



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 21, 2026 – 04:10 PM UTC

PDB ID : 3E0S / pdb_00003e0s
Title : Crystal structure of an uncharacterized protein from Chlorobium tepidum
Authors : Bonanno, J.B.; Dickey, M.; Bain, K.T.; Powell, A.; Ozyurt, S.; Smith, D.; Wasserman, S.; Sauder, J.M.; Burley, S.K.; Almo, S.C.; New York SGX Research Center for Structural Genomics (NYSGXRC)
Deposited on : 2008-07-31
Resolution : 2.09 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

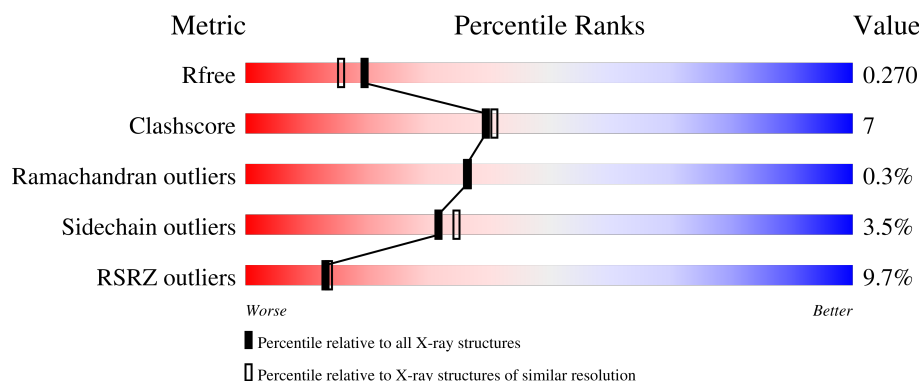
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.09 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	6658 (2.10-2.10)
Clashscore	190562	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (2.10-2.10)
RSRZ outliers	180081	6662 (2.10-2.10)

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	326	13% 79% 12% 9%
1	B	326	4% 75% 13% 10%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 4786 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 uncharacterized protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	296	Total	C	N	O	S	0	3	0
			2282	1456	393	426	7			
1	B	294	Total	C	N	O	S	0	4	0
			2286	1455	397	426	8			

There are 22 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	205	MET	-	expression tag	UNP Q8KE09
A	206	SER	-	expression tag	UNP Q8KE09
A	207	LEU	-	expression tag	UNP Q8KE09
A	523	GLU	-	expression tag	UNP Q8KE09
A	524	GLY	-	expression tag	UNP Q8KE09
A	525	HIS	-	expression tag	UNP Q8KE09
A	526	HIS	-	expression tag	UNP Q8KE09
A	527	HIS	-	expression tag	UNP Q8KE09
A	528	HIS	-	expression tag	UNP Q8KE09
A	529	HIS	-	expression tag	UNP Q8KE09
A	530	HIS	-	expression tag	UNP Q8KE09
B	205	MET	-	expression tag	UNP Q8KE09
B	206	SER	-	expression tag	UNP Q8KE09
B	207	LEU	-	expression tag	UNP Q8KE09
B	523	GLU	-	expression tag	UNP Q8KE09
B	524	GLY	-	expression tag	UNP Q8KE09
B	525	HIS	-	expression tag	UNP Q8KE09
B	526	HIS	-	expression tag	UNP Q8KE09
B	527	HIS	-	expression tag	UNP Q8KE09
B	528	HIS	-	expression tag	UNP Q8KE09
B	529	HIS	-	expression tag	UNP Q8KE09
B	530	HIS	-	expression tag	UNP Q8KE09

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	O	S	0	0
			5	4	1		
2	A	1	Total	O	S	0	0
			5	4	1		
2	A	1	Total	O	S	0	0
			5	4	1		
2	B	1	Total	O	S	0	0
			5	4	1		
2	B	1	Total	O	S	0	0
			5	4	1		

