



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 10:43 AM UTC

PDB ID : 4BZ2 / pdb_00004bz2
Title : Structure of dengue virus EDIII in complex with Fab 2D73
Authors : Li, J.; Watterson, D.; Chang, C.W.; Li, X.Q.; Ericsson, D.J.; Qiu, L.W.; Cai, J.P.; Chen, J.; Fry, S.R.; Cooper, M.A.; Che, X.Y.; Young, P.R.; Kobe, B.
Deposited on : 2013-07-23
Resolution : 2.03 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

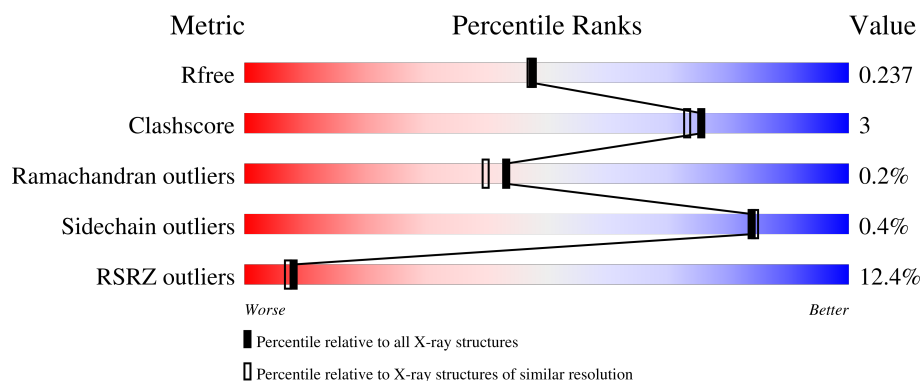
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.03 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	13299 (2.04-2.00)
Clashscore	190562	1022 (2.02-2.02)
Ramachandran outliers	187476	1014 (2.02-2.02)
Sidechain outliers	187428	1014 (2.02-2.02)
RSRZ outliers	180081	13314 (2.04-2.00)

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	101	2% 82% 17% .
2	H	221	19% 89% 8% .
3	L	212	10% 97% .

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 8256 atoms, of which 4023 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 ENVELOPE PROTEIN.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	101	1596	509	799	135	148	5	0	1	0

There are 7 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	296	VAL	-	expression tag	UNP Q7TGC7
A	297	GLU	-	expression tag	UNP Q7TGC7
A	298	PHE	-	expression tag	UNP Q7TGC7
A	299	LYS	-	expression tag	UNP Q7TGC7
A	300	ARG	-	expression tag	UNP Q7TGC7
A	395	HIS	-	expression tag	UNP Q7TGC7
A	396	HIS	-	expression tag	UNP Q7TGC7

- Molecule 2 is a protein called FAB 2D73 HEAVY CHAIN.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
2	H	213	3230	1042	1591	270	321	6	0	0	0

- Molecule 3 is a protein called FAB 2D73 LIGHT CHAIN.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
3	L	212	3257	1035	1599	277	338	8	0	1	0

- Molecule 4 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	3	Total	Na	0	0
			3	3		

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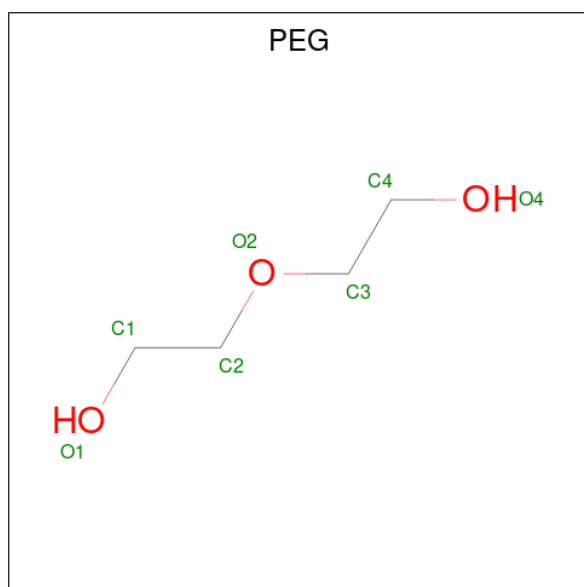
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	H	3	Total	Na	0	0
			3	3		
4	L	2	Total	Na	0	0
			2	2		

