Full wwPDB X-ray Structure Validation Report (i)

Feb 1, 2016 – 06:39 PM GMT

PDB ID	:	4MA9
Title	:	Wild type Salmonella Alkyl Hydroperoxide Reductase C in its substrate-ready conformation
Authors	:	Perkins, A.; Karplus, P.A.
Deposited on	:	2013-08-15
Resolution	:	1.82 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
http://wwpdb.org/validation/2016/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

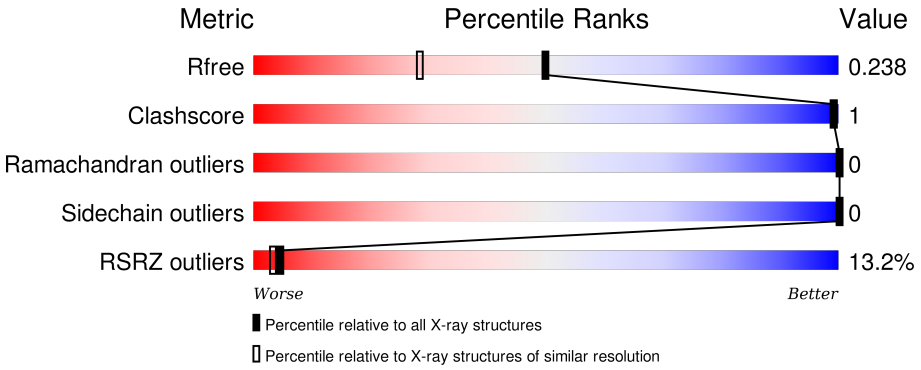
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026688
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.82 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}	91344	5422 (1.84-1.80)
Clashscore	102246	6347 (1.84-1.80)
Ramachandran outliers	100387	6276 (1.84-1.80)
Sidechain outliers	100360	6276 (1.84-1.80)
RSRZ outliers	91569	5439 (1.84-1.80)

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 on the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria. 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 <=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	186	4% 85% . 12%
1	B	186	13% 97% .
1	C	186	17% 98% .
1	D	186	12% 99% .
1	E	186	19% 100%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	GOL	B	203	-	-	-	X

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 14783 atoms, of which 7029 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 Alkyl hydroperoxide reductase subunit C.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	163	Total	C	H	N	O	S	0	4	0
			2550	826	1248	216	257	3			
1	B	186	Total	C	H	N	O	S	0	12	0
			3026	980	1490	254	297	5			
1	C	186	Total	C	H	N	O	S	0	2	0
			2889	933	1424	242	286	4			
1	D	186	Total	C	H	N	O	S	0	2	0
			2886	932	1422	242	286	4			
1	E	186	Total	C	H	N	O	S	0	0	0
			2865	926	1413	241	281	4			

- Molecule 2 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	1	Total	Cl	0	0
			1	1		
2	A	1	Total	Cl	0	0
			1	1		
2	D	1	Total	Cl	0	0
			1	1		
2	C	1	Total	Cl	0	0
			1	1		
2	E	1	Total	Cl	0	0
			1	1		

- Molecule 3 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	1	Total	K	0	0
			1	1		
3	A	1	Total	K	0	0
			1	1		

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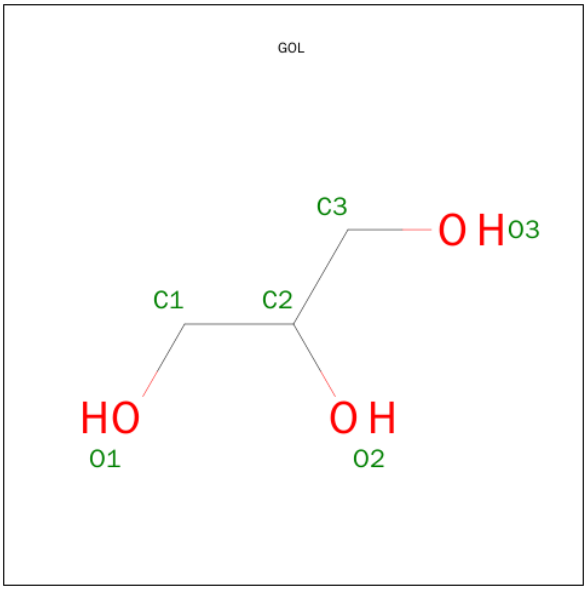
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	D	1	Total K 1 1	0	0

- Molecule 4 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C H O 14 3 8 3	0	0
4	B	1	Total C H O 14 3 8 3	0	0
4	C	1	Total C H O 14 3 8 3	0	0
4	D	1	Total C H O 14 3 8 3	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	127	Total O 127 127	0	4
5	B	133	Total O 133 133	0	2
5	C	99	Total O 99 99	0	0
5	D	102	Total O 102 102	0	2

