



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 08:54 AM UTC

PDB ID : 6QZ4 / pdb_00006qz4
Title : Structure of MHETase from Ideonella sakaiensis
Authors : Allen, M.D.; Johnson, C.W.; Knott, B.C.; Beckham, G.T.; McGeehan, J.E.
Deposited on : 2019-03-11
Resolution : 1.80 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

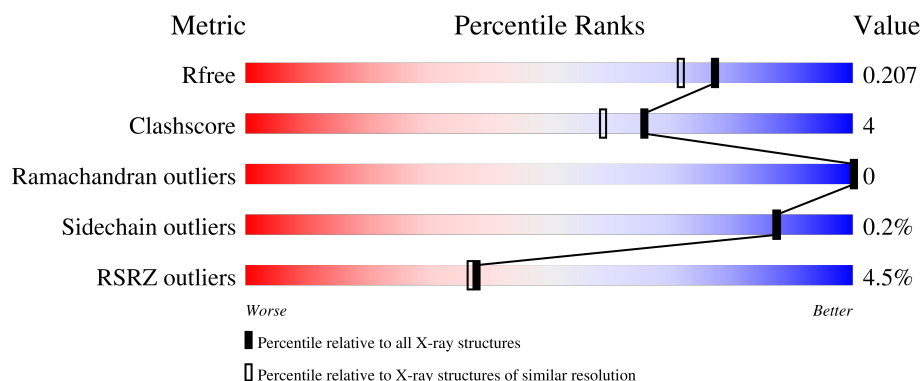
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.80 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	7662 (1.80-1.80)
Clashscore	190562	8479 (1.80-1.80)
Ramachandran outliers	187476	8391 (1.80-1.80)
Sidechain outliers	187428	8390 (1.80-1.80)
RSRZ outliers	180081	7663 (1.80-1.80)

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	611	8% 89% 7%
1	B	611	8% 86% 7% 7%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 9845 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 Mono(2-hydroxyethyl) terephthalate hydrolase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	568	Total	C	N	O	S	0	6	0
			4217	2646	737	806	28			
1	B	568	Total	C	N	O	S	0	3	0
			4209	2639	739	803	28			

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	604	LEU	-	expression tag	UNP A0A0K8P8E7
A	605	GLU	-	expression tag	UNP A0A0K8P8E7
A	606	HIS	-	expression tag	UNP A0A0K8P8E7
A	607	HIS	-	expression tag	UNP A0A0K8P8E7
A	608	HIS	-	expression tag	UNP A0A0K8P8E7
A	609	HIS	-	expression tag	UNP A0A0K8P8E7
A	610	HIS	-	expression tag	UNP A0A0K8P8E7
A	611	HIS	-	expression tag	UNP A0A0K8P8E7
B	604	LEU	-	expression tag	UNP A0A0K8P8E7
B	605	GLU	-	expression tag	UNP A0A0K8P8E7
B	606	HIS	-	expression tag	UNP A0A0K8P8E7
B	607	HIS	-	expression tag	UNP A0A0K8P8E7
B	608	HIS	-	expression tag	UNP A0A0K8P8E7
B	609	HIS	-	expression tag	UNP A0A0K8P8E7
B	610	HIS	-	expression tag	UNP A0A0K8P8E7
B	611	HIS	-	expression tag	UNP A0A0K8P8E7

- Molecule 2 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Ca	0	0
			1	1		
2	B	1	Total	Ca	0	0
			1	1		

- Molecule 3 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



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

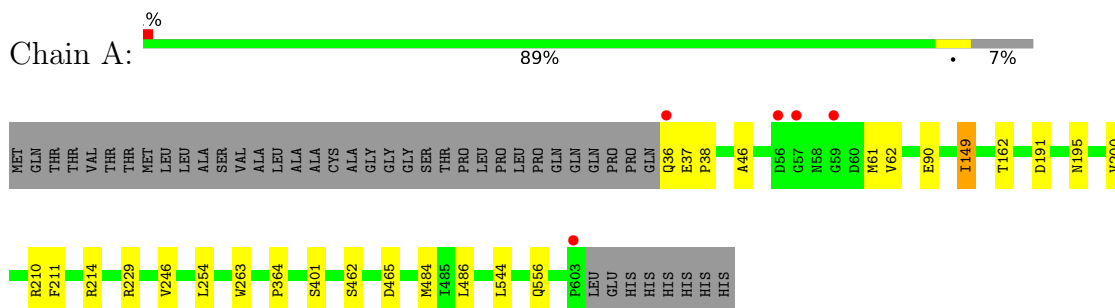
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	866	Total	O	0	0
			866	866		
4	B	541	Total	O	0	0
			541	541		

