



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 11:11 AM UTC

PDB ID : 2V0T / pdb_00002v0t
Title : The A178L mutation in the C-terminal hinge of the flexible loop-6 of triosephosphate isomerase (TIM) induces a more closed conformation of this hinge region in dimeric and monomeric TIM
Authors : Alahuhta, M.; Casteleijn, M.G.; Neubauer, P.; Wierenga, R.K.
Deposited on : 2007-05-18
Resolution : 2.20 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

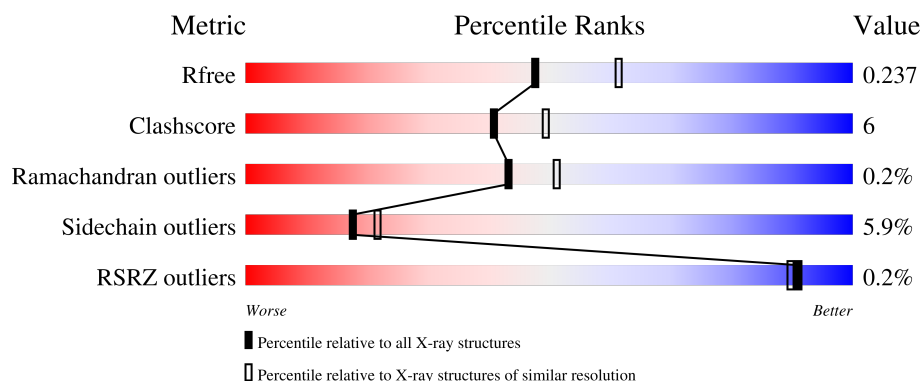
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	6164 (2.20-2.20)
Clashscore	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)
RSRZ outliers	180081	6166 (2.20-2.20)

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	250	
1	B	250	
1	C	250	
1	D	250	
1	E	250	

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Mol	Chain	Length	Quality of chain
1	F	250	82% 12% ...
1	G	250	82% 16% .
1	H	250	83% 12% ..

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 16444 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 TRIOSEPHOSPHATE ISOMERASE GLYCOSOMAL.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	243	Total	C	N	O	S	0	0	0
			1849	1177	324	343	5			
1	B	249	Total	C	N	O	S	0	0	0
			1886	1200	331	350	5			
1	C	242	Total	C	N	O	S	0	1	0
			1851	1177	324	345	5			
1	D	249	Total	C	N	O	S	0	0	0
			1886	1200	331	350	5			
1	E	244	Total	C	N	O	S	0	0	0
			1853	1180	325	343	5			
1	F	242	Total	C	N	O	S	0	0	0
			1842	1172	323	342	5			
1	G	249	Total	C	N	O	S	0	0	0
			1886	1200	331	350	5			
1	H	242	Total	C	N	O	S	0	0	0
			1842	1172	323	342	5			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	178	LEU	ALA	engineered mutation	UNP P04789
B	178	LEU	ALA	engineered mutation	UNP P04789
C	178	LEU	ALA	engineered mutation	UNP P04789
D	178	LEU	ALA	engineered mutation	UNP P04789
E	178	LEU	ALA	engineered mutation	UNP P04789
F	178	LEU	ALA	engineered mutation	UNP P04789
G	178	LEU	ALA	engineered mutation	UNP P04789
H	178	LEU	ALA	engineered mutation	UNP P04789

- 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	B	1	Total	O	S	0	0
			5	4	1		
2	C	1	Total	O	S	0	0
			5	4	1		
2	D	1	Total	O	S	0	0
			5	4	1		
2	E	1	Total	O	S	0	0
			5	4	1		
2	E	1	Total	O	S	0	0
			5	4	1		
2	F	1	Total	O	S	0	0
			5	4	1		
2	G	1	Total	O	S	0	0
			5	4	1		
2	H	1	Total	O	S	0	0
			5	4	1		

- Molecule 3 is 4-(2-HYDROXYETHYL)-1-PIPERAZINE ETHANESULFONIC ACID (CCD ID: EPE) (formula: $C_8H_{18}N_2O_4S$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	C	1	Total	C	N	O	S	0	0
			15	8	2	4	1		
3	D	1	Total	C	N	O	S	0	0
			15	8	2	4	1		

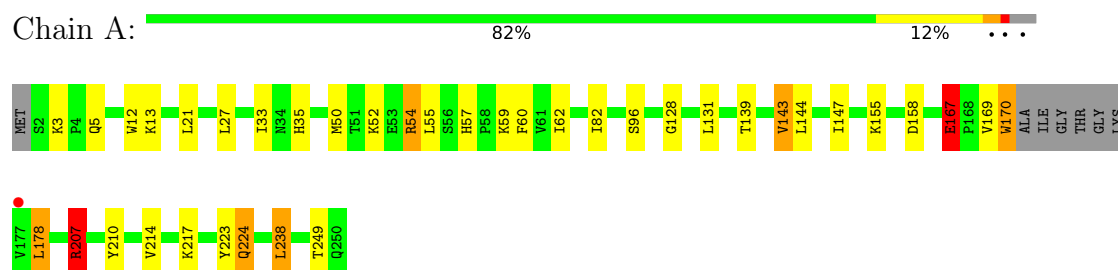
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	206	Total	O	0	0
			206	206		
4	B	196	Total	O	0	0
			196	196		
4	C	202	Total	O	0	0
			202	202		
4	D	214	Total	O	0	0
			214	214		
4	E	206	Total	O	0	0
			206	206		
4	F	187	Total	O	0	0
			187	187		
4	G	126	Total	O	0	0
			126	126		
4	H	132	Total	O	0	0
			132	132		

