



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 07:46 AM GMT

PDB ID : 3C4X
Title : Crystal Structure of G protein coupled receptor kinase 1 bound to ATP and magnesium chloride at 2.9Å
Authors : Singh, P.; Tesmer, J.J.G.
Deposited on : 2008-01-30
Resolution : 2.90 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 ⓘ symbol.

The following versions of software and data (see [references ⓘ](#)) 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

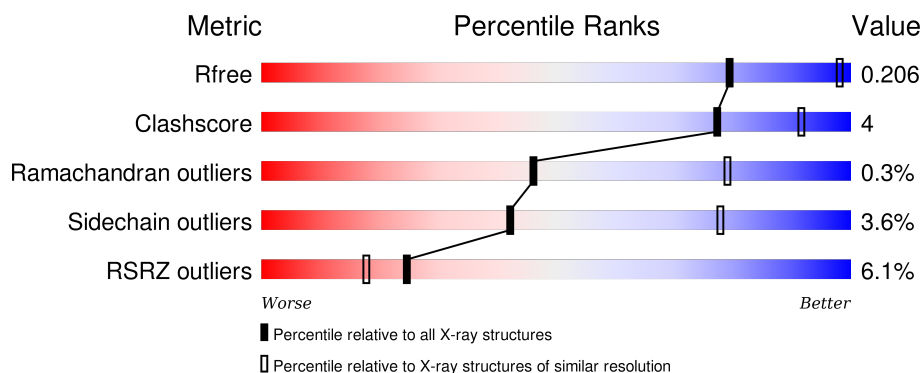
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.90 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	1451 (2.90-2.90)
Clashscore	102246	1668 (2.90-2.90)
Ramachandran outliers	100387	1630 (2.90-2.90)
Sidechain outliers	100360	1632 (2.90-2.90)
RSRZ outliers	91569	1456 (2.90-2.90)

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 $\leq 5\%$. 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	543	<div> <div>4%</div> <div>80% 11% 9%</div> </div>
1	B	543	<div> <div>7%</div> <div>78% 9% 13%</div> </div>

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 7967 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 Rhodopsin kinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	496	Total	C	N	O	S	0	2	0
			3995	2563	690	723	19			
1	B	475	Total	C	N	O	S	0	1	0
			3846	2468	664	695	19			

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	536	VAL	-	EXPRESSION TAG	UNP P28327
A	537	ASP	-	EXPRESSION TAG	UNP P28327
A	538	HIS	-	EXPRESSION TAG	UNP P28327
A	539	HIS	-	EXPRESSION TAG	UNP P28327
A	540	HIS	-	EXPRESSION TAG	UNP P28327
A	541	HIS	-	EXPRESSION TAG	UNP P28327
A	542	HIS	-	EXPRESSION TAG	UNP P28327
A	543	HIS	-	EXPRESSION TAG	UNP P28327
B	536	VAL	-	EXPRESSION TAG	UNP P28327
B	537	ASP	-	EXPRESSION TAG	UNP P28327
B	538	HIS	-	EXPRESSION TAG	UNP P28327
B	539	HIS	-	EXPRESSION TAG	UNP P28327
B	540	HIS	-	EXPRESSION TAG	UNP P28327
B	541	HIS	-	EXPRESSION TAG	UNP P28327
B	542	HIS	-	EXPRESSION TAG	UNP P28327
B	543	HIS	-	EXPRESSION TAG	UNP P28327

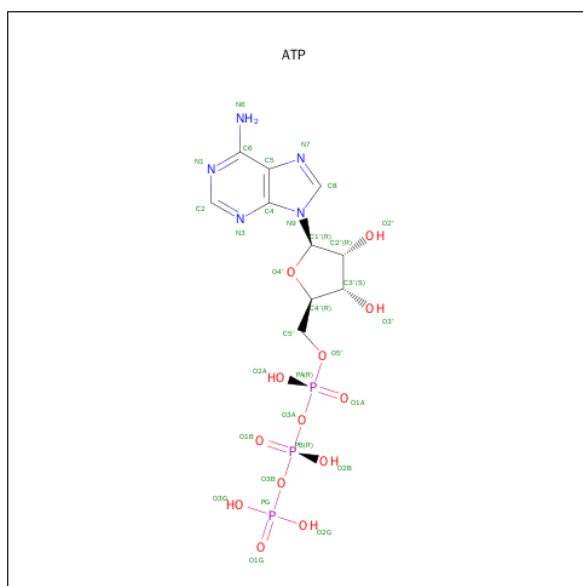
- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

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

- Molecule 3 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	2	Total Cl 2 2	0	0

- Molecule 4 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: C₁₀H₁₆N₅O₁₃P₃).