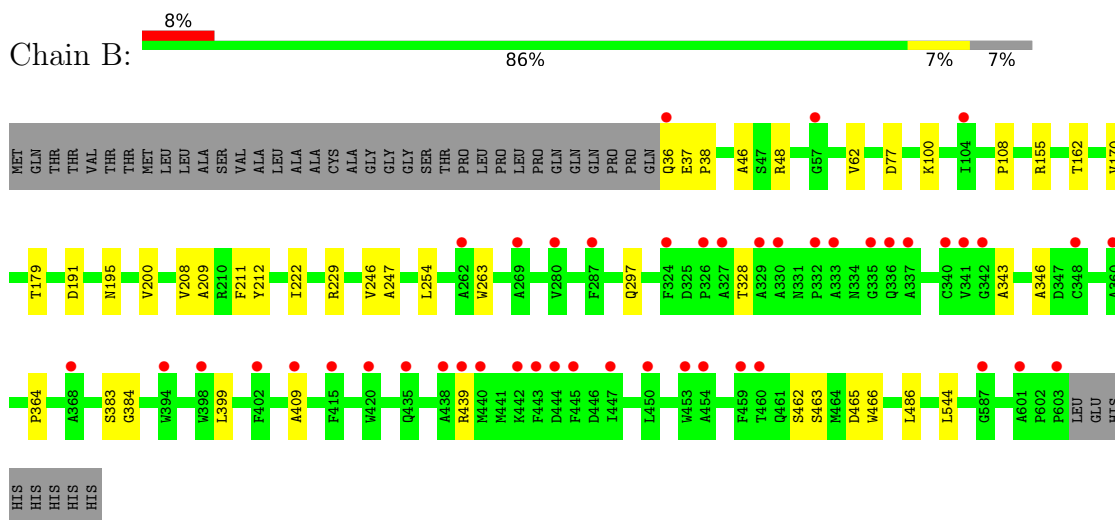
3 Residue-property plots [i](#)

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: Mono(2-hydroxyethyl) terephthalate hydrolase



- Molecule 1: Mono(2-hydroxyethyl) terephthalate hydrolase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	90.21Å 92.80Å 159.99Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.24 – 1.80 46.24 – 1.80	Depositor EDS
% Data completeness (in resolution range)	97.8 (46.24-1.80) 98.0 (46.24-1.80)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.64 (at 1.79Å)	Xtriage
Refinement program	PHENIX (1.13_2998: ???)	Depositor
R, R_{free}	0.182 , 0.205 0.183 , 0.207	Depositor DCC
R_{free} test set	6101 reflections (4.89%)	wwPDB-VP
Wilson B-factor (Å ²)	24.9	Xtriage
Anisotropy	0.446	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 43.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	0.000 for k,h,-l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	9845	wwPDB-VP
Average B, all atoms (Å ²)	30.0	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 49.59 % 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 7.3023e-05. 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: SO4, CA

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	0.17	0/4348	0.37	0/5926
1	B	0.13	0/4331	0.34	0/5902
All	All	0.15	0/8679	0.35	0/11828

There are no bond length outliers.

There are no bond angle outliers.

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	4217	0	4021	31	0
1	B	4209	0	4007	31	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	5	0	0	0	0
3	B	5	0	0	0	0
4	A	866	0	0	4	1
4	B	541	0	0	11	1
All	All	9845	0	8028	62	2

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 4.

