6 (2%)	0	100	100
1	B	249/252 (99%)	243 (98%)	6 (2%)	0	100	100
1	C	252/252 (100%)	246 (98%)	6 (2%)	0	100	100
1	D	250/252 (99%)	246 (98%)	4 (2%)	0	100	100
All	All	1000/1008 (99%)	978 (98%)	22 (2%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

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	212/215 (99%)	212 (100%)	0	100	100
1	B	210/215 (98%)	209 (100%)	1 (0%)	81	87
1	C	215/215 (100%)	213 (99%)	2 (1%)	70	78
1	D	210/215 (98%)	208 (99%)	2 (1%)	68	75
All	All	847/860 (98%)	842 (99%)	5 (1%)	78	85

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	173	VAL
1	C	35	VAL
1	C	136	VAL
1	D	12	LYS
1	D	136	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	30	HIS
1	A	182	ASN
1	B	182	ASN
1	C	46	ASN
1	C	182	ASN
1	C	205	ASN
1	D	5	HIS
1	D	46	ASN
1	D	182	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 18 ligands modelled in this entry, 14 are monoatomic - leaving 4 for Mogul analysis.

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	$\# Z > 2$
4	PO4	A	252	2	4,4,4	1.20	0	6,6,6	0.40	0
4	PO4	C	252	2	4,4,4	1.18	0	6,6,6	0.52	0
4	PO4	D	252	2	4,4,4	1.17	0	6,6,6	0.59	0
4	PO4	B	252	2	4,4,4	1.12	0	6,6,6	0.78	0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	249/252 (98%)	-0.66	0 100 100	5, 11, 24, 37	2 (0%)
1	B	248/252 (98%)	-0.58	1 (0%) 88 88	6, 13, 27, 38	3 (1%)
1	C	249/252 (98%)	-0.62	0 100 100	6, 13, 23, 32	5 (2%)
1	D	249/252 (98%)	-0.53	0 100 100	6, 14, 29, 37	3 (1%)
All	All	995/1008 (98%)	-0.60	1 (0%) 92 91	5, 13, 26, 38	13 (1%)

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	1	MET	2.7

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

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q< 0.9’ lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
4	PO4	B	252	5/5	0.96	0.08	14,19,22,22	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	NA	A	251	1/1	0.97	0.04	11,11,11,11	0
4	PO4	C	252	5/5	0.97	0.08	16,22,26,27	0
5	CL	D	253	1/1	0.97	0.04	32,32,32,32	0
4	PO4	A	252	5/5	0.98	0.07	10,16,19,23	0
3	NA	B	251	1/1	0.98	0.08	16,16,16,16	0
3	NA	C	251	1/1	0.98	0.10	12,12,12,12	0
4	PO4	D	252	5/5	0.98	0.07	18,22,26,26	0
3	NA	D	251	1/1	0.98	0.05	16,16,16,16	0
2	MN	A	250	1/1	1.00	0.01	7,7,7,7	0
2	MN	B	249	1/1	1.00	0.01	8,8,8,8	0
2	MN	B	250	1/1	1.00	0.01	9,9,9,9	0
2	MN	C	249	1/1	1.00	0.01	9,9,9,9	0
2	MN	C	250	1/1	1.00	0.01	9,9,9,9	0
2	MN	D	249	1/1	1.00	0.01	9,9,9,9	0
2	MN	D	250	1/1	1.00	0.02	9,9,9,9	0
2	MN	A	249	1/1	1.00	0.01	8,8,8,8	0
5	CL	D	254	1/1	1.00	0.07	22,22,22,22	0

6.5 Other polymers [i](#)

There are no such residues in this entry.