Full wwPDB X-ray Structure Validation Report (i)

Sep 4, 2023 – 09:55 PM EDT

PDB ID	:	3UYC
Title	:	Designed protein KE59 R8_2/7A
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Deposited on	:	2011-12-06
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 (i) 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 (i)) were used in the production of this report:

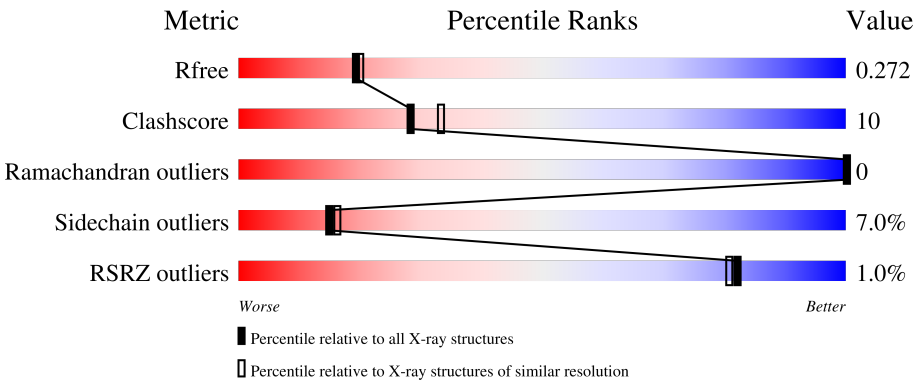
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.35
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35

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 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}	130704	4898 (2.20-2.20)
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)
RSRZ outliers	127900	4800 (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 <=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	75% 17% • •
1	B	249	2% 73% 19% 6% ••

2 Entry composition (i)

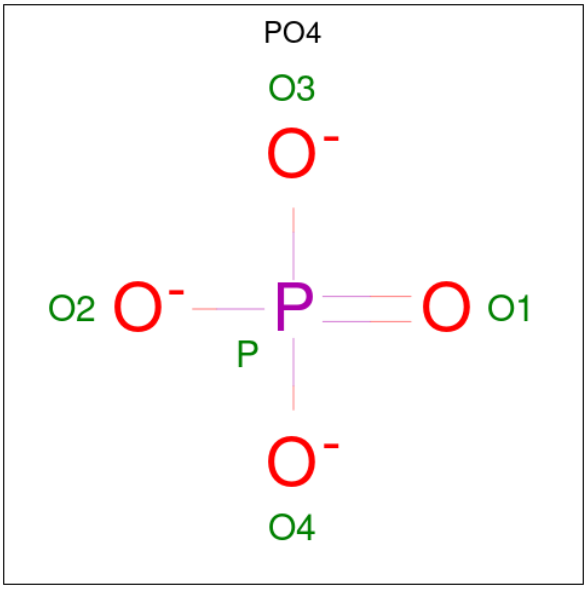
There are 3 unique types of molecules in this entry. The entry contains 3904 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Kemp eliminase KE59 R8_2/7A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	241	1883	1206	323	349	5	0	0	0
1	B	246	1954	1245	340	364	5	0	0	0

- Molecule 2 is PHOSPHATE ION (three-letter code: PO4) (formula: O_4P).



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

- Molecule 3 is water.

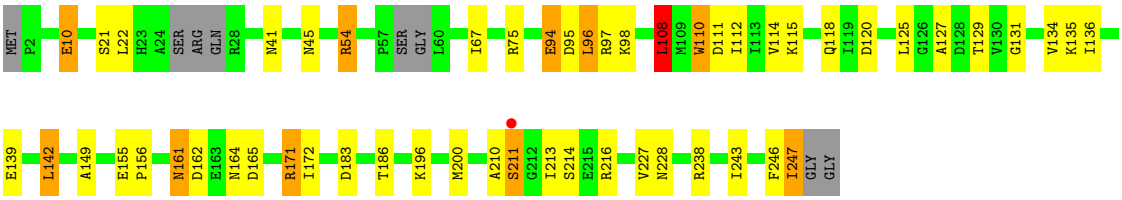
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	23	23	23	0	0
			Total	O		
3	B	34	34	34	0	0

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.