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	54.12Å 95.12Å 234.82Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.75 – 2.90 19.75 – 2.90	Depositor EDS
% Data completeness (in resolution range)	96.0 (19.75-2.90) 96.0 (19.75-2.90)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.26 (at 2.88Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.193 , (Not available) 0.195 , 0.206	Depositor DCC
R_{free} test set	1336 reflections (5.30%)	DCC
Wilson B-factor (Å ²)	51.2	Xtriage
Anisotropy	0.073	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 69.8	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Outliers	0 of 26552 reflections	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	7967	wwPDB-VP
Average B, all atoms (Å ²)	49.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.08% 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, 0.375 respectively for untwinned datasets, and 0.333, 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: MG, ATP, 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	0.54	0/4091	0.65	0/5519
1	B	0.45	0/3938	0.56	0/5311
All	All	0.49	0/8029	0.61	0/10830

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 [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	3995	0	3952	34	0
1	B	3846	0	3809	26	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	2	0	0	0	0
4	A	31	0	12	1	0
4	B	31	0	12	0	0
5	A	53	0	0	1	0
5	B	7	0	0	0	0
All	All	7967	0	7785	58	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 4.

All (58) 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:49:ALA:HB3	5:A:574:HOH:O	1.80	0.80
1:B:518:GLU:O	1:B:522:THR:HG22	1.82	0.80
1:B:88:LEU:HD23	1:B:150:VAL:HG21	1.65	0.79
1:A:87:GLN:HE21	1:A:87:GLN:HA	1.59	0.67
1:B:88:LEU:HD23	1:B:150:VAL:CG2	2.25	0.66
1:A:410:VAL:HG21	1:A:428:LEU:HD13	1.78	0.64
1:B:88:LEU:CD2	1:B:150:VAL:HG21	2.30	0.60
1:A:44:LEU:HD11	1:B:166:LEU:HD23	1.85	0.58
1:B:426:ALA:HB1	1:B:436:LEU:HB2	1.87	0.56
1:A:61:MET:HE2	1:A:159:PHE:HE1	1.71	0.56
1:A:61:MET:HE2	1:A:159:PHE:CE1	2.41	0.56
1:B:233:MET:HE3	1:B:502:PHE:CE1	2.41	0.56
1:A:297:GLN:OE1	1:A:328:VAL:HG22	2.06	0.55
1:B:518:GLU:O	1:B:522:THR:CG2	2.54	0.55
1:A:403:GLN:NE2	1:A:407:GLU:OE2	2.39	0.55
1:B:513:ILE:HB	1:B:514:PRO:HD3	1.90	0.53
1:B:250:LEU:HD11	1:B:262:LEU:HD22	1.91	0.53
1:B:295:THR:OG1	1:B:379:LEU:HD13	2.09	0.52
1:A:52:GLU:O	1:A:54:LEU:N	2.42	0.52
1:A:530:VAL:HG21	1:A:533:PRO:HB3	1.92	0.52
1:B:522:THR:HG23	1:B:524:VAL:HG23	1.91	0.51
1:A:272:ILE:HD13	1:A:322:LEU:HD11	1.91	0.51
1:A:61:MET:CE	1:A:159:PHE:HE1	2.25	0.50
1:A:201:VAL:HG21	4:A:562:ATP:O4'	2.11	0.50
1:B:234:VAL:HG11	1:B:336:ALA:O	2.12	0.50
1:B:209:THR:HG21	1:B:519:MET:CE	2.42	0.50
1:B:110:LEU:HD22	1:B:143:PHE:HE2	1.77	0.50
1:B:359:GLU:HG2	1:B:432:PRO:HG3	1.94	0.49
1:B:321:LEU:O	1:B:328:VAL:HA	2.13	0.49
1:A:166:LEU:HD23	1:B:44:LEU:HD11	1.94	0.49
1:A:157:ALA:HB3	1:A:158:PRO:HD3	1.95	0.49
1:A:87:GLN:NE2	1:A:87:GLN:HA	2.25	0.48
1:A:239:LEU:HD21	1:A:333:LEU:HD12	1.95	0.48
1:B:97:THR:O	1:B:97:THR:HG22	2.14	0.47
1:A:61:MET:CE	1:A:159:PHE:CE1	2.99	0.46
1:B:250:LEU:CD1	1:B:262:LEU:HD22	2.45	0.46
1:A:423:PHE:CE2	1:A:427:LEU:HD11	2.51	0.46
1:B:157:ALA:HB3	1:B:158:PRO:HD3	1.98	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:288:GLU:HB3	1:B:289:PRO:HD3	1.98	0.45
1:B:205:GLN:HB2	1:B:212:LEU:HD23	1.99	0.45
1:B:83:GLY:N	1:B:84:PRO:HD2	2.33	0.44
1:A:484:VAL:O	1:A:484:VAL:HG12	2.17	0.44
1:A:242:VAL:HG13	1:A:304[A]:HIS:CD2	2.52	0.44
1:A:323:ASP:OD1	1:A:323:ASP:C	2.56	0.43
1:A:221:LYS:HB2	1:A:490:VAL:HG21	2.00	0.43
1:A:321:LEU:O	1:A:328:VAL:HA	2.19	0.43
1:A:74:GLN:HE22	1:A:529:ASN:ND2	2.17	0.43
1:B:209:THR:HG21	1:B:519:MET:HE2	2.01	0.42
1:A:436:LEU:HD12	1:A:437:GLY:H	1.84	0.42
1:A:146:LEU:O	1:A:150:VAL:HG23	2.19	0.42
1:A:295:THR:OG1	1:A:379:LEU:HD13	2.20	0.42
1:A:383:ILE:HG21	1:A:416:PHE:CD1	2.55	0.41
1:A:311:ILE:HD12	1:A:346:THR:HG21	2.00	0.41
1:B:193:LEU:HD11	1:B:203:ALA:HB2	2.03	0.41
1:A:83:GLY:N	1:A:84:PRO:CD	2.84	0.40
1:A:272:ILE:CD1	1:A:322:LEU:HD11	2.51	0.40
1:A:484:VAL:O	1:A:484:VAL:CG1	2.69	0.40
1:A:30:SER:O	1:A:31:ARG:CB	2.69	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	494/543 (91%)	473 (96%)	19 (4%)	2 (0%)	39	74
1	B	470/543 (87%)	451 (96%)	18 (4%)	1 (0%)	52	84
All	All	964/1086 (89%)	924 (96%)	37 (4%)	3 (0%)	46	79