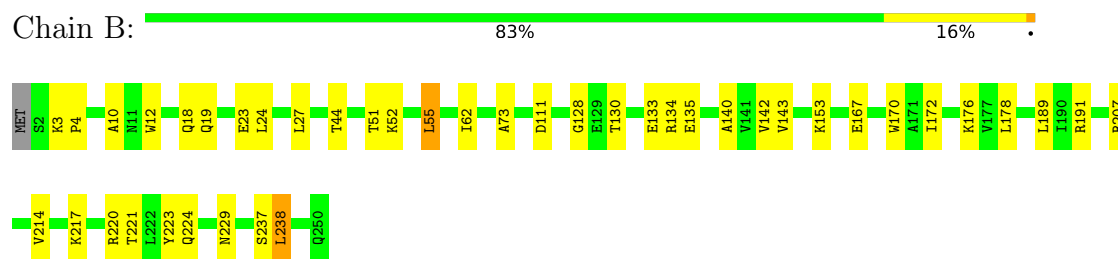
3 Residue-property plots

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.

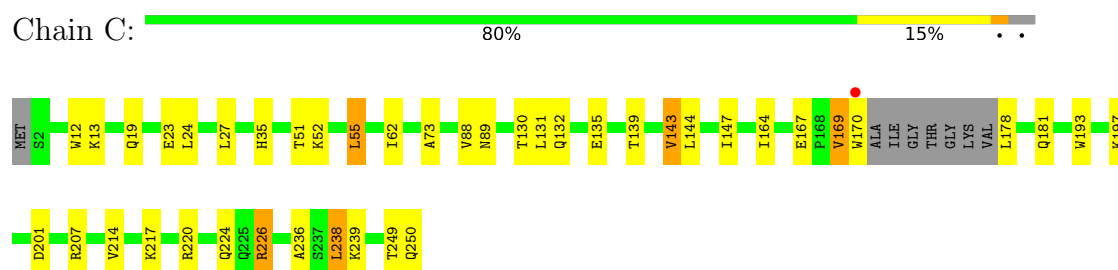
• Molecule 1: TRIOSEPHOSPHATE ISOMERASE GLYCOSOMAL



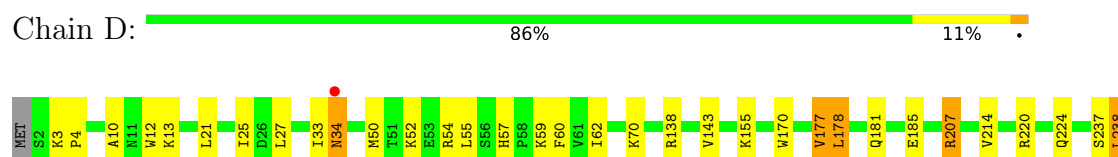
• Molecule 1: TRIOSEPHOSPHATE ISOMERASE GLYCOSOMAL



• Molecule 1: TRIOSEPHOSPHATE ISOMERASE GLYCOSOMAL



• Molecule 1: TRIOSEPHOSPHATE ISOMERASE GLYCOSOMAL





• Molecule 1: TRIOSEPHOSPHATE ISOMERASE GLYCOSOMAL

Chain E:  85% 10% ..



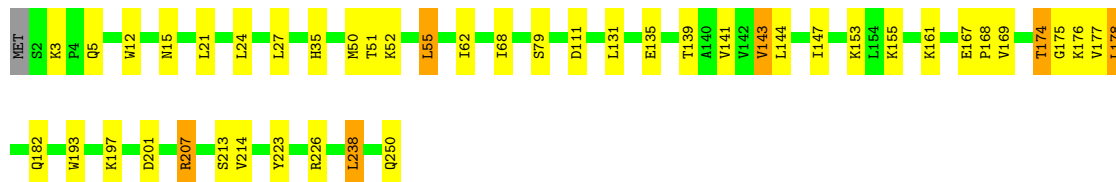
• Molecule 1: TRIOSEPHOSPHATE ISOMERASE GLYCOSOMAL

Chain F:  82% 12% ...



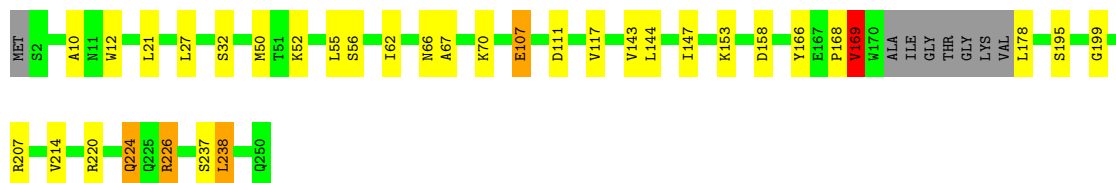
• Molecule 1: TRIOSEPHOSPHATE ISOMERASE GLYCOSOMAL

Chain G:  82% 16% .