- Molecule 5 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

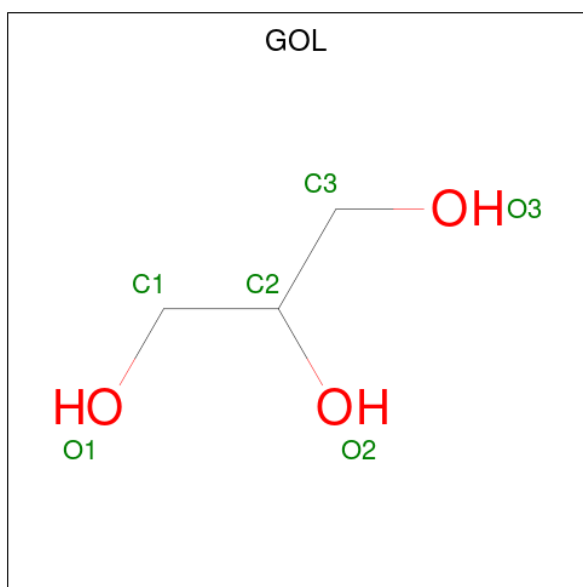
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	H	1	Total	Cl	0	0
			1	1		
5	L	2	Total	Cl	0	0
			2	2		

- Molecule 6 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: C₄H₁₀O₃).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	H	1	Total	C	H	O	0	0
			17	4	10	3		

- Molecule 7 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	H	1	Total	C	H	O	0	0
			14	3	8	3		
7	H	1	Total	C	H	O	0	0
			14	3	8	3		
7	L	1	Total	C	H	O	0	0
			14	3	8	3		

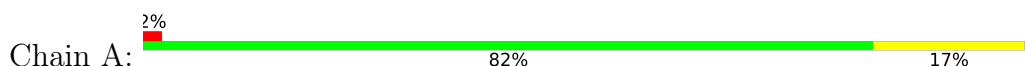
- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	37	Total	O	0	0
			37	37		
8	H	25	Total	O	0	0
			25	25		
8	L	41	Total	O	0	0
			41	41		

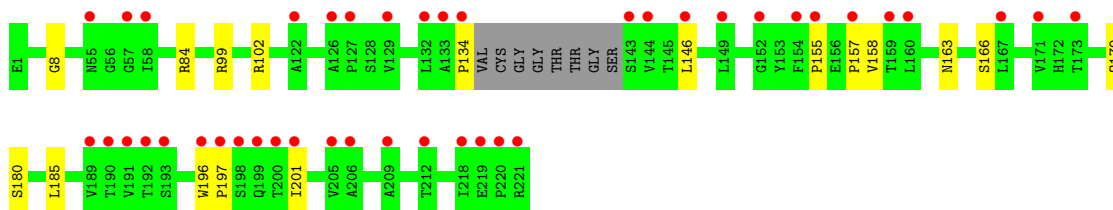
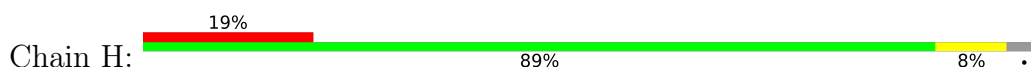
3 Residue-property plots [i](#)

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.

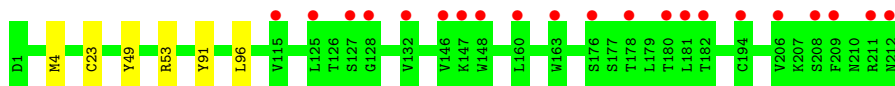
- Molecule 1: ENVELOPE PROTEIN



- Molecule 2: FAB 2D73 HEAVY CHAIN



- Molecule 3: FAB 2D73 LIGHT CHAIN



4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	108.66Å 108.66Å 108.56Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.59 – 2.03 48.59 – 2.03	Depositor EDS
% Data completeness (in resolution range)	100.0 (48.59-2.03) 100.0 (48.59-2.03)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.81 (at 2.03Å)	Xtriage
Refinement program	PHENIX (PHENIX.REFINE)	Depositor
R, R_{free}	0.205 , 0.225 0.218 , 0.237	Depositor DCC
R_{free} test set	2148 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å ²)	44.7	Xtriage
Anisotropy	0.060	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 41.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	0.022 for -h,-l,-k 0.015 for l,-k,h	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	8256	wwPDB-VP
Average B, all atoms (Å ²)	69.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.16% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: PEG, CL, NA, GOL