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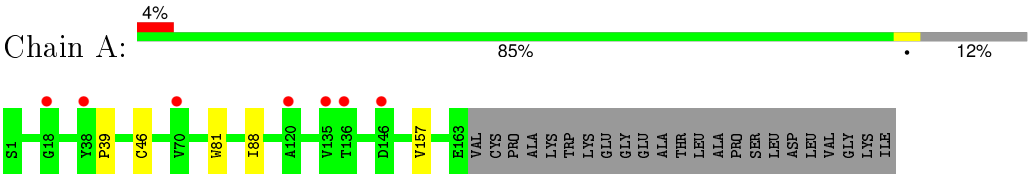
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	E	42	Total 42	O 42	0	0

3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

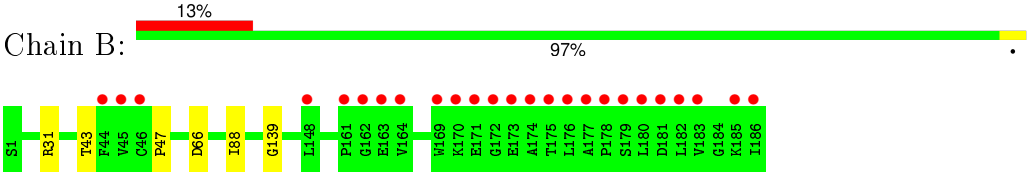
- Molecule 1: Alkyl hydroperoxide reductase subunit C

Chain A:



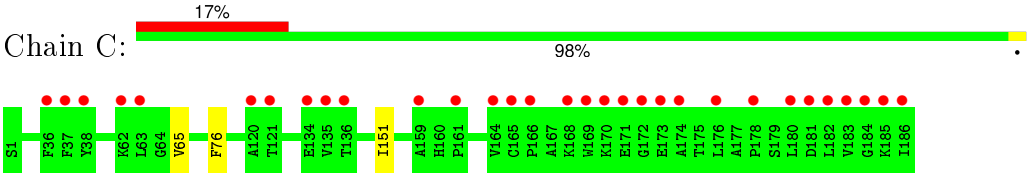
- Molecule 1: Alkyl hydroperoxide reductase subunit C

Chain B:



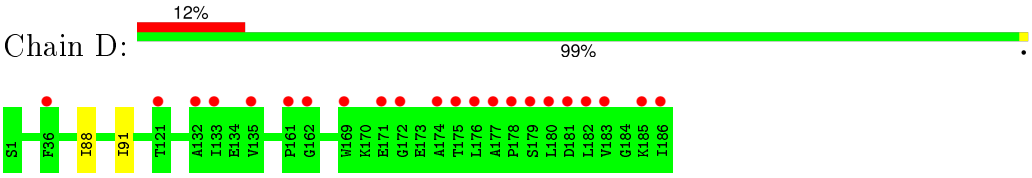
- Molecule 1: Alkyl hydroperoxide reductase subunit C

Chain C:



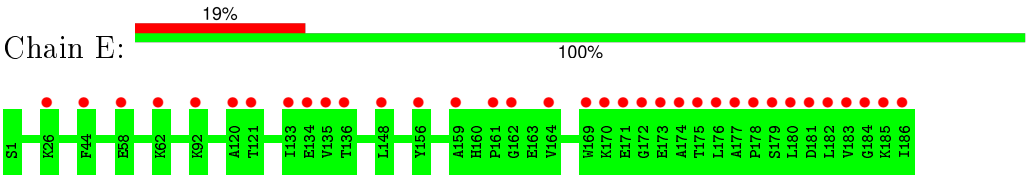
- Molecule 1: Alkyl hydroperoxide reductase subunit C

Chain D:



- Molecule 1: Alkyl hydroperoxide reductase subunit C

Chain E:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	126.84Å 171.15Å 135.32Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	36.76 – 1.82 36.76 – 1.82	Depositor EDS
% Data completeness (in resolution range)	96.0 (36.76-1.82) 96.0 (36.76-1.82)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.06 (at 1.82Å)	Xtriage
Refinement program	BUSTER 2.11.4	Depositor
R, R_{free}	0.204 , 0.240 0.214 , 0.238	Depositor DCC
R_{free} test set	6384 reflections (5.34%)	DCC
Wilson B-factor (Å^2)	29.9	Xtriage
Anisotropy	0.148	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.42 , 67.0	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Outliers	2 of 125942 reflections (0.002%)	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	14783	wwPDB-VP
Average B, all atoms (Å^2)	51.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.40% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 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: GOL, K, 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	0.53	0/1348	0.69	0/1827
1	B	0.55	0/1586	0.67	0/2151
1	C	0.53	0/1506	0.66	0/2041
1	D	0.50	0/1506	0.65	0/2041
1	E	0.43	0/1486	0.59	0/2014
All	All	0.51	0/7432	0.65	0/10074