• Molecule 1: TRIOSEPHOSPHATE ISOMERASE GLYCOSOMAL

Chain H:  83% 12% ..



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	76.69Å 79.25Å 174.00Å 90.00° 99.22° 90.00°	Depositor
Resolution (Å)	19.81 – 2.20 19.81 – 2.20	Depositor EDS
% Data completeness (in resolution range)	100.0 (19.81-2.20) 98.6 (19.81-2.20)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.59 (at 2.21Å)	Xtriage
Refinement program	REFMAC 5.3.0028	Depositor
R, R_{free}	0.178 , 0.238 0.178 , 0.237	Depositor DCC
R_{free} test set	5153 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	20.7	Xtriage
Anisotropy	0.498	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 33.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	16444	wwPDB-VP
Average B, all atoms (Å ²)	13.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.63% 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

5.1 Standard geometry

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

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	0.85	1/1882 (0.1%)	1.04	3/2551 (0.1%)
1	B	0.85	0/1920	0.99	0/2603
1	C	0.90	1/1884 (0.1%)	1.06	4/2553 (0.2%)
1	D	0.87	1/1920 (0.1%)	0.98	1/2603 (0.0%)
1	E	0.88	0/1886	1.01	0/2558
1	F	0.84	0/1875	1.01	2/2541 (0.1%)
1	G	0.79	0/1920	0.99	2/2603 (0.1%)
1	H	0.79	1/1875 (0.1%)	0.99	0/2541
All	All	0.85	4/15162 (0.0%)	1.01	12/20553 (0.1%)

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	F	0	1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	177	VAL	CA-CB	5.51	1.62	1.54
1	A	167	GLU	N-CA	-5.43	1.40	1.46
1	C	164	ILE	CA-CB	5.37	1.60	1.54
1	H	169	VAL	CA-CB	5.27	1.61	1.54

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	207	ARG	NE-CZ-NH1	-9.44	112.06	121.50

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	207	ARG	NE-CZ-NH2	9.19	127.47	119.20
1	C	207	ARG	CD-NE-CZ	7.67	135.14	124.40
1	A	54	ARG	N-CA-C	6.91	118.89	111.36
1	D	34	ASN	N-CA-C	5.89	119.23	112.57
1	F	167	GLU	CB-CA-C	-5.85	103.67	110.17
1	F	226	ARG	N-CA-C	5.36	117.82	111.33
1	A	167	GLU	N-CA-CB	-5.33	103.69	111.20
1	A	207	ARG	NE-CZ-NH2	-5.11	114.60	119.20
1	G	167	GLU	CA-C-N	-5.11	115.09	120.66
1	G	167	GLU	C-N-CA	-5.11	115.09	120.66
1	C	181	GLN	N-CA-C	5.02	116.44	111.07

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	F	169	VAL	Peptide

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	1849	0	1880	23	0
1	B	1886	0	1923	25	0
1	C	1851	0	1876	29	0
1	D	1886	0	1923	16	0
1	E	1853	0	1885	24	0
1	F	1842	0	1871	28	0
1	G	1886	0	1923	28	0
1	H	1842	0	1871	28	0
2	A	10	0	0	0	0
2	B	5	0	0	0	0
2	C	5	0	0	0	0
2	D	5	0	0	0	0
2	E	10	0	0	0	0
2	F	5	0	0	0	0
2	G	5	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	H	5	0	0	0	0
3	C	15	0	17	0	0
3	D	15	0	17	0	0
4	A	206	0	0	2	0
4	B	196	0	0	2	0
4	C	202	0	0	2	0
4	D	214	0	0	2	0
4	E	206	0	0	4	0
4	F	187	0	0	4	0
4	G	126	0	0	5	0
4	H	132	0	0	1	0
All	All	16444	0	15186	196	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 6.

All (196) 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:C:89:ASN:HB2	4:C:2097:HOH:O	1.52	1.10
1:E:153:LYS:HE2	4:E:2143:HOH:O	1.63	0.96
1:H:226:ARG:HH21	1:H:226:ARG:HG2	1.31	0.96
1:F:226:ARG:HG2	1:F:226:ARG:HH21	1.29	0.95
1:E:220:ARG:HG2	1:E:220:ARG:HH21	1.36	0.90
1:D:181:GLN:OE1	1:D:185:GLU:OE2	1.91	0.88
1:F:169:VAL:O	1:F:169:VAL:HG23	1.72	0.86
1:H:226:ARG:HH21	1:H:226:ARG:CG	1.95	0.79
1:H:224:GLN:HA	1:H:224:GLN:HE21	1.44	0.79
1:C:131:LEU:O	1:C:135:GLU:HG3	1.83	0.79
1:C:226:ARG:CG	1:C:226:ARG:HH21	1.97	0.78
1:B:111:ASP:OD1	1:B:153:LYS:HE3	1.83	0.77
1:F:220:ARG:NH2	1:F:224:GLN:HE22	1.83	0.77
1:G:153:LYS:HE2	4:G:2091:HOH:O	1.86	0.75
1:H:111:ASP:OD1	1:H:153:LYS:HD2	1.90	0.72
1:F:169:VAL:O	1:F:169:VAL:CG2	2.38	0.71
1:C:226:ARG:HH21	1:C:226:ARG:HG3	1.56	0.70
1:E:220:ARG:HH21	1:E:220:ARG:CG	2.04	0.70
1:B:111:ASP:OD1	1:B:153:LYS:CE	2.40	0.68
1:C:226:ARG:HH21	1:C:226:ARG:CB	2.05	0.68
1:A:170:TRP:H	1:A:170:TRP:CD1	2.12	0.66
1:F:52:LYS:HG3	1:F:62:ILE:HD13	1.77	0.66

