



wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 31, 2021 – 12:13 AM EDT

PDB ID : 3A2V
Title : Peroxiredoxin (C207S) from *Aeropyrum pernix* K1 complexed with hydrogen peroxide
Authors : Nakamura, T.; Kado, Y.; Yamaguchi, F.; Ishikawa, K.; Matsumura, H.; Inoue, T.
Deposited on : 2009-06-04
Resolution : 1.65 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtrriage (Phenix) : 1.13
EDS : 2.23.2
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.23.2

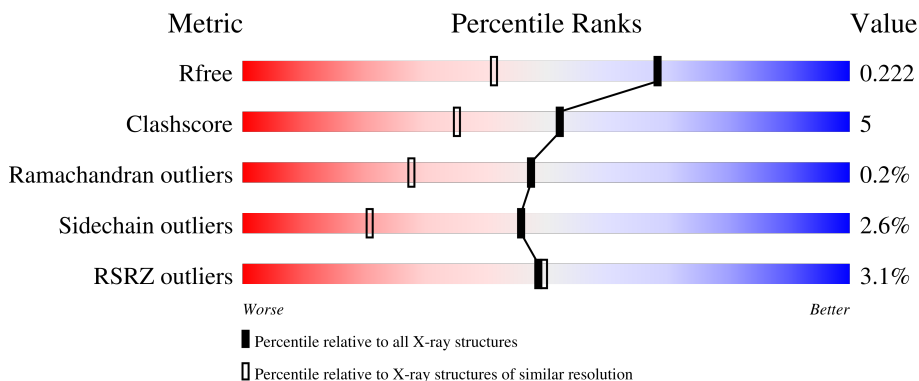
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.65 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.



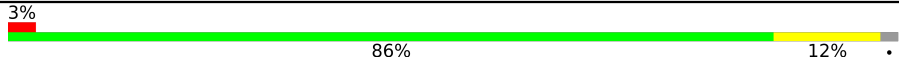

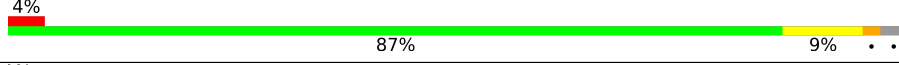
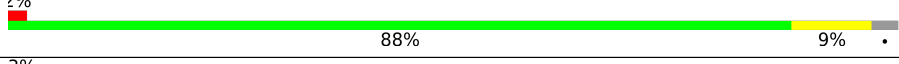

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1827 (1.66-1.66)
Clashscore	141614	1931 (1.66-1.66)
Ramachandran outliers	138981	1891 (1.66-1.66)
Sidechain outliers	138945	1891 (1.66-1.66)
RSRZ outliers	127900	1791 (1.66-1.66)

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	249	0% 80% 17% ..
1	B	249	3% 88% 9% .
1	C	249	5% 80% 16% ..
1	D	249	3% 85% 10% .
1	E	249	2% 87% 10% ...

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Mol	Chain	Length	Quality of chain
1	F	249	 3% 86% 12% .
1	G	249	 4% 86% 10% ..
1	H	249	 4% 87% 9% ..
1	I	249	 2% 88% 9% .
1	J	249	 3% 80% 16% ..

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 20999 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 Probable peroxiredoxin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	243	Total 2050	C 1334	N 350	O 359	S 7	0	15	0
1	B	242	Total 1993	C 1287	N 348	O 352	S 6	0	6	0
1	C	243	Total 2038	C 1318	N 358	O 354	S 8	0	11	0
1	D	240	Total 1978	C 1276	N 349	O 346	S 7	0	7	0
1	E	242	Total 1990	C 1281	N 352	O 351	S 6	0	5	0
1	F	244	Total 2014	C 1302	N 348	O 357	S 7	0	7	0
1	G	243	Total 1998	C 1288	N 350	O 353	S 7	0	5	0
1	H	242	Total 1996	C 1292	N 349	O 349	S 6	0	5	0
1	I	242	Total 1993	C 1286	N 352	O 349	S 6	0	5	0
1	J	243	Total 2019	C 1300	N 353	O 358	S 8	0	6	0

There are 10 discrepancies between the modelled and reference sequences:

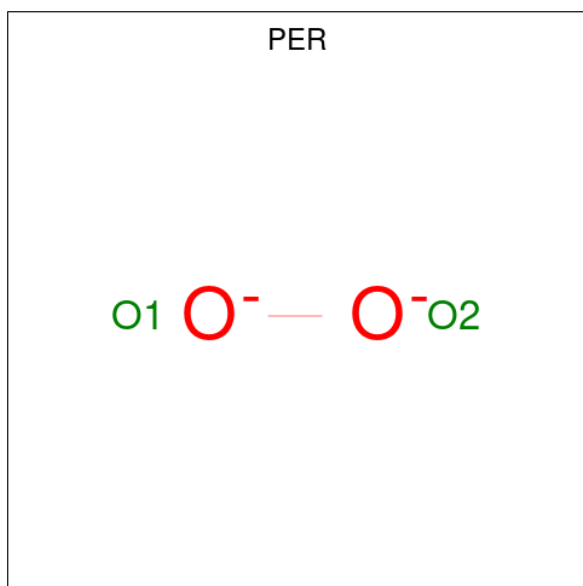
Chain	Residue	Modelled	Actual	Comment	Reference
A	207	SER	CYS	engineered mutation	UNP Q9Y9L0
B	207	SER	CYS	engineered mutation	UNP Q9Y9L0
C	207	SER	CYS	engineered mutation	UNP Q9Y9L0
D	207	SER	CYS	engineered mutation	UNP Q9Y9L0
E	207	SER	CYS	engineered mutation	UNP Q9Y9L0
F	207	SER	CYS	engineered mutation	UNP Q9Y9L0
G	207	SER	CYS	engineered mutation	UNP Q9Y9L0
H	207	SER	CYS	engineered mutation	UNP Q9Y9L0
I	207	SER	CYS	engineered mutation	UNP Q9Y9L0

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Chain	Residue	Modelled	Actual	Comment	Reference
J	207	SER	CYS	engineered mutation	UNP Q9Y9L0

- Molecule 2 is PEROXIDE ION (three-letter code: PER) (formula: O₂).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total O 2 2	0	0
2	B	1	Total O 2 2	0	0
2	C	1	Total O 2 2	0	0
2	D	1	Total O 2 2	0	0
2	E	1	Total O 2 2	0	0
2	F	1	Total O 2 2	0	0
2	G	1	Total O 2 2	0	0
2	H	1	Total O 2 2	0	0
2	I	1	Total O 2 2	0	0
2	J	1	Total O 2 2	0	0

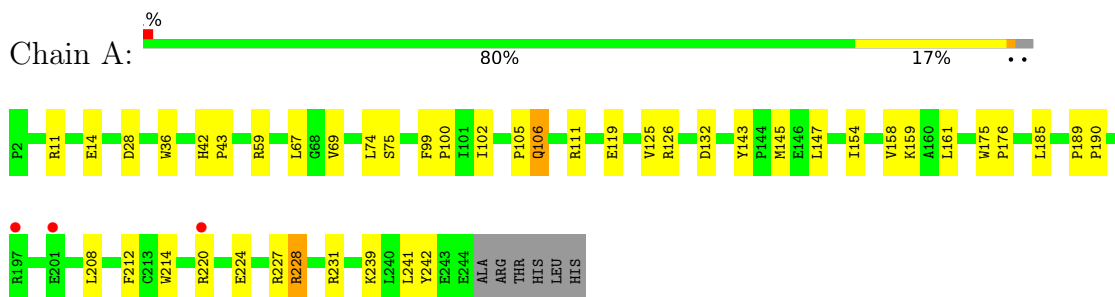
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	106	Total 106	O 106	0	0
3	B	79	Total 79	O 79	0	0
3	C	77	Total 77	O 77	0	0
3	D	88	Total 88	O 88	0	0
3	E	79	Total 79	O 79	0	0
3	F	76	Total 76	O 76	0	0
3	G	93	Total 93	O 93	0	0
3	H	85	Total 85	O 85	0	0
3	I	124	Total 124	O 124	0	0
3	J	103	Total 103	O 103	0	0