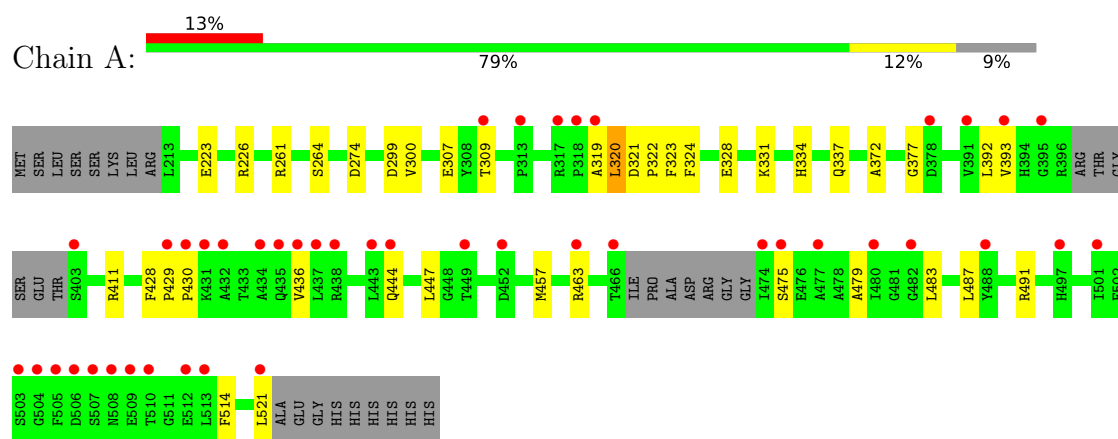
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	84	Total	O	0	0
			84	84		
3	B	109	Total	O	0	0
			109	109		

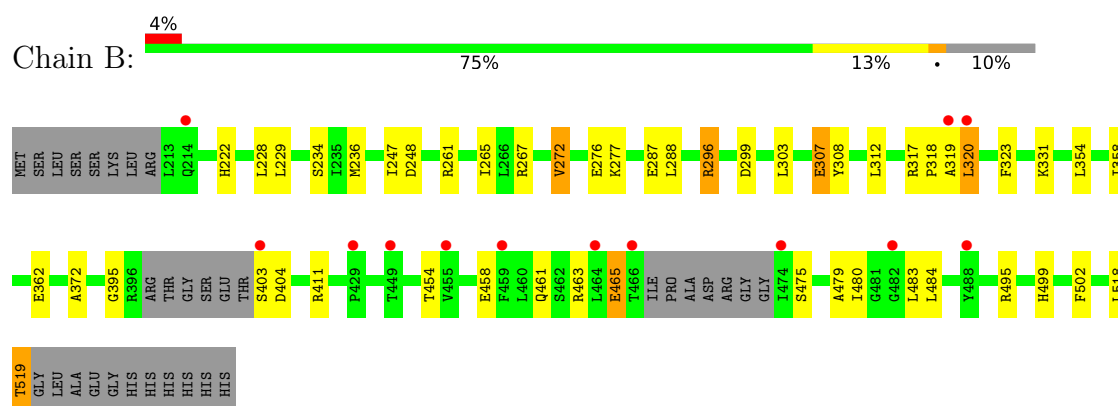
3 Residue-property plots [i](#)

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: uncharacterized protein



- Molecule 1: uncharacterized protein



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	33.74Å 212.48Å 55.42Å 90.00° 106.94° 90.00°	Depositor
Resolution (Å)	20.00 – 2.09 20.00 – 2.09	Depositor EDS
% Data completeness (in resolution range)	93.1 (20.00-2.09) 93.0 (20.00-2.09)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	0.09	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.56 (at 2.08Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.218 , 0.272 0.221 , 0.270	Depositor DCC
R_{free} test set	2072 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	21.9	Xtriage
Anisotropy	0.313	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 46.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.059 for h,-k,-h-l	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	4786	wwPDB-VP
Average B, all atoms (Å ²)	34.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.39% of the height of the origin peak. No significant pseudotranslation is detected.*

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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: SO4

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	0.79	0/2333	1.00	3/3164 (0.1%)
1	B	0.80	1/2341 (0.0%)	1.00	1/3175 (0.0%)
All	All	0.80	1/4674 (0.0%)	1.00	4/6339 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	272	VAL	CA-CB	5.07	1.61	1.54

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	429	PRO	CA-C-N	6.60	128.09	119.84
1	A	429	PRO	C-N-CA	6.60	128.09	119.84
1	B	372	ALA	N-CA-C	6.04	118.36	111.11
1	A	372	ALA	N-CA-C	5.34	117.52	111.11

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

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	2282	0	2196	23	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	2286	0	2202	37	0
2	A	15	0	0	0	0
2	B	10	0	0	1	0
3	A	84	0	0	2	0
3	B	109	0	0	2	0
All	All	4786	0	4398	60	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 7.