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:12:TRP:CD1	1:C:238:LEU:HD13	2.32	0.65
1:F:226:ARG:HG2	1:F:226:ARG:NH2	2.07	0.65
1:C:169:VAL:O	1:C:170:TRP:CG	2.49	0.65
1:E:152:LYS:NZ	1:E:152:LYS:HB3	2.12	0.65
1:F:220:ARG:NH2	1:F:250:GLN:O	2.27	0.63
1:D:12:TRP:CD1	1:D:238:LEU:HD13	2.32	0.63
1:E:152:LYS:HB3	1:E:152:LYS:HZ3	1.64	0.62
1:H:166:TYR:CE2	1:H:168:PRO:HG3	2.34	0.61
1:E:153:LYS:NZ	4:E:2145:HOH:O	2.34	0.61
1:H:111:ASP:OD1	1:H:153:LYS:CD	2.49	0.60
1:E:12:TRP:CD1	1:E:238:LEU:HD13	2.37	0.60
1:F:128:GLY:HA3	1:F:167:GLU:O	2.02	0.60
1:F:33:ILE:HD12	1:F:57:HIS:CE1	2.36	0.59
1:E:122:MET:HE1	4:E:2173:HOH:O	2.02	0.59
1:B:18:GLN:NE2	4:B:2019:HOH:O	2.35	0.59
1:D:52:LYS:HG3	1:D:62:ILE:HD13	1.84	0.59
1:A:224:GLN:HE21	1:A:224:GLN:HA	1.67	0.59
1:B:12:TRP:CD1	1:B:238:LEU:HD13	2.38	0.59
1:H:52:LYS:HG3	1:H:62:ILE:HD13	1.85	0.58
1:E:131:LEU:O	1:E:135:GLU:HG3	2.03	0.58
1:B:52:LYS:HG3	1:B:62:ILE:HD13	1.86	0.58
1:G:131:LEU:HA	1:G:169:VAL:HG23	1.85	0.57
1:B:3:LYS:HB3	1:B:4:PRO:HD2	1.87	0.57
1:E:152:LYS:NZ	1:E:152:LYS:CB	2.67	0.57
1:C:193:TRP:CE2	1:C:197:LYS:HG3	2.39	0.57
1:C:132:GLN:NE2	1:F:132:GLN:HG2	2.20	0.56
1:F:34:ASN:ND2	4:F:2036:HOH:O	2.37	0.56
1:H:117:VAL:HG11	1:H:158:ASP:HB3	1.87	0.56
1:A:57:HIS:HB3	1:A:60:PHE:CD1	2.40	0.56
1:F:220:ARG:NH2	1:F:224:GLN:NE2	2.53	0.56
1:F:52:LYS:HG3	1:F:62:ILE:CD1	2.35	0.56
1:G:153:LYS:CE	4:G:2091:HOH:O	2.46	0.56
1:H:70:LYS:HD3	4:H:2004:HOH:O	2.06	0.56
1:G:131:LEU:O	1:G:135:GLU:HG2	2.06	0.56
1:A:128:GLY:HA3	1:A:167:GLU:O	2.06	0.55
1:D:57:HIS:HB3	1:D:60:PHE:CD1	2.41	0.55
1:F:181:GLN:CD	1:F:181:GLN:H	2.15	0.55
1:B:221:THR:HG23	4:B:2178:HOH:O	2.05	0.55
1:G:52:LYS:HG3	1:G:62:ILE:HD13	1.88	0.55
1:B:133:GLU:CD	1:B:142:VAL:HG21	2.31	0.54
1:D:25:ILE:HG21	1:D:54:ARG:HB3	1.90	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:G:178:LEU:HG	1:G:182:GLN:HB2	1.89	0.54
1:C:220:ARG:NH2	1:C:250:GLN:O	2.40	0.54
1:G:12:TRP:CD1	1:G:238:LEU:HD13	2.43	0.54
1:B:220:ARG:O	1:B:224:GLN:HG2	2.06	0.54
1:H:226:ARG:CG	1:H:226:ARG:NH2	2.64	0.54
1:H:224:GLN:HA	1:H:224:GLN:NE2	2.17	0.54
1:C:139:THR:O	1:C:143:VAL:HG13	2.08	0.53
1:C:169:VAL:O	1:C:170:TRP:CD1	2.60	0.53
1:C:226:ARG:HG3	1:C:226:ARG:NH2	2.24	0.53
1:C:19:GLN:O	1:C:23:GLU:HG3	2.09	0.53
1:F:141:VAL:HG23	4:F:2136:HOH:O	2.08	0.53
1:G:50:MET:HB2	4:G:2027:HOH:O	2.09	0.52
1:F:247:LYS:O	1:F:250:GLN:HG3	2.08	0.52
1:C:52:LYS:HG3	1:C:62:ILE:HD13	1.91	0.52
1:G:193:TRP:CE2	1:G:197:LYS:HG3	2.44	0.52
1:F:21:LEU:HB2	1:F:50:MET:HE1	1.93	0.51
1:G:139:THR:O	1:G:143:VAL:HG13	2.10	0.51
1:G:12:TRP:O	1:G:15:ASN:HB2	2.10	0.51
1:H:52:LYS:HG3	1:H:62:ILE:CD1	2.40	0.51
1:D:10:ALA:HB1	1:D:237:SER:HB2	1.93	0.51