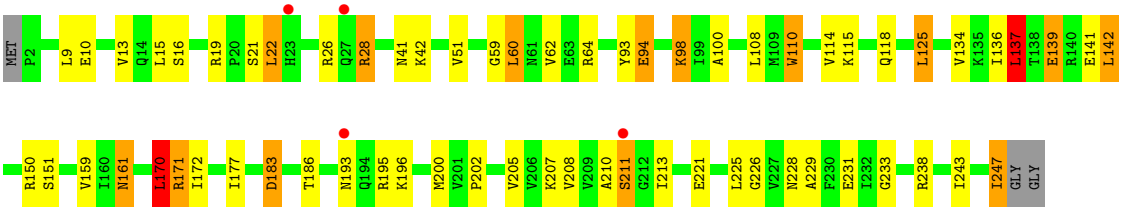
• Molecule 1: Kemp eliminase KE59 R8_2/7A

Chain A: 75% 17%



• Molecule 1: Kemp eliminase KE59 R8_2/7A

Chain B: 2% 73% 19% 6%



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α, β, γ	99.57Å 65.47Å 75.73Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	41.59 – 2.20 41.60 – 2.20	Depositor EDS
% Data completeness (in resolution range)	97.9 (41.59-2.20) 97.9 (41.60-2.20)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	0.11	Depositor
$< I/\sigma(I) >$ [1]	5.66 (at 2.20Å)	Xtriage
Refinement program	REFMAC 5.4.0067	Depositor
R, R_{free}	0.209 , 0.275 0.217 , 0.272	Depositor DCC
R_{free} test set	1282 reflections (5.09%)	wwPDB-VP
Wilson B-factor (Å^2)	23.7	Xtriage
Anisotropy	0.080	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 33.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.47$, $< L^2 > = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	3904	wwPDB-VP
Average B, all atoms (Å^2)	23.0	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 66.25 % 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 6.2248e-06. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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: PO4

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	1.29	3/1908 (0.2%)	1.12	7/2576 (0.3%)
1	B	1.30	7/1982 (0.4%)	1.17	15/2673 (0.6%)
All	All	1.29	10/3890 (0.3%)	1.15	22/5249 (0.4%)

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	A	0	2
1	B	0	1
All	All	0	3

All (10) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	141	GLU	CD-OE2	-7.95	1.17	1.25
1	B	141	GLU	CD-OE1	-6.49	1.18	1.25
1	B	221	GLU	CG-CD	5.75	1.60	1.51
1	A	94	GLU	CB-CG	-5.66	1.41	1.52
1	B	139	GLU	CD-OE2	-5.43	1.19	1.25
1	B	193	ASN	CB-CG	5.40	1.63	1.51
1	B	94	GLU	CB-CG	-5.37	1.42	1.52
1	A	155	GLU	CG-CD	5.28	1.59	1.51
1	B	26	ARG	CG-CD	-5.28	1.38	1.51
1	A	227	VAL	CB-CG1	5.18	1.63	1.52

All (22) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	108	LEU	CA-CB-CG	10.57	139.61	115.30
1	A	171	ARG	NE-CZ-NH1	8.34	124.47	120.30
1	B	108	LEU	CB-CG-CD1	8.07	124.72	111.00
1	B	26	ARG	NE-CZ-NH1	-7.97	116.31	120.30
1	A	108	LEU	CB-CG-CD2	7.56	123.84	111.00
1	A	75	ARG	NE-CZ-NH1	7.48	124.04	120.30
1	A	171	ARG	NE-CZ-NH2	-6.98	116.81	120.30
1	B	171	ARG	NE-CZ-NH2	-6.36	117.12	120.30
1	B	19	ARG	NE-CZ-NH2	-6.05	117.27	120.30
1	B	137	LEU	CA-CB-CG	5.97	129.03	115.30
1	B	137	LEU	CB-CG-CD1	5.97	121.15	111.00
1	A	120	ASP	CB-CG-OD1	5.84	123.56	118.30
1	B	183	ASP	CB-CG-OD1	5.75	123.47	118.30
1	A	75	ARG	NH1-CZ-NH2	-5.60	113.24	119.40
1	B	26	ARG	CB-CA-C	-5.58	99.24	110.40
1	A	54	ARG	NE-CZ-NH2	-5.57	117.52	120.30
1	B	59	GLY	N-CA-C	5.54	126.95	113.10
1	B	211	SER	C-N-CA	-5.26	111.25	122.30
1	B	238	ARG	NE-CZ-NH1	5.21	122.90	120.30
1	B	161	ASN	N-CA-CB	-5.19	101.26	110.60
1	B	15	LEU	CB-CG-CD1	-5.17	102.22	111.00
1	B	170	LEU	CB-CG-CD1	5.16	119.78	111.00

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	210	ALA	Peptide
1	A	211	SER	Peptide
1	B	210	ALA	Peptide

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	1883	0	1922	37	0
1	B	1954	0	2016	40	0
2	A	5	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	5	0	0	1	0
3	A	23	0	0	0	0
3	B	34	0	0	1	0
All	All	3904	0	3938	76	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 10.