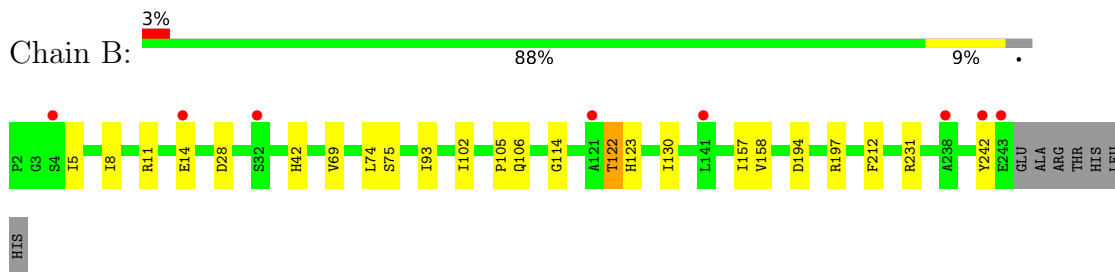
3 Residue-property plots [i](#)

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.

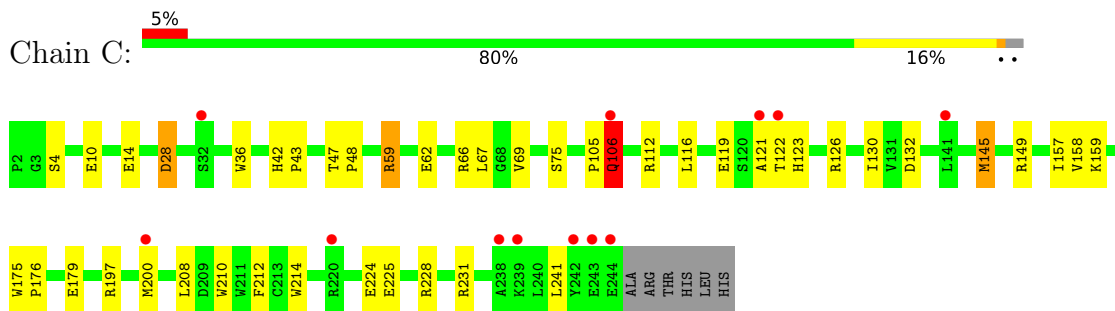
- Molecule 1: Probable peroxiredoxin



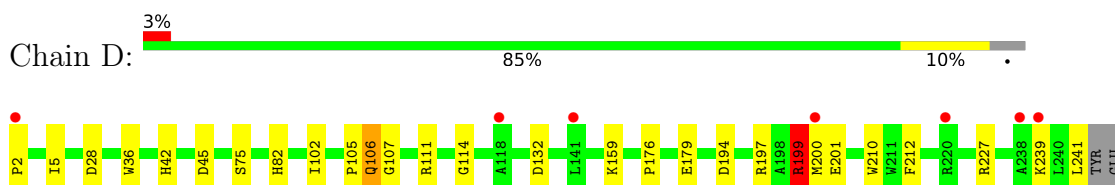
- Molecule 1: Probable peroxiredoxin



- Molecule 1: Probable peroxiredoxin




- Molecule 1: Probable peroxiredoxin



GLU
ALA
ARG
THR
HIS
LEU
HIS


- Molecule 1: Probable peroxiredoxin

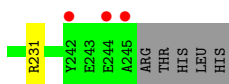
Chain E:  2% 87% 10% ..




LEU
HIS

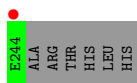
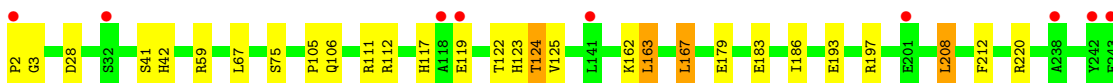
- Molecule 1: Probable peroxiredoxin

Chain F:  3% 86% 12% .




- Molecule 1: Probable peroxiredoxin

Chain G:  4% 86% 10% ..




- Molecule 1: Probable peroxiredoxin

Chain H:  4% 87% 9% ..



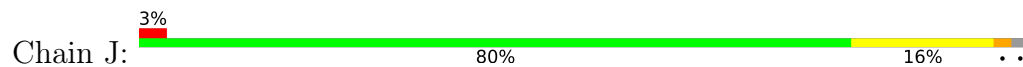
ALA
ARG
THR
HIS
HIS
LEU
HIS

- Molecule 1: Probable peroxiredoxin

Chain I:  2% 88% 9% .