All (62) 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:61:MET:CE	1:A:210:ARG:HG2	1.79	1.10
1:A:61:MET:CE	1:A:210:ARG:CG	2.38	1.01
1:A:61:MET:HE1	1:A:210:ARG:HB2	1.51	0.93
1:A:61:MET:HE1	1:A:210:ARG:CG	1.98	0.93
1:A:61:MET:HE1	1:A:210:ARG:CB	2.02	0.89
1:A:61:MET:HE3	1:A:210:ARG:HG2	1.62	0.81
1:B:328:THR:OG1	4:B:901:HOH:O	1.98	0.81
1:A:556:GLN:NE2	4:A:902:HOH:O	2.21	0.73
1:A:61:MET:CE	1:A:210:ARG:CB	2.67	0.72
1:B:346:ALA:O	4:B:903:HOH:O	2.06	0.71
1:A:61:MET:HE1	1:A:210:ARG:CD	2.23	0.68
1:B:37:GLU:OE1	4:B:904:HOH:O	2.11	0.68
1:B:246:VAL:HG23	1:B:544:LEU:HD22	1.75	0.68
1:A:61:MET:HE2	1:A:210:ARG:HG2	1.75	0.67
1:B:77:ASP:HB3	4:B:1282:HOH:O	1.96	0.65
1:B:179:THR:OG1	4:B:905:HOH:O	2.14	0.64
1:B:297:GLN:O	4:B:906:HOH:O	2.15	0.64
1:A:36:GLN:HB2	1:A:62:VAL:O	2.00	0.61
1:B:36:GLN:HE22	1:B:209:ALA:HB3	1.66	0.60
1:A:246:VAL:HG23	1:A:544:LEU:HD22	1.83	0.59
1:A:61:MET:CE	1:A:210:ARG:CD	2.82	0.56
1:A:36:GLN:N	1:A:38:PRO:HD2	2.23	0.53
1:B:229:ARG:HD3	1:B:254:LEU:HD12	1.88	0.53
1:B:37:GLU:N	1:B:38:PRO:HD2	2.24	0.51
1:A:149[B]:ILE:HD11	4:A:1577:HOH:O	2.08	0.51
1:A:37:GLU:N	1:A:38:PRO:HD2	2.27	0.50
1:B:343:ALA:O	4:B:907:HOH:O	2.20	0.50
1:A:36:GLN:N	1:A:62:VAL:H	2.10	0.49
1:B:191:ASP:HA	1:B:195:ASN:HB3	1.93	0.49
1:A:90:GLU:OE2	4:A:901:HOH:O	2.20	0.49
1:A:214:ARG:NH1	4:A:903:HOH:O	2.22	0.49
1:B:263:TRP:CD2	1:B:364:PRO:HA	2.48	0.48
1:B:100:LYS:HG3	4:B:981:HOH:O	2.12	0.48
1:B:462:SER:O	1:B:465:ASP:HB2	2.14	0.48
1:B:439:ARG:NE	4:B:909:HOH:O	2.24	0.48
1:A:263:TRP:CD2	1:A:364:PRO:HA	2.49	0.47
1:B:263:TRP:HB2	1:B:364:PRO:HB3	1.96	0.47
1:A:61:MET:HE2	1:A:210:ARG:NE	2.30	0.47
1:B:247:ALA:HB3	1:B:486:LEU:HD23	1.96	0.47
1:A:61:MET:CE	1:A:210:ARG:HB2	2.29	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:36:GLN:N	1:B:62:VAL:H	2.13	0.46
1:A:484:MET:HG2	1:A:486[B]:LEU:HD12	1.96	0.46
1:A:484:MET:HE3	1:A:486[B]:LEU:HD11	1.98	0.46
1:A:61:MET:HE1	1:A:210:ARG:HD3	1.98	0.45
1:B:155:ARG:NH1	4:B:927:HOH:O	2.50	0.44
1:A:46:ALA:HA	1:A:211:PHE:CZ	2.53	0.44
1:B:48:ARG:HD2	4:B:944:HOH:O	2.17	0.43
1:B:37:GLU:H	1:B:38:PRO:HD2	1.83	0.43
1:A:229:ARG:HD3	1:A:254:LEU:HD12	1.99	0.42
1:A:263:TRP:HB2	1:A:364:PRO:HB3	2.01	0.42
1:B:36:GLN:HB2	1:B:62:VAL:O	2.19	0.42
1:B:399:LEU:C	1:B:409:ALA:HB2	2.45	0.41
1:B:222:ILE:HG12	1:B:246:VAL:HB	2.01	0.41
1:B:463:SER:HA	1:B:466:TRP:CE2	2.55	0.41
1:B:46:ALA:HA	1:B:211:PHE:CZ	2.56	0.41
1:B:208:VAL:HG13	1:B:212:TYR:HD2	1.86	0.41
1:A:462:SER:O	1:A:465:ASP:HB2	2.20	0.41
1:A:191:ASP:HA	1:A:195:ASN:HB3	2.01	0.41
1:B:108:PRO:HG2	1:B:170:VAL:HG11	2.03	0.41
1:B:162:THR:HB	1:B:200:VAL:HG21	2.03	0.41
1:B:383:SER:OG	1:B:384:GLY:N	2.54	0.40
1:A:162:THR:HB	1:A:200:VAL:HG21	2.03	0.40