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	0.38	0/818	0.62	0/1104
2	H	0.26	0/1684	0.63	2/2298 (0.1%)
3	L	0.25	0/1697	0.58	0/2298
All	All	0.28	0/4199	0.61	2/5700 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	H	8	GLY	CA-C-N	5.16	125.10	119.78
2	H	8	GLY	C-N-CA	5.16	125.10	119.78

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	797	799	797	10	0
2	H	1639	1591	1586	10	0
3	L	1658	1599	1599	3	0
4	A	3	0	0	0	0
4	H	3	0	0	0	0
4	L	2	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	H	1	0	0	0	0
5	L	2	0	0	0	0
6	H	7	10	10	2	0
7	H	12	16	16	0	0
7	L	6	8	8	1	0
8	A	37	0	0	2	0
8	H	25	0	0	1	0
8	L	41	0	0	1	0
All	All	4233	4023	4016	24	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 3.

All (24) 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:308:ILE:HD11	1:A:389:LEU:HD11	1.85	0.59
2:H:196:TRP:CG	2:H:197:PRO:HA	2.40	0.56
3:L:91:TYR:HA	3:L:96:LEU:HD22	1.88	0.56
2:H:185:LEU:HD12	2:H:185:LEU:C	2.33	0.54
1:A:354:SER:O	1:A:355:THR:C	2.51	0.53
2:H:84:ARG:NH1	8:H:2016:HOH:O	2.22	0.49
3:L:4:MET:HE3	3:L:23:CYS:SG	2.53	0.48
1:A:393:ARG:HG3	8:A:2015:HOH:O	2.14	0.48
3:L:49:TYR:CZ	3:L:53:ARG:HG2	2.50	0.47
1:A:371:PRO:HD2	8:A:2019:HOH:O	2.16	0.46
7:L:217:GOL:O1	8:L:2010:HOH:O	2.21	0.46
1:A:313:ALA:HB1	6:H:226:PEG:H22	1.98	0.45
2:H:134:PRO:HD3	2:H:146:LEU:CD2	2.47	0.44
1:A:361:THR:O	1:A:362:ASN:HB2	2.18	0.44
1:A:332:PRO:HA	1:A:358:ALA:O	2.17	0.44
2:H:102:ARG:O	6:H:226:PEG:H11	2.19	0.43
2:H:158:VAL:CG2	2:H:185:LEU:HD21	2.48	0.43
1:A:305:LYS:HG2	1:A:306:PHE:N	2.33	0.43
1:A:350:ARG:NH1	1:A:370:GLU:OE1	2.53	0.42
2:H:179:GLN:HG2	2:H:180:SER:N	2.35	0.42
2:H:196:TRP:CD1	2:H:201:ILE:HG13	2.54	0.42
1:A:312[A]:MET:HE1	1:A:378:ILE:HD12	2.01	0.41
2:H:155:PRO:C	2:H:157:PRO:HD2	2.46	0.41
2:H:163:ASN:HB2	2:H:166:SER:HB3	2.04	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	100/101 (99%)	98 (98%)	1 (1%)	1 (1%)	12	5
2	H	209/221 (95%)	200 (96%)	9 (4%)	0	100	100
3	L	211/212 (100%)	202 (96%)	9 (4%)	0	100	100
All	All	520/534 (97%)	500 (96%)	19 (4%)	1 (0%)	43	40

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	355	THR

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	89/88 (101%)	88 (99%)	1 (1%)	65	68
2	H	183/189 (97%)	182 (100%)	1 (0%)	81	81
3	L	190/189 (100%)	190 (100%)	0	100	100
All	All	462/466 (99%)	460 (100%)	2 (0%)	84	84

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	369	LEU
2	H	99	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	366	ASN
2	H	207	HIS
3	L	190	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 15 ligands modelled in this entry, 11 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	$\# Z > 2$
7	GOL	H	228	-	5,5,5	0.36	0	5,5,5	0.26	0
7	GOL	H	227	-	5,5,5	0.36	0	5,5,5	0.36	0
6	PEG	H	226	-	6,6,6	0.65	0	5,5,5	0.57	0
7	GOL	L	217	-	5,5,5	0.39	0	5,5,5	0.26	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
7	GOL	H	228	-	-	0/4/4/4	-
7	GOL	H	227	-	-	2/4/4/4	-
6	PEG	H	226	-	-	0/4/4/4	-
7	GOL	L	217	-	-	3/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
7	L	217	GOL	C1-C2-C3-O3
7	L	217	GOL	O2-C2-C3-O3
7	H	227	GOL	O1-C1-C2-C3
7	H	227	GOL	O1-C1-C2-O2
7	L	217	GOL	O1-C1-C2-O2