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	1302	1248	1230	3	0
1	B	1536	1490	1477	4	0
1	C	1465	1424	1415	2	0
1	D	1464	1422	1416	1	0
1	E	1452	1413	1414	0	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	D	1	0	0	0	0
2	E	1	0	0	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	D	1	0	0	0	0
4	A	6	8	8	0	0
4	B	6	8	8	0	0
4	C	6	8	8	0	0
4	D	6	8	8	0	0
5	A	127	0	0	0	0
5	B	133	0	0	0	0
5	C	99	0	0	0	0
5	D	102	0	0	0	0
5	E	42	0	0	0	0
All	All	7754	7029	6984	8	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 1.

All (8) 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:157:VAL:HG11	1:B:139:GLY:HA3	1.88	0.55
1:B:31:ARG:HD3	1:B:66:ASP:OD2	2.08	0.53
1:D:88:ILE:HG23	1:D:91:ILE:HD12	2.02	0.42
1:B:47[A]:PRO:CG	1:B:88:ILE:HD11	2.51	0.41
1:B:43[A]:THR:HG22	1:C:76:PHE:CD2	2.55	0.41
1:A:81:TRP:CD2	1:A:88:ILE:HG13	2.57	0.40
1:C:65:VAL:HG21	1:C:151:ILE:HG21	2.03	0.40
1:A:39:PRO:HD2	1:A:46:CYS:SG	2.62	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	165/186 (89%)	161 (98%)	4 (2%)	0	100	100
1	B	196/186 (105%)	192 (98%)	4 (2%)	0	100	100
1	C	186/186 (100%)	181 (97%)	5 (3%)	0	100	100
1	D	186/186 (100%)	182 (98%)	4 (2%)	0	100	100
1	E	184/186 (99%)	178 (97%)	6 (3%)	0	100	100
All	All	917/930 (99%)	894 (98%)	23 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	140/154 (91%)	140 (100%)	0	100	100
1	B	164/154 (106%)	164 (100%)	0	100	100
1	C	156/154 (101%)	156 (100%)	0	100	100
1	D	156/154 (101%)	156 (100%)	0	100	100
1	E	153/154 (99%)	153 (100%)	0	100	100
All	All	769/770 (100%)	769 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 carbohydrates in this entry.

5.6 Ligand geometry (i)

Of 12 ligands modelled in this entry, 8 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	GOL	A	203	-	5,5,5	0.18	0	5,5,5	0.23	0
4	GOL	B	203	-	5,5,5	0.24	0	5,5,5	0.23	0
4	GOL	C	202	-	5,5,5	0.17	0	5,5,5	0.31	0
4	GOL	D	203	-	5,5,5	0.27	0	5,5,5	0.73	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
4	GOL	A	203	-	-	0/4/4/4	0/0/0/0
4	GOL	B	203	-	-	0/4/4/4	0/0/0/0
4	GOL	C	202	-	-	0/4/4/4	0/0/0/0
4	GOL	D	203	-	-	0/4/4/4	0/0/0/0

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

There are no such residues in this entry.

5.8 Polymer linkage issues

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, 95^{th} 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	163/186 (87%)	0.09	7 (4%) 39 32	24, 38, 61, 71	0
1	B	186/186 (100%)	0.53	25 (13%) 4 3	24, 39, 81, 101	0
1	C	186/186 (100%)	0.76	31 (16%) 2 1	28, 45, 101, 123	0
1	D	186/186 (100%)	0.64	22 (11%) 6 4	33, 46, 80, 103	0
1	E	186/186 (100%)	1.11	35 (18%) 2 1	42, 67, 103, 128	0
All	All	907/930 (97%)	0.64	120 (13%) 4 3	24, 46, 93, 128	0

All (120) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	172	GLY	10.0
1	E	174	ALA	9.4
1	C	176	LEU	8.9
1	B	182	LEU	8.6
1	B	174	ALA	8.4
1	C	172	GLY	7.8
1	E	182	LEU	7.6
1	D	176	LEU	6.8
1	D	181	ASP	6.7
1	B	180	LEU	6.6
1	B	172	GLY	6.5
1	E	176	LEU	6.3
1	B	181	ASP	6.3
1	C	170	LYS	6.2
1	C	185	LYS	6.1
1	C	171	GLU	6.0
1	D	172	GLY	5.9
1	D	171	GLU	5.9
1	E	159	ALA	5.8
1	E	171	GLU	5.6