1:E:220:ARG:CG	1:E:220:ARG:NH2	2.69	0.51
1:F:12:TRP:CD1	1:F:238:LEU:HD13	2.46	0.51
1:H:12:TRP:CD1	1:H:238:LEU:HD13	2.46	0.50
1:H:169:VAL:HG23	1:H:169:VAL:O	2.11	0.50
1:F:131:LEU:H	1:F:170:TRP:C	2.19	0.50
1:B:52:LYS:HG3	1:B:62:ILE:CD1	2.41	0.50
1:E:110:ALA:HB3	1:E:153:LYS:HE3	1.94	0.50
1:G:52:LYS:HG3	1:G:62:ILE:CD1	2.42	0.50
1:G:169:VAL:HG13	1:G:176:LYS:H	1.76	0.50
1:A:12:TRP:CD1	1:A:238:LEU:HD13	2.47	0.49
1:F:181:GLN:H	1:F:181:GLN:NE2	2.10	0.49
1:H:220:ARG:O	1:H:224:GLN:HG2	2.12	0.49
1:A:52:LYS:HG3	1:A:62:ILE:HD13	1.95	0.49
1:D:170:TRP:CZ2	1:D:178:LEU:HD22	2.47	0.49
1:H:224:GLN:HE21	1:H:224:GLN:CA	2.21	0.49
1:D:52:LYS:HG3	1:D:62:ILE:CD1	2.43	0.49
1:H:111:ASP:OD1	1:H:153:LYS:HE3	2.13	0.49
1:A:3:LYS:NZ	1:A:223:TYR:O	2.46	0.48
1:B:133:GLU:OE1	1:B:142:VAL:HG11	2.13	0.48
1:D:13:LYS:HD3	1:F:73:ALA:HA	1.95	0.48
1:E:52:LYS:HG3	1:E:62:ILE:HD13	1.95	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:62:ILE:HD11	1:E:88:VAL:HG22	1.94	0.48
1:F:52:LYS:O	4:F:2057:HOH:O	2.19	0.48
1:G:169:VAL:HG13	1:G:176:LYS:N	2.28	0.48
1:A:33:ILE:O	1:A:59:LYS:NZ	2.46	0.48
1:C:62:ILE:HD11	1:C:88:VAL:HG22	1.94	0.48
1:F:139:THR:O	1:F:143:VAL:HG13	2.14	0.48
1:G:141:VAL:HG23	4:G:2085:HOH:O	2.14	0.48
1:H:10:ALA:HB1	1:H:237:SER:HB2	1.95	0.48
1:C:236:ALA:HA	1:C:239:LYS:HD2	1.96	0.47
1:A:96:SER:OG	1:A:167:GLU:OE1	2.28	0.47
1:G:161:LYS:HE2	4:G:2074:HOH:O	2.14	0.47
1:G:174:THR:HB	1:G:175:GLY:H	1.50	0.47
1:F:130:THR:HA	1:F:170:TRP:C	2.40	0.47
1:E:220:ARG:O	1:E:224:GLN:HG2	2.14	0.47
1:B:130:THR:C	1:B:170:TRP:HB3	2.40	0.46
1:F:221:THR:HG23	4:F:2170:HOH:O	2.16	0.46
1:D:10:ALA:CB	1:D:237:SER:HB2	2.46	0.46
1:F:35:HIS:HE1	1:F:249:THR:OG1	1.99	0.46
1:C:130:THR:HA	1:C:169:VAL:HB	1.98	0.45
1:E:128:GLY:HA3	1:E:167:GLU:O	2.16	0.45
1:A:131:LEU:HB2	1:A:170:TRP:HB3	1.99	0.45
1:H:21:LEU:CB	1:H:50:MET:HE1	2.46	0.45
1:A:13:LYS:HD3	1:B:73:ALA:HA	1.99	0.45
1:D:33:ILE:O	1:D:59:LYS:NZ	2.50	0.45
1:B:10:ALA:HB1	1:B:237:SER:HB2	1.99	0.45
1:A:54:ARG:HD2	4:A:2067:HOH:O	2.16	0.45
1:B:133:GLU:HB3	1:B:142:VAL:HG21	1.99	0.45
1:F:217:LYS:H	1:F:217:LYS:HD2	1.82	0.45
1:G:51:THR:O	1:G:55:LEU:HB2	2.17	0.45
1:A:35:HIS:HE1	1:A:249:THR:OG1	2.00	0.45
1:G:3:LYS:NZ	1:G:223:TYR:O	2.50	0.44
1:G:177:VAL:HG12	1:G:213:SER:HB3	1.99	0.44
1:C:51:THR:O	1:C:55:LEU:HB2	2.17	0.44
1:D:138:ARG:NH2	4:D:2141:HOH:O	2.50	0.44
1:C:226:ARG:CB	1:C:226:ARG:NH2	2.79	0.44
1:A:139:THR:O	1:A:143:VAL:HG13	2.17	0.44
1:A:82:ILE:HD13	1:B:44:THR:HG21	1.98	0.44
1:B:3:LYS:NZ	1:B:223:TYR:O	2.50	0.44
1:E:224:GLN:HG2	1:E:224:GLN:H	1.65	0.44
1:A:178:LEU:HG	1:A:210:TYR:OH	2.19	0.43
1:D:21:LEU:HB2	1:D:50:MET:HE1	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:226:ARG:CG	1:C:226:ARG:NH2	2.67	0.43