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	31	ARG
1	A	53	SER
1	B	156	GLN

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	415/449 (92%)	400 (96%)	15 (4%)	42	78
1	B	402/449 (90%)	388 (96%)	14 (4%)	43	78
All	All	817/898 (91%)	788 (96%)	29 (4%)	42	78

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

Mol	Chain	Res	Type
1	A	51	ARG
1	A	77	ARG
1	A	87	GLN
1	A	99	ASP
1	A	105	GLN
1	A	206	MET
1	A	234	VAL
1	A	249	SER
1	A	283	ASN
1	A	309	ASN
1	A	433	GLU
1	A	442	SER
1	A	448	THR
1	A	490	VAL
1	A	522	THR
1	B	77	ARG
1	B	130	THR
1	B	188	LEU
1	B	205	GLN
1	B	206	MET
1	B	309	ASN

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Mol	Chain	Res	Type
1	B	330	ILE
1	B	333	LEU
1	B	390	ARG
1	B	396	VAL
1	B	453	ARG
1	B	472	ASP
1	B	500	THR
1	B	504	GLN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	74	GLN
1	A	87	GLN
1	A	105	GLN
1	A	118	GLN
1	A	459	GLN
1	B	87	GLN
1	B	144	GLN
1	B	205	GLN
1	B	219	ASN
1	B	268	ASN
1	B	309	ASN
1	B	343	GLN
1	B	529	ASN

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 carbohydrates in this entry.