All (76) 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:211:SER:HB2	1:A:213:ILE:HG13	1.25	1.11
1:A:211:SER:CB	1:A:213:ILE:HG13	1.88	1.04
1:A:211:SER:HB2	1:A:213:ILE:CG1	1.99	0.92
1:B:60:LEU:CD2	1:B:62:VAL:HG23	2.01	0.90
1:B:211:SER:O	2:B:301:PO4:O3	1.97	0.82
1:A:114:VAL:H	1:A:118:GLN:HE22	1.34	0.74
1:B:114:VAL:H	1:B:118:GLN:HE22	1.34	0.73
1:B:136:ILE:HG22	1:B:137:LEU:HD13	1.74	0.69
1:B:114:VAL:H	1:B:118:GLN:NE2	1.92	0.67
1:A:211:SER:HB2	1:A:213:ILE:H	1.62	0.65
1:A:54:ARG:NH2	1:A:95:ASP:OD2	2.30	0.65
1:B:243:ILE:HD11	1:B:247:ILE:HD11	1.81	0.62
1:A:211:SER:HB2	1:A:213:ILE:CB	2.30	0.62
1:B:60:LEU:HD21	1:B:62:VAL:HG23	1.81	0.62
1:A:211:SER:HB2	1:A:213:ILE:N	2.14	0.62
1:A:108:LEU:HD13	1:A:129:THR:HG23	1.82	0.61
1:A:183:ASP:OD2	1:A:186:THR:HG23	2.00	0.60
1:B:60:LEU:HD22	1:B:62:VAL:HG23	1.79	0.60
1:A:114:VAL:H	1:A:118:GLN:NE2	1.97	0.60
1:B:170:LEU:HD21	1:B:202:PRO:HD3	1.84	0.59
1:B:211:SER:HB2	1:B:231:GLU:O	2.04	0.58
1:A:211:SER:CB	1:A:213:ILE:CG1	2.70	0.57
1:A:139:GLU:OE2	1:A:171:ARG:HD2	2.02	0.57
1:B:139:GLU:OE2	1:B:171:ARG:HD2	2.05	0.56
1:B:22:LEU:HD22	1:B:125:LEU:HD11	1.87	0.56
1:A:164:ASN:O	1:A:164:ASN:OD1	2.23	0.55
1:A:142:LEU:HD13	1:A:172:ILE:CD1	2.37	0.55
1:A:67:ILE:HD11	1:A:98:LYS:HB3	1.89	0.54
1:A:243:ILE:HD11	1:A:247:ILE:HD11	1.90	0.53
1:B:142:LEU:HD13	1:B:172:ILE:CD1	2.39	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:60:LEU:HD21	1:B:62:VAL:CG2	2.38	0.53
1:B:41:ASN:ND2	1:B:228:ASN:HD22	2.08	0.52
1:A:216:ARG:NH1	1:A:246:PHE:O	2.42	0.51
1:A:196:LYS:O	1:A:200:MET:HG3	2.10	0.51
1:A:135:LYS:NZ	1:A:162:ASP:OD2	2.43	0.51
1:A:111:ASP:OD1	1:A:112:ILE:N	2.42	0.51
1:B:243:ILE:O	1:B:247:ILE:HD13	2.10	0.51
1:B:183:ASP:OD2	1:B:186:THR:HG23	2.12	0.50
1:A:211:SER:CB	1:A:213:ILE:H	2.25	0.49
1:A:142:LEU:HD13	1:A:172:ILE:HD11	1.94	0.49
1:B:150:ARG:HD2	3:B:268:HOH:O	2.12	0.49
1:B:211:SER:CB	1:B:231:GLU:O	2.61	0.49
1:B:134:VAL:HG22	1:B:142:LEU:HD11	1.94	0.48
1:B:94:GLU:O	1:B:98:LYS:HG2	2.12	0.48
1:A:96:LEU:HD11	1:A:127:ALA:HB2	1.96	0.48
1:A:164:ASN:OD1	1:A:164:ASN:C	2.52	0.48
1:A:183:ASP:OD2	1:A:186:THR:CG2	2.62	0.47
1:B:196:LYS:O	1:B:200:MET:HG3	2.15	0.47
1:A:149:ALA:HB3	1:A:156:PRO:HG3	1.96	0.47
1:B:110:TRP:HA	1:B:110:TRP:CE3	2.50	0.47
1:A:41:ASN:ND2	1:A:228:ASN:HD22	2.13	0.46
1:A:134:VAL:HG11	1:A:165:ASP:HA	1.97	0.46
1:B:207:LYS:HE2	1:B:226:GLY:O	2.15	0.46
1:B:208:VAL:HG22	1:B:229:ALA:HB3	1.97	0.46
1:B:243:ILE:CD1	1:B:247:ILE:HD11	2.46	0.46
1:B:16:SER:O	1:B:115:LYS:HE2	2.15	0.46
1:A:238:ARG:NH1	1:B:151:SER:OG	2.47	0.45
1:A:110:TRP:CE3	1:A:110:TRP:HA	2.53	0.43
1:B:28:ARG:NH1	1:B:100:ALA:O	2.51	0.43
1:B:9:LEU:HD23	1:B:9:LEU:HA	1.89	0.43
1:B:51:VAL:HB	1:B:233:GLY:HA2	2.01	0.42
1:A:115:LYS:H	1:A:118:GLN:HE21	1.67	0.42
1:B:177:ILE:HD12	1:B:205:VAL:HG11	2.00	0.42
1:A:108:LEU:HD11	1:A:131:GLY:N	2.35	0.41
1:B:22:LEU:HD22	1:B:125:LEU:CD1	2.50	0.41
1:B:13:VAL:HG13	1:B:114:VAL:HG11	2.02	0.41
1:B:195:ARG:HG2	1:B:225:LEU:CD1	2.50	0.41
1:A:134:VAL:HG22	1:A:142:LEU:HD11	2.03	0.41
1:B:93:TYR:CG	1:B:125:LEU:HD21	2.55	0.41
1:B:142:LEU:HD13	1:B:172:ILE:HD13	2.02	0.41
1:B:110:TRP:CH2	1:B:159:VAL:HG21	2.56	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:10:GLU:O	1:A:10:GLU:HG3	2.15	0.41
1:B:41:ASN:HD21	1:B:228:ASN:HD22	1.67	0.41
1:B:211:SER:HB2	1:B:213:ILE:HD12	2.02	0.41
1:A:161:ASN:HD22	1:A:161:ASN:HA	1.50	0.40
1:A:94:GLU:O	1:A:98:LYS:HG2	2.22	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	235/249 (94%)	228 (97%)	7 (3%)	0	100	100
1	B	244/249 (98%)	239 (98%)	5 (2%)	0	100	100
All	All	479/498 (96%)	467 (98%)	12 (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	201/221 (91%)	187 (93%)	14 (7%)	15	16
1	B	214/221 (97%)	199 (93%)	15 (7%)	15	16
All	All	415/442 (94%)	386 (93%)	29 (7%)	15	16