- Molecule 1: Probable peroxiredoxin



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	76.21Å 103.11Å 104.40Å 106.02° 104.91° 92.97°	Depositor
Resolution (Å)	39.25 – 1.65 39.24 – 1.65	Depositor EDS
% Data completeness (in resolution range)	94.0 (39.25-1.65) 94.0 (39.24-1.65)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.79 (at 1.65Å)	Xtrriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.194 , 0.223 0.193 , 0.222	Depositor DCC
R_{free} test set	16633 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å ²)	23.1	Xtrriage
Anisotropy	0.064	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.44 , 51.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	20999	wwPDB-VP
Average B, all atoms (Å ²)	25.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.15% 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: PER

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	0.66	0/2153	0.71	0/2927
1	B	0.63	0/2066	0.69	1/2808 (0.0%)
1	C	0.58	0/2128	0.67	0/2889
1	D	0.63	0/2053	0.72	1/2788 (0.0%)
1	E	0.64	0/2060	0.70	1/2797 (0.0%)
1	F	0.63	0/2093	0.68	0/2846
1	G	0.66	0/2070	0.69	0/2813
1	H	0.63	0/2069	0.71	0/2814
1	I	0.71	0/2065	0.73	0/2807
1	J	0.73	0/2076	0.76	2/2822 (0.1%)
All	All	0.65	0/20833	0.71	5/28311 (0.0%)

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	231	ARG	NE-CZ-NH2	-6.76	116.92	120.30
1	D	199	ARG	NE-CZ-NH2	-6.14	117.23	120.30
1	J	147	LEU	CB-CG-CD2	5.25	119.93	111.00
1	E	215	ASP	CB-CG-OD1	5.05	122.85	118.30
1	J	169	ARG	NE-CZ-NH2	-5.04	117.78	120.30

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	2050	0	2084	38	0
1	B	1993	0	2004	24	0
1	C	2038	0	2064	34	0
1	D	1978	0	2001	20	0
1	E	1990	0	1998	24	0
1	F	2014	0	2012	31	0
1	G	1998	0	1996	23	0
1	H	1996	0	2000	28	0
1	I	1993	0	1998	24	0
1	J	2019	0	2001	34	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
2	E	2	0	0	0	0
2	F	2	0	0	0	0
2	G	2	0	0	0	0
2	H	2	0	0	0	0
2	I	2	0	0	0	0
2	J	2	0	0	0	0
3	A	106	0	0	1	0
3	B	79	0	0	0	0
3	C	77	0	0	1	0
3	D	88	0	0	1	0
3	E	79	0	0	1	0
3	F	76	0	0	1	0
3	G	93	0	0	0	0
3	H	85	0	0	1	0
3	I	124	0	0	1	0
3	J	103	0	0	1	0
All	All	20999	0	20158	221	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 5.

The worst 5 of 221 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:I:242:TYR:CD1	1:J:214[B]:TRP:HH2	1.55	1.23

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:59:ARG:HD3	1:F:179[B]:GLU:OE1	1.41	1.20
1:E:59:ARG:CD	1:F:179[B]:GLU:OE1	1.91	1.16
1:E:59:ARG:HD2	1:F:179[B]:GLU:OE2	1.49	1.12
1:E:59:ARG:HD2	1:F:179[B]:GLU:CD	1.71	1.10

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	256/249 (103%)	251 (98%)	4 (2%)	1 (0%)	34	16
1	B	246/249 (99%)	243 (99%)	3 (1%)	0	100	100
1	C	252/249 (101%)	244 (97%)	6 (2%)	2 (1%)	19	5
1	D	245/249 (98%)	239 (98%)	4 (2%)	2 (1%)	19	5
1	E	245/249 (98%)	238 (97%)	7 (3%)	0	100	100
1	F	249/249 (100%)	245 (98%)	4 (2%)	0	100	100
1	G	246/249 (99%)	241 (98%)	5 (2%)	0	100	100
1	H	245/249 (98%)	240 (98%)	5 (2%)	0	100	100
1	I	245/249 (98%)	241 (98%)	4 (2%)	0	100	100
1	J	247/249 (99%)	238 (96%)	7 (3%)	2 (1%)	19	5
All	All	2476/2490 (99%)	2420 (98%)	49 (2%)	7 (0%)	47	22