All (60) 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:A:223:GLU:OE1	1:A:226:ARG:NH2	2.05	0.87
1:B:229:LEU:HB3	1:B:358[A]:ILE:HD13	1.65	0.78
1:B:518:LEU:O	1:B:519:THR:HB	1.85	0.77
1:B:499:HIS:HB3	3:B:544:HOH:O	1.85	0.76
1:A:457:MET:HE1	1:A:491:ARG:HD3	1.73	0.69
1:A:320:LEU:HD13	1:A:479:ALA:HB1	1.76	0.68
1:A:457:MET:CE	1:A:491:ARG:HD3	2.29	0.62
1:B:323:PHE:HE1	1:B:463:ARG:HG2	1.65	0.62
1:A:428:PHE:HE1	1:A:521:LEU:HD11	1.66	0.60
1:A:457:MET:HE1	1:A:491:ARG:CD	2.33	0.58
1:A:324:PHE:O	1:A:328:GLU:HG3	2.05	0.57
1:B:229:LEU:CB	1:B:358[A]:ILE:HD13	2.36	0.56
1:A:483:LEU:O	1:A:487:LEU:HG	2.06	0.55
1:B:320:LEU:HD13	1:B:479:ALA:HB1	1.89	0.55
1:B:454:THR:O	1:B:458:GLU:HG2	2.07	0.55
1:B:354:LEU:HD11	1:B:358[A]:ILE:HD11	1.87	0.55
1:B:234[A]:SER:OG	3:B:607:HOH:O	2.18	0.54
1:B:307:GLU:HG3	1:B:308:TYR:N	2.23	0.53
1:B:395:GLY:HA3	1:B:502:PHE:CZ	2.44	0.53
1:B:354:LEU:CD1	1:B:358[A]:ILE:HD11	2.39	0.53
1:B:403:SER:CB	1:B:495:ARG:HH21	2.22	0.53
1:B:299:ASP:O	1:B:303:LEU:HD13	2.09	0.51
1:A:444:GLN:NE2	3:A:557:HOH:O	2.44	0.51
1:B:320:LEU:HD13	1:B:479:ALA:CB	2.41	0.51
1:B:299:ASP:OD1	1:B:331:LYS:HE3	2.11	0.50
1:A:411:ARG:HD3	3:A:542:HOH:O	2.11	0.50
1:B:323:PHE:CE1	1:B:463:ARG:HG2	2.44	0.49
1:B:411:ARG:HB3	1:B:411:ARG:HH11	1.76	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:248:ASP:OD2	1:B:248:ASP:C	2.57	0.47
1:B:247:ILE:O	1:B:248:ASP:HB3	2.15	0.47
1:B:312:LEU:CD1	1:B:320:LEU:HD22	2.45	0.47
1:B:236:MET:HE3	1:B:288:LEU:HD21	1.97	0.46
1:B:320:LEU:HD21	1:B:483:LEU:HD11	1.98	0.46
1:B:480:ILE:O	1:B:484:LEU:HB2	2.16	0.45
1:A:377:GLY:HA2	1:A:521:LEU:HD22	1.99	0.45
1:B:222:HIS:HA	1:B:272:VAL:HG13	1.99	0.45
1:A:320:LEU:HD13	1:A:479:ALA:CB	2.45	0.45
1:B:319:ALA:HB1	1:B:475:SER:O	2.16	0.44
1:A:436:VAL:HG13	1:A:514:PHE:CZ	2.52	0.44
1:B:320:LEU:HD12	1:B:320:LEU:HA	1.92	0.44
1:B:317:ARG:N	1:B:318:PRO:HD2	2.32	0.44
1:B:229:LEU:HB2	1:B:358[A]:ILE:HG21	1.99	0.44
1:B:276:GLU:OE2	1:B:277:LYS:HE3	2.18	0.44
1:A:411:ARG:HB2	1:A:447:LEU:HB3	1.99	0.43
1:A:334:HIS:HD2	1:A:337:GLN:OE1	2.01	0.43
1:A:457:MET:HE1	1:A:491:ARG:NE	2.33	0.43
1:B:312:LEU:HD11	1:B:320:LEU:HD22	2.01	0.43
1:A:321:ASP:N	1:A:322:PRO:HD2	2.34	0.42
1:A:320:LEU:HD12	1:A:320:LEU:HA	1.95	0.42
1:A:319:ALA:HB2	1:A:475:SER:HB3	2.01	0.42
1:B:228:LEU:CD2	1:B:265:ILE:HG21	2.49	0.42
1:B:277:LYS:HD3	1:B:277:LYS:HA	1.81	0.41
1:A:323:PHE:CE1	1:A:463:ARG:HG2	2.56	0.41
1:B:461:GLN:O	1:B:465:GLU:HG2	2.21	0.41
1:B:296:ARG:HD3	2:B:4:SO4:O3	2.21	0.41
1:B:411:ARG:HB3	1:B:411:ARG:NH1	2.36	0.41
1:A:392:LEU:O	1:A:393:VAL:C	2.62	0.40
1:B:465:GLU:HG2	1:B:465:GLU:H	1.72	0.40
1:A:299:ASP:OD1	1:A:331:LYS:HE3	2.21	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	293/326 (90%)	286 (98%)	6 (2%)	1 (0%)	36	36
1	B	292/326 (90%)	288 (99%)	3 (1%)	1 (0%)	36	36
All	All	585/652 (90%)	574 (98%)	9 (2%)	2 (0%)	36	36