All (29) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	10	GLU
1	A	21	SER
1	A	22	LEU
1	A	45	ASN
1	A	96	LEU
1	A	97	ARG
1	A	108	LEU
1	A	110	TRP
1	A	125	LEU
1	A	136	ILE
1	A	142	LEU
1	A	161	ASN
1	A	214	SER
1	A	247	ILE
1	B	10	GLU
1	B	21	SER
1	B	22	LEU
1	B	28	ARG
1	B	42	LYS
1	B	60	LEU
1	B	64	ARG
1	B	98	LYS
1	B	110	TRP
1	B	125	LEU
1	B	137	LEU
1	B	142	LEU
1	B	161	ASN
1	B	170	LEU
1	B	247	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	41	ASN
1	A	118	GLN
1	A	161	ASN
1	B	41	ASN
1	B	118	GLN
1	B	124	ASN
1	B	161	ASN

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)

2 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	PO4	B	301	-	4,4,4	1.11	0	6,6,6	1.32	0
2	PO4	A	300	-	4,4,4	0.42	0	6,6,6	1.68	2 (33%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	300	PO4	O3-P-O1	-3.14	99.40	110.89
2	A	300	PO4	O4-P-O2	2.26	115.22	107.97

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	301	PO4	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 (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	241/249 (96%)	-0.43	1 (0%)	92	91	11, 21, 39, 50	0
1	B	246/249 (98%)	-0.40	4 (1%)	72	70	11, 22, 43, 56	0
All	All	487/498 (97%)	-0.41	5 (1%)	82	81	11, 22, 42, 56	0

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	211	SER	3.1
1	B	23	HIS	2.8
1	B	211	SER	2.8
1	B	193	ASN	2.1
1	B	27	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 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	PO4	B	301	5/5	0.95	0.14	32,37,39,42	0
2	PO4	A	300	5/5	0.97	0.10	34,35,41,41	0

6.5 Other polymers (i)

There are no such residues in this entry.