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	106[A]	GLN
1	C	106[B]	GLN
1	D	106	GLN

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Mol	Chain	Res	Type
1	A	106	GLN
1	D	239	LYS

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	225/215 (105%)	215 (96%)	10 (4%)	28	7
1	B	215/215 (100%)	212 (99%)	3 (1%)	67	46
1	C	221/215 (103%)	212 (96%)	9 (4%)	30	8
1	D	214/215 (100%)	209 (98%)	5 (2%)	50	25
1	E	214/215 (100%)	210 (98%)	4 (2%)	57	34
1	F	217/215 (101%)	212 (98%)	5 (2%)	50	25
1	G	215/215 (100%)	208 (97%)	7 (3%)	38	12
1	H	214/215 (100%)	208 (97%)	6 (3%)	43	18
1	I	214/215 (100%)	211 (99%)	3 (1%)	67	46
1	J	216/215 (100%)	207 (96%)	9 (4%)	30	8
All	All	2165/2150 (101%)	2104 (97%)	61 (3%)	46	18

5 of 61 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	106	GLN
1	J	112	ARG
1	F	220	ARG
1	J	62	GLU
1	J	212	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 21 such sidechains are listed below:

Mol	Chain	Res	Type
1	G	123	HIS

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Mol	Chain	Res	Type
1	H	123	HIS
1	J	204	GLN
1	H	204	GLN
1	H	106	GLN

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

10 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	PER	A	1	-	0,1,1	-	-	-		
2	PER	E	251	-	0,1,1	-	-	-		
2	PER	F	251	-	0,1,1	-	-	-		
2	PER	H	251	-	0,1,1	-	-	-		
2	PER	G	251	-	0,1,1	-	-	-		
2	PER	B	251	-	0,1,1	-	-	-		
2	PER	J	251	-	0,1,1	-	-	-		
2	PER	D	251	-	0,1,1	-	-	-		
2	PER	I	251	-	0,1,1	-	-	-		
2	PER	C	251	-	0,1,1	-	-	-		

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	243/249 (97%)	-0.22	3 (1%) 79 81	16, 22, 36, 48	0
1	B	242/249 (97%)	0.03	8 (3%) 46 47	16, 25, 40, 48	0
1	C	243/249 (97%)	0.24	12 (4%) 29 28	18, 27, 44, 62	0
1	D	240/249 (96%)	-0.06	7 (2%) 51 52	16, 24, 42, 50	0
1	E	242/249 (97%)	-0.13	4 (1%) 70 73	15, 24, 39, 44	0
1	F	244/249 (97%)	-0.12	7 (2%) 51 52	16, 25, 41, 54	0
1	G	243/249 (97%)	0.03	10 (4%) 37 37	17, 24, 40, 59	0
1	H	242/249 (97%)	0.07	9 (3%) 41 41	16, 24, 36, 47	0
1	I	242/249 (97%)	-0.15	6 (2%) 57 58	13, 20, 35, 45	0
1	J	243/249 (97%)	-0.16	8 (3%) 46 47	14, 21, 37, 56	0
All	All	2424/2490 (97%)	-0.05	74 (3%) 49 49	13, 24, 40, 62	0

The worst 5 of 74 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	F	245	ALA	7.7
1	D	238	ALA	6.3
1	J	238	ALA	6.1
1	H	242[A]	TYR	4.9
1	G	242	TYR	4.6

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 monosaccharides 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
2	PER	F	251	2/2	0.90	0.14	28,28,28,37	0
2	PER	B	251	2/2	0.91	0.11	28,28,28,35	0
2	PER	A	1	2/2	0.91	0.09	25,25,25,31	0
2	PER	J	251	2/2	0.91	0.15	22,22,22,29	0
2	PER	C	251	2/2	0.93	0.09	27,27,27,33	0
2	PER	D	251	2/2	0.93	0.07	30,30,30,35	0
2	PER	H	251	2/2	0.94	0.06	29,29,29,32	0
2	PER	G	251	2/2	0.94	0.11	29,29,29,33	0
2	PER	E	251	2/2	0.96	0.08	32,32,32,34	0
2	PER	I	251	2/2	0.97	0.08	22,22,22,27	0

6.5 Other polymers [i](#)

There are no such residues in this entry.