1:A:96:SER:CB	1:A:169:VAL:HG22	2.47	0.43
1:G:35:HIS:CD2	1:G:250:GLN:HG2	2.54	0.43
1:G:5:GLN:OE1	1:G:207:ARG:NH2	2.52	0.43
1:H:21:LEU:HB2	1:H:50:MET:HE1	1.99	0.43
1:C:73:ALA:HA	1:E:13:LYS:HD3	2.01	0.43
1:A:5:GLN:OE1	1:A:207:ARG:NH2	2.52	0.43
1:B:220:ARG:O	1:B:220:ARG:HD2	2.19	0.43
1:C:226:ARG:HG2	4:C:2183:HOH:O	2.18	0.43
1:C:62:ILE:CD1	1:C:88:VAL:HG22	2.49	0.42
1:G:21:LEU:HB2	1:G:50:MET:HE1	2.01	0.42
1:D:220:ARG:O	1:D:224:GLN:HG2	2.18	0.42
1:H:144:LEU:HA	1:H:147:ILE:HG22	2.01	0.42
1:H:111:ASP:OD1	1:H:153:LYS:CE	2.67	0.42
1:A:207:ARG:HD3	4:A:2166:HOH:O	2.19	0.42
1:C:144:LEU:HA	1:C:147:ILE:HG22	2.00	0.42
1:G:144:LEU:HA	1:G:147:ILE:HG22	2.01	0.42
1:E:181:GLN:HB2	4:E:2161:HOH:O	2.20	0.42
1:A:144:LEU:HA	1:A:147:ILE:HG22	2.02	0.42
1:C:220:ARG:O	1:C:224:GLN:HG2	2.19	0.42
1:E:110:ALA:HB1	1:E:153:LYS:HG3	2.01	0.42
1:H:55:LEU:HD23	1:H:56:SER:N	2.35	0.42
1:A:21:LEU:HB2	1:A:50:MET:HE1	2.01	0.41
1:B:19:GLN:O	1:B:23:GLU:HG3	2.20	0.41
1:G:111:ASP:OD1	1:G:153:LYS:HD2	2.20	0.41
1:G:168:PRO:CB	1:G:178:LEU:HD22	2.50	0.41
1:A:57:HIS:HB3	1:A:60:PHE:HD1	1.83	0.41
1:C:52:LYS:HG3	1:C:62:ILE:CD1	2.50	0.41
1:H:195:SER:HA	1:H:199:GLY:O	2.20	0.41
1:B:24:LEU:HD11	1:B:238:LEU:HA	2.01	0.41
1:C:35:HIS:HE1	1:C:249:THR:OG1	2.02	0.41
1:C:226:ARG:NH2	1:C:226:ARG:HB3	2.35	0.41
1:H:107:GLU:H	1:H:107:GLU:CD	2.28	0.41
1:B:51:THR:O	1:B:55:LEU:HB2	2.20	0.41
1:E:21:LEU:CB	1:E:50:MET:HE1	2.50	0.41
1:B:128:GLY:HA3	1:B:167:GLU:O	2.20	0.41
1:B:111:ASP:OD1	1:B:153:LYS:CD	2.68	0.41
1:E:21:LEU:HB2	1:E:50:MET:HE1	2.02	0.41
1:H:66:ASN:CG	1:H:67:ALA:H	2.28	0.41
1:B:140:ALA:HA	1:B:189:LEU:HD21	2.02	0.41
1:B:191:ARG:NH2	1:B:229:ASN:OD1	2.46	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:207:ARG:HD3	4:D:2155:HOH:O	2.21	0.41
1:H:10:ALA:CB	1:H:237:SER:HB2	2.51	0.41
1:D:3:LYS:HA	1:D:4:PRO:HD2	1.88	0.41
1:E:139:THR:O	1:E:143:VAL:HG13	2.21	0.41
1:F:155:LYS:HD3	1:F:155:LYS:HA	1.70	0.41
1:G:68:ILE:O	1:G:79:SER:HA	2.20	0.41
1:H:226:ARG:HG2	1:H:226:ARG:NH2	2.14	0.40
1:A:155:LYS:O	1:A:158:ASP:HB2	2.22	0.40
1:E:63:ALA:HA	1:E:90:TRP:O	2.22	0.40
1:G:155:LYS:HA	1:G:155:LYS:HD3	1.88	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	239/250 (96%)	235 (98%)	4 (2%)	0	100	100
1	B	247/250 (99%)	240 (97%)	7 (3%)	0	100	100
1	C	239/250 (96%)	236 (99%)	2 (1%)	1 (0%)	30	34
1	D	247/250 (99%)	243 (98%)	4 (2%)	0	100	100
1	E	240/250 (96%)	233 (97%)	7 (3%)	0	100	100
1	F	238/250 (95%)	233 (98%)	4 (2%)	1 (0%)	30	34
1	G	247/250 (99%)	240 (97%)	7 (3%)	0	100	100
1	H	238/250 (95%)	228 (96%)	9 (4%)	1 (0%)	30	34
All	All	1935/2000 (97%)	1888 (98%)	44 (2%)	3 (0%)	43	51