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:A:1340:HOH:O	4:A:1442:HOH:O[3_554]	1.83	0.37
4:B:1112:HOH:O	4:B:1241:HOH:O[3_454]	2.15	0.05

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	572/611 (94%)	556 (97%)	16 (3%)	0	100	100
1	B	569/611 (93%)	551 (97%)	18 (3%)	0	100	100
All	All	1141/1222 (93%)	1107 (97%)	34 (3%)	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	420/449 (94%)	416 (99%)	4 (1%)	68	64
1	B	417/449 (93%)	417 (100%)	0	100	100
All	All	837/898 (93%)	833 (100%)	4 (0%)	87	80

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	149[A]	ILE
1	A	149[B]	ILE
1	A	401[A]	SER
1	A	401[B]	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	202	GLN
1	A	297	GLN
1	A	336	GLN
1	A	339	GLN
1	A	556	GLN
1	B	58	ASN
1	B	278	GLN
1	B	339	GLN
1	B	435	GLN

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Mol	Chain	Res	Type
1	B	461	GLN
1	B	581	GLN

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 ⓘ

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 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	$\# Z > 2$
3	SO4	B	802	-	4,4,4	0.24	0	6,6,6	0.09	0
3	SO4	A	802	-	4,4,4	0.24	0	6,6,6	0.08	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

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	568/611 (92%)	-0.32	5 (0%) 81 81	11, 22, 34, 69	6 (1%)
1	B	568/611 (92%)	0.66	46 (8%) 18 16	19, 35, 51, 75	3 (0%)
All	All	1136/1222 (92%)	0.17	51 (4%) 38 37	11, 27, 48, 75	9 (0%)

All (51) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	36	GLN	4.5
1	A	36	GLN	4.1
1	B	330	ALA	4.1
1	B	443	PHE	3.7
1	B	603	PRO	3.6
1	B	337	ALA	3.1
1	A	56	ASP	3.0
1	B	444	ASP	2.9
1	B	333	ALA	2.9
1	B	327	ALA	2.8
1	B	368	ALA	2.8
1	B	438	ALA	2.8
1	B	332	PRO	2.8
1	B	326	PRO	2.7
1	B	409	ALA	2.6
1	B	341	VAL	2.6
1	B	342	GLY	2.5
1	B	348	CYS	2.5
1	B	445	PHE	2.5
1	B	262	ALA	2.5
1	B	360	ALA	2.4
1	B	453	TRP	2.4
1	B	287	PHE	2.4
1	B	269	ALA	2.4

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Mol	Chain	Res	Type	RSRZ
1	B	587	GLY	2.4
1	B	415	PHE	2.4
1	B	447	ILE	2.4
1	B	329	ALA	2.4
1	B	57	GLY	2.4
1	B	336	GLN	2.3
1	B	601	ALA	2.3
1	A	57	GLY	2.3
1	B	280	VAL	2.3
1	B	439	ARG	2.2
1	B	460	THR	2.2
1	A	59	GLY	2.2
1	B	324	PHE	2.2
1	B	435	GLN	2.2
1	A	603	PRO	2.1
1	B	459	PHE	2.1
1	B	440	MET	2.1
1	B	450	LEU	2.1
1	B	454	ALA	2.1
1	B	402	PHE	2.1
1	B	398	TRP	2.1
1	B	420	TRP	2.1
1	B	340	CYS	2.1
1	B	104[A]	ILE	2.0
1	B	394	TRP	2.0
1	B	442	LYS	2.0
1	B	335	GLY	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 [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
3	SO4	A	802	5/5	0.95	0.09	38,38,42,43	0
3	SO4	B	802	5/5	0.95	0.07	44,44,47,50	0
2	CA	B	801	1/1	0.98	0.04	37,37,37,37	0
2	CA	A	801	1/1	0.99	0.03	20,20,20,20	0

6.5 Other polymers [i](#)

There are no such residues in this entry.