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	404	ASP
1	A	430	PRO

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	232/283 (82%)	225 (97%)	7 (3%)	36	41
1	B	235/283 (83%)	226 (96%)	9 (4%)	29	32
All	All	467/566 (82%)	451 (97%)	16 (3%)	32	35

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	261	ARG
1	A	264	SER
1	A	274	ASP
1	A	300	VAL
1	A	307	GLU
1	A	309	THR
1	A	320	LEU
1	B	261	ARG
1	B	267	ARG
1	B	287	GLU
1	B	296	ARG

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Mol	Chain	Res	Type
1	B	307	GLU
1	B	320	LEU
1	B	362	GLU
1	B	465	GLU
1	B	519	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	334	HIS
1	A	335	HIS
1	A	456	GLN
1	B	239	ASN
1	B	394	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

5 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	SO4	A	2	-	4,4,4	0.22	0	6,6,6	0.45	0
2	SO4	A	1	-	4,4,4	0.17	0	6,6,6	0.22	0
2	SO4	A	5	-	4,4,4	0.28	0	6,6,6	0.25	0
2	SO4	B	4	-	4,4,4	0.35	0	6,6,6	0.38	0
2	SO4	B	3	-	4,4,4	0.25	0	6,6,6	0.25	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.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	4	SO4	1	0

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 ⓘ

6.1 Protein, DNA and RNA chains ⓘ

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	296/326 (90%)	0.74	44 (14%) 5 5	11, 35, 54, 59	3 (1%)
1	B	294/326 (90%)	0.40	13 (4%) 39 41	12, 32, 48, 58	4 (1%)
All	All	590/652 (90%)	0.57	57 (9%) 13 14	11, 33, 52, 59	7 (1%)

All (57) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	403	SER	5.4
1	A	508	ASN	4.7
1	A	466	THR	4.5
1	B	474	ILE	4.5
1	A	432	ALA	4.2
1	B	403	SER	4.1
1	A	474	ILE	4.1
1	A	319	ALA	4.0
1	A	449	THR	4.0
1	A	429	PRO	3.6
1	A	430	PRO	3.1
1	A	504	GLY	3.0
1	A	395	GLY	2.9
1	A	482	GLY	2.9
1	A	497	HIS	2.9
1	A	503	SER	2.8
1	B	466	THR	2.8
1	A	435	GLN	2.8
1	A	509	GLU	2.8
1	A	513	LEU	2.8
1	A	393	VAL	2.8
1	A	505	PHE	2.7
1	A	437	LEU	2.6
1	A	443	LEU	2.6

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Mol	Chain	Res	Type	RSRZ
1	A	488	TYR	2.6
1	A	477	ALA	2.6
1	A	438	ARG	2.5
1	B	319	ALA	2.5
1	B	482	GLY	2.5
1	B	320	LEU	2.5
1	B	459	PHE	2.4
1	A	480	ILE	2.4
1	A	510	THR	2.4
1	A	452	ASP	2.4
1	A	506	ASP	2.4
1	A	391	VAL	2.4
1	A	507	SER	2.4
1	A	378	ASP	2.4
1	B	429	PRO	2.3
1	A	434	ALA	2.3
1	A	317	ARG	2.3
1	A	475	SER	2.3
1	A	512	GLU	2.3
1	B	455	VAL	2.3
1	A	309	THR	2.3
1	B	449	THR	2.3
1	A	313	PRO	2.2
1	A	318	PRO	2.2
1	A	431	LYS	2.2
1	B	214	GLN	2.2
1	A	463	ARG	2.1
1	B	464	LEU	2.1
1	B	488	TYR	2.1
1	A	521	LEU	2.1
1	A	501	ILE	2.1
1	A	436	VAL	2.1
1	A	444	GLN	2.0

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

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
2	SO4	A	2	5/5	0.90	0.13	54,55,57,57	0
2	SO4	B	3	5/5	0.90	0.13	66,66,66,66	0
2	SO4	A	5	5/5	0.96	0.07	42,42,44,45	0
2	SO4	B	4	5/5	0.96	0.07	33,34,35,37	0
2	SO4	A	1	5/5	0.99	0.06	36,39,40,40	0

6.5 Other polymers

There are no such residues in this entry.