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Mol	Chain	Res	Type	RSRZ
1	D	174	ALA	5.6
1	B	177	ALA	5.5
1	E	173	GLU	5.4
1	B	179	SER	5.4
1	E	175	THR	5.3
1	C	174	ALA	5.3
1	B	185	LYS	5.3
1	D	179	SER	5.2
1	B	170	LYS	5.0
1	D	180	LEU	4.8
1	D	182	LEU	4.8
1	E	185	LYS	4.8
1	C	169	TRP	4.8
1	E	181	ASP	4.8
1	D	175	THR	4.7
1	B	46[A]	CYS	4.6
1	E	179	SER	4.4
1	B	175	THR	4.4
1	C	182	LEU	4.2
1	E	169	TRP	4.2
1	D	178	PRO	4.2
1	E	135	VAL	4.0
1	B	44[A]	PHE	4.0
1	E	148	LEU	3.9
1	D	177	ALA	3.9
1	E	180	LEU	3.9
1	D	185	LYS	3.8
1	E	183	VAL	3.8
1	E	177	ALA	3.8
1	B	176	LEU	3.8
1	E	161	PRO	3.8
1	C	164	VAL	3.7
1	E	62	LYS	3.7
1	B	169	TRP	3.5
1	E	170	LYS	3.5
1	D	133	ILE	3.5
1	E	133	ILE	3.5
1	C	184	GLY	3.5
1	C	180	LEU	3.5
1	E	156	TYR	3.4
1	E	178	PRO	3.4
1	B	171	GLU	3.4

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Mol	Chain	Res	Type	RSRZ
1	C	161	PRO	3.4
1	E	186	ILE	3.3
1	B	173	GLU	3.3
1	D	161	PRO	3.3
1	B	164	VAL	3.3
1	C	135	VAL	3.3
1	C	62	LYS	3.2
1	E	184	GLY	3.2
1	B	186	ILE	3.2
1	B	162	GLY	3.2
1	C	37	PHE	3.1
1	C	186	ILE	3.1
1	B	178	PRO	3.0
1	C	168	LYS	3.0
1	C	166	PRO	3.0
1	C	120	ALA	2.9
1	C	181	ASP	2.9
1	D	169	TRP	2.9
1	E	134	GLU	2.9
1	C	38	TYR	2.8
1	C	63	LEU	2.8
1	D	121	THR	2.8
1	B	161	PRO	2.8
1	B	183	VAL	2.8
1	E	58	GLU	2.8
1	C	165	CYS	2.7
1	B	45[A]	VAL	2.7
1	E	121	THR	2.7
1	C	121	THR	2.6
1	D	183	VAL	2.6
1	C	183	VAL	2.6
1	A	135	VAL	2.5
1	C	36	PHE	2.4
1	C	173	GLU	2.4
1	D	186	ILE	2.4
1	E	136	THR	2.4
1	E	164	VAL	2.3
1	D	162	GLY	2.3
1	E	26	LYS	2.3
1	A	120	ALA	2.3
1	D	135	VAL	2.3
1	C	134	GLU	2.2

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Mol	Chain	Res	Type	RSRZ
1	E	162	GLY	2.2
1	D	132	ALA	2.2
1	E	120	ALA	2.2
1	E	92	LYS	2.2
1	E	44	PHE	2.1
1	C	159	ALA	2.1
1	D	36	PHE	2.1
1	A	146[A]	ASP	2.1
1	C	136	THR	2.1
1	A	18	GLY	2.1
1	B	163	GLU	2.0
1	A	38	TYR	2.0
1	B	148	LEU	2.0
1	A	70	VAL	2.0
1	C	178	PRO	2.0
1	A	136	THR	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 carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95^{th} 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	LLDF	B-factors(Å^2)	Q<0.9
4	GOL	B	203	6/6	0.91	0.29	4.34	63,73,80,81	0
4	GOL	D	203	6/6	0.88	0.15	1.99	60,66,71,72	0
3	K	B	202	1/1	0.94	0.14	1.94	57,57,57,57	0
4	GOL	A	203	6/6	0.69	0.22	1.65	69,76,76,77	0
4	GOL	C	202	6/6	0.74	0.23	1.32	69,77,82,82	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	LLDF	B-factors(Å^2)	Q<0.9
3	K	D	202	1/1	0.93	0.09	-1.07	71,71,71,71	0
2	CL	E	201	1/1	0.99	0.07	-1.51	60,60,60,60	0
2	CL	A	201	1/1	0.99	0.05	-1.65	37,37,37,37	0
2	CL	D	201	1/1	0.99	0.04	-1.78	46,46,46,46	0
2	CL	B	201	1/1	1.00	0.05	-1.78	41,41,41,41	0
2	CL	C	201	1/1	0.99	0.04	-1.90	43,43,43,43	0
3	K	A	202	1/1	0.94	0.22	-	59,59,59,59	1

6.5 Other polymers (i)

There are no such residues in this entry.