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	F	169	VAL
1	H	169	VAL
1	C	13	LYS

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	194/198 (98%)	183 (94%)	11 (6%)	18	23
1	B	197/198 (100%)	185 (94%)	12 (6%)	17	20
1	C	194/198 (98%)	182 (94%)	12 (6%)	16	20
1	D	197/198 (100%)	186 (94%)	11 (6%)	19	24
1	E	194/198 (98%)	181 (93%)	13 (7%)	15	17
1	F	193/198 (98%)	182 (94%)	11 (6%)	18	23
1	G	197/198 (100%)	186 (94%)	11 (6%)	19	24
1	H	193/198 (98%)	182 (94%)	11 (6%)	18	23
All	All	1559/1584 (98%)	1467 (94%)	92 (6%)	18	22

All (92) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	27	LEU
1	A	55	LEU
1	A	143	VAL
1	A	167	GLU
1	A	170	TRP
1	A	178	LEU
1	A	207	ARG
1	A	214	VAL
1	A	217	LYS
1	A	224	GLN
1	A	238	LEU
1	B	27	LEU
1	B	55	LEU

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Mol	Chain	Res	Type
1	B	134	ARG
1	B	135	GLU
1	B	143	VAL
1	B	172	ILE
1	B	176	LYS
1	B	178	LEU
1	B	207	ARG
1	B	214	VAL
1	B	217	LYS
1	B	238	LEU
1	C	24	LEU
1	C	27	LEU
1	C	55	LEU
1	C	143	VAL
1	C	167	GLU
1	C	169	VAL
1	C	178	LEU
1	C	201	ASP
1	C	214	VAL
1	C	217	LYS
1	C	226	ARG
1	C	238	LEU
1	D	27	LEU
1	D	34	ASN
1	D	55	LEU
1	D	70	LYS
1	D	143	VAL
1	D	155	LYS
1	D	177	VAL
1	D	178	LEU
1	D	207	ARG
1	D	214	VAL
1	D	238	LEU
1	E	24	LEU
1	E	27	LEU
1	E	55	LEU
1	E	143	VAL
1	E	152	LYS
1	E	169	VAL
1	E	207	ARG
1	E	213	SER
1	E	214	VAL

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Mol	Chain	Res	Type
1	E	220	ARG
1	E	224	GLN
1	E	238	LEU
1	E	250	GLN
1	F	19	GLN
1	F	27	LEU
1	F	143	VAL
1	F	169	VAL
1	F	170	TRP
1	F	198	ILE
1	F	207	ARG
1	F	214	VAL
1	F	217	LYS
1	F	226	ARG
1	F	238	LEU
1	G	24	LEU
1	G	27	LEU
1	G	55	LEU
1	G	143	VAL
1	G	174	THR
1	G	178	LEU
1	G	201	ASP
1	G	207	ARG
1	G	214	VAL
1	G	226	ARG
1	G	238	LEU
1	H	27	LEU
1	H	32	SER
1	H	107	GLU
1	H	143	VAL
1	H	169	VAL
1	H	178	LEU
1	H	207	ARG
1	H	214	VAL
1	H	224	GLN
1	H	226	ARG
1	H	238	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (27) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	19	GLN

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Mol	Chain	Res	Type
1	A	34	ASN
1	A	35	HIS
1	A	132	GLN
1	A	182	GLN
1	B	19	GLN
1	B	34	ASN
1	B	181	GLN
1	C	34	ASN
1	C	35	HIS
1	C	187	HIS
1	C	224	GLN
1	D	19	GLN
1	D	34	ASN
1	D	181	GLN
1	E	35	HIS
1	F	19	GLN
1	F	35	HIS
1	F	181	GLN
1	F	224	GLN
1	F	250	GLN
1	G	19	GLN
1	G	35	HIS
1	H	35	HIS
1	H	89	ASN
1	H	224	GLN
1	H	250	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