There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	H	226	PEG	2	0
7	L	217	GOL	1	0

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, 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	101/101 (100%)	0.00	2 (1%) 65 65	21, 47, 68, 83	1 (0%)
2	H	213/221 (96%)	0.99	42 (19%) 3 2	31, 81, 142, 174	0
3	L	212/212 (100%)	0.35	21 (9%) 13 12	23, 65, 116, 135	1 (0%)
All	All	526/534 (98%)	0.54	65 (12%) 8 7	21, 61, 132, 174	2 (0%)

All (65) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	H	155	PRO	5.7
1	A	296	VAL	5.6
2	H	160	LEU	5.3
2	H	154	PHE	5.0
2	H	58	ILE	4.9
2	H	221	ARG	4.8
2	H	57	GLY	4.7
2	H	200	THR	4.6
2	H	134	PRO	4.5
2	H	206	ALA	3.8
2	H	212	THR	3.3
2	H	126	ALA	3.3
2	H	201	ILE	3.3
2	H	198	SER	3.2
2	H	191	VAL	3.2
2	H	146	LEU	3.2
2	H	157	PRO	3.2
2	H	219	GLU	3.1
2	H	143	SER	2.9
2	H	127	PRO	2.8
2	H	192	THR	2.7
3	L	182	THR	2.7
1	A	396	HIS	2.6

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Mol	Chain	Res	Type	RSRZ
2	H	149	LEU	2.6
2	H	209	ALA	2.6
2	H	55	ASN	2.6
2	H	193	SER	2.6
3	L	181	LEU	2.6
2	H	173	THR	2.5
2	H	189	VAL	2.5
3	L	194	CYS	2.5
3	L	212	ASN	2.5
2	H	205	VAL	2.4
2	H	129	VAL	2.4
2	H	220	PRO	2.4
2	H	133	ALA	2.4
3	L	160	LEU	2.4
3	L	163	TRP	2.4
2	H	196	TRP	2.3
2	H	152	GLY	2.3
3	L	147	LYS	2.3
3	L	176	SER	2.2
2	H	144	VAL	2.2
3	L	206	VAL	2.2
2	H	167	LEU	2.2
3	L	208	SER	2.2
3	L	209	PHE	2.2
2	H	199	GLN	2.1
2	H	132	LEU	2.1
3	L	127	SER	2.1
3	L	180	THR	2.1
3	L	148	TRP	2.1
2	H	218	ILE	2.1
3	L	128	GLY	2.1
2	H	122	ALA	2.1
3	L	125	LEU	2.1
2	H	159	THR	2.1
3	L	211	ARG	2.1
2	H	171	VAL	2.1
2	H	197	PRO	2.1
3	L	146	VAL	2.1
2	H	190	THR	2.0
3	L	178	THR	2.0
3	L	115	VAL	2.0
3	L	132	VAL	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 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
7	GOL	H	228	6/6	0.71	0.16	71,86,97,97	0
6	PEG	H	226	7/7	0.72	0.26	61,78,98,98	0
4	NA	A	1398	1/1	0.74	0.18	68,68,68,68	0
4	NA	H	224	1/1	0.77	0.23	72,72,72,72	0
7	GOL	L	217	6/6	0.82	0.17	86,104,113,120	0
4	NA	L	215	1/1	0.84	0.22	53,53,53,53	0
4	NA	H	225	1/1	0.84	0.17	58,58,58,58	0
5	CL	H	223	1/1	0.85	0.17	101,101,101,101	0
4	NA	A	1399	1/1	0.86	0.25	72,72,72,72	0
7	GOL	H	227	6/6	0.86	0.23	101,121,124,125	0
5	CL	L	214	1/1	0.87	0.12	85,85,85,85	0
4	NA	L	216	1/1	0.93	0.10	59,59,59,59	0
4	NA	H	222	1/1	0.94	0.10	55,55,55,55	0
5	CL	L	213	1/1	0.95	0.07	79,79,79,79	0
4	NA	A	1397	1/1	0.95	0.10	53,53,53,53	0

6.5 Other polymers [i](#)

There are no such residues in this entry.