5.6 Ligand geometry

Of 6 ligands modelled in this entry, 4 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$
4	ATP	A	562	2	24,33,33	0.98	1 (4%)	31,52,52	1.95	5 (16%)
4	ATP	B	562	2	24,33,33	0.94	2 (8%)	31,52,52	2.42	7 (22%)

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	ATP	A	562	2	-	0/18/38/38	0/3/3/3
4	ATP	B	562	2	-	0/18/38/38	0/3/3/3

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	562	ATP	O4'-C1'	2.02	1.43	1.41
4	A	562	ATP	C5-C4	2.63	1.46	1.40
4	B	562	ATP	C5-C4	2.67	1.46	1.40

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	562	ATP	N3-C2-N1	-8.31	122.53	128.89
4	A	562	ATP	N3-C2-N1	-7.75	122.96	128.89
4	B	562	ATP	PA-O3A-PB	-5.05	118.55	132.73
4	B	562	ATP	C2'-C1'-N9	-4.79	106.98	114.29
4	B	562	ATP	PB-O3B-PG	-4.25	118.41	132.67
4	A	562	ATP	PB-O3B-PG	-3.11	122.23	132.67
4	A	562	ATP	O4'-C1'-N9	-3.07	101.68	108.10
4	B	562	ATP	C1'-N9-C4	-2.97	122.45	126.94

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	562	ATP	C4-C5-N7	-2.97	106.75	109.48
4	A	562	ATP	O3G-PG-O2G	2.06	115.23	107.38
4	A	562	ATP	O2A-PA-O3A	2.08	114.52	105.09
4	B	562	ATP	O4'-C1'-N9	2.80	113.95	108.10

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
4	A	562	ATP	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

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	496/543 (91%)	0.09	20 (4%)	42 35	32, 46, 69, 81	0
1	B	475/543 (87%)	0.29	39 (8%)	14 9	32, 47, 66, 75	0
All	All	971/1086 (89%)	0.18	59 (6%)	25 18	32, 46, 67, 81	0

All (59) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	282	ASP	4.8
1	B	533	PRO	4.3
1	B	283	ASN	3.8
1	B	120	GLN	3.6
1	A	140	ASP	3.5
1	B	501	GLU	3.5
1	B	341	ALA	3.4
1	B	504	GLN	3.2
1	B	133	ARG	3.1
1	A	489	THR	3.1
1	B	414	ASP	3.0
1	B	497	LYS	3.0
1	A	118	GLN	2.9
1	B	132	ALA	2.9
1	B	279	VAL	2.9
1	A	533	PRO	2.9
1	B	281	GLU	2.9
1	B	129	GLU	2.9
1	B	48	GLU	2.8
1	B	197	GLY	2.8
1	B	118	GLN	2.8
1	B	100	ASP	2.8
1	B	195	ARG	2.7
1	B	108	GLN	2.7

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Mol	Chain	Res	Type	RSRZ
1	B	192	VAL	2.7
1	A	48	GLU	2.7
1	B	116	GLU	2.7
1	A	280	ASP	2.7
1	B	200	GLU	2.7
1	B	52	GLU	2.7
1	B	225	LYS	2.6
1	A	393	GLY	2.6
1	B	128	ALA	2.6
1	B	433	GLU	2.6
1	B	33	ARG	2.6
1	A	80	GLU	2.5
1	A	49	ALA	2.5
1	A	492	GLY	2.5
1	A	470	VAL	2.5
1	A	342	GLY	2.5
1	B	498	ALA	2.4
1	B	496	GLU	2.4
1	B	340	LYS	2.3
1	B	434	LYS	2.3
1	A	127	ASP	2.3
1	A	282	ASP	2.3
1	A	101	ALA	2.3
1	B	49	ALA	2.3
1	A	116	GLU	2.2
1	B	97	THR	2.2
1	B	99	ASP	2.2
1	B	222	ARG	2.1
1	B	148	ARG	2.1
1	A	30	SER	2.1
1	B	474	ARG	2.1
1	A	102	LEU	2.1
1	A	414	ASP	2.1
1	B	349	TYR	2.0
1	A	120	GLN	2.0

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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, 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	LLDF	B-factors(\AA^2)	Q<0.9
4	ATP	B	562	31/31	0.94	0.20	-0.23	50,52,60,61	0
3	CL	A	565	1/1	0.97	0.14	-1.24	55,55,55,55	0
4	ATP	A	562	31/31	0.98	0.12	-2.50	32,40,43,45	0
2	MG	A	564	1/1	0.95	0.16	-	19,19,19,19	0
2	MG	B	563	1/1	0.79	0.15	-	58,58,58,58	0
3	CL	A	566	1/1	0.98	0.18	-	41,41,41,41	0

6.5 Other polymers [i](#)

There are no such residues in this entry.