12 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	1252	-	4,4,4	0.32	0	6,6,6	0.46	0
2	SO4	E	1252	-	4,4,4	0.39	0	6,6,6	0.58	0
2	SO4	A	1251	-	4,4,4	0.29	0	6,6,6	0.44	0
3	EPE	D	1252	-	15,15,15	1.02	1 (6%)	19,20,20	1.52	3 (15%)
3	EPE	C	1252	-	15,15,15	1.53	1 (6%)	19,20,20	2.08	6 (31%)
2	SO4	D	1251	-	4,4,4	0.19	0	6,6,6	0.42	0
2	SO4	G	1251	-	4,4,4	0.25	0	6,6,6	0.58	0
2	SO4	H	1251	-	4,4,4	0.25	0	6,6,6	0.30	0
2	SO4	B	1251	-	4,4,4	0.39	0	6,6,6	0.17	0
2	SO4	C	1251	-	4,4,4	0.32	0	6,6,6	0.31	0
2	SO4	F	1251	-	4,4,4	0.25	0	6,6,6	0.37	0
2	SO4	E	1251	-	4,4,4	0.23	0	6,6,6	0.50	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
3	EPE	D	1252	-	-	4/9/19/19	0/1/1/1
3	EPE	C	1252	-	-	5/9/19/19	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	1252	EPE	C10-S	5.41	1.85	1.77
3	D	1252	EPE	C10-S	3.27	1.82	1.77

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	1252	EPE	O1S-S-C10	-4.39	100.09	106.73
3	C	1252	EPE	O2S-S-C10	-3.87	100.88	106.73
3	D	1252	EPE	O1S-S-C10	-3.37	101.64	106.73
3	C	1252	EPE	O3S-S-C10	-3.27	99.62	106.00
3	C	1252	EPE	O3S-S-O2S	3.15	119.27	111.40
3	C	1252	EPE	C7-N4-C5	-2.84	103.66	111.24
3	D	1252	EPE	O2S-S-C10	-2.77	102.55	106.73
3	C	1252	EPE	C5-N4-C3	2.36	113.91	108.84
3	D	1252	EPE	C5-N4-C3	2.05	113.26	108.84

There are no chirality outliers.

All (9) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	C	1252	EPE	C8-C7-N4-C3
3	C	1252	EPE	C9-C10-S-O2S
3	C	1252	EPE	C9-C10-S-O3S
3	D	1252	EPE	C10-C9-N1-C6
3	C	1252	EPE	N4-C7-C8-O8
3	D	1252	EPE	C8-C7-N4-C5
3	C	1252	EPE	C9-C10-S-O1S
3	D	1252	EPE	C8-C7-N4-C3
3	D	1252	EPE	C10-C9-N1-C2

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	243/250 (97%)	-0.44	1 (0%) 88 87	6, 12, 21, 32	0
1	B	249/250 (99%)	-0.32	0 100 100	6, 12, 28, 39	0
1	C	242/250 (96%)	-0.36	1 (0%) 88 87	6, 12, 20, 45	1 (0%)
1	D	249/250 (99%)	-0.42	1 (0%) 88 87	6, 12, 19, 27	0
1	E	244/250 (97%)	-0.36	0 100 100	6, 13, 21, 29	0
1	F	242/250 (96%)	-0.43	1 (0%) 88 87	6, 12, 19, 34	0
1	G	249/250 (99%)	-0.26	0 100 100	8, 13, 18, 28	0
1	H	242/250 (96%)	-0.24	0 100 100	7, 13, 20, 34	0
All	All	1960/2000 (98%)	-0.35	4 (0%) 91 90	6, 12, 21, 45	1 (0%)

All (4) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	170	TRP	2.8
1	D	34	ASN	2.7
1	F	170	TRP	2.7
1	A	177	VAL	2.3

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($\text{\AA}^2$)	Q<0.9
2	SO4	G	1251	5/5	0.90	0.10	40,42,42,44	0
2	SO4	E	1252	5/5	0.91	0.10	25,27,32,32	0
2	SO4	A	1252	5/5	0.92	0.11	34,37,37,38	0
3	EPE	D	1252	15/15	0.92	0.11	38,45,52,53	0
2	SO4	H	1251	5/5	0.94	0.07	39,41,42,42	0
2	SO4	E	1251	5/5	0.96	0.09	35,36,37,37	0
2	SO4	A	1251	5/5	0.97	0.05	29,30,31,31	0
2	SO4	B	1251	5/5	0.97	0.06	23,24,25,25	0
3	EPE	C	1252	15/15	0.97	0.06	9,16,25,30	0
2	SO4	F	1251	5/5	0.97	0.05	34,34,34,35	0
2	SO4	C	1251	5/5	0.98	0.06	21,21,23,24	0
2	SO4	D	1251	5/5	0.99	0.06	16,16,19,19	0

6.5 Other polymers [i](#)

There are no such residues in this entry.