WORLDWIDE wwPDB PROTEIN DATA BANK

wwPDB X-ray Structure Validation Summary Report (i)

May 26, 2022 – 04:14 pm BST

PDB ID	:	7ZF3
Title	:	SARS-CoV-2 Omicron RBD in complex with Omi-3 and EY6A Fabs
Authors	:	Zhou, D.; Huo, J.; Ren, J.; Stuart, D.I.
Deposited on	:	2022-04-01
Resolution	:	3.15 Å(reported)

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

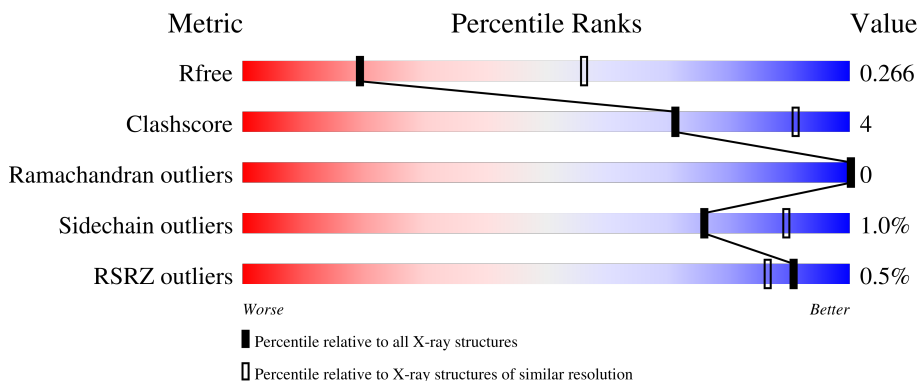|		
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.28.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0267
CCP4	:	7.1.010 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.28.1

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 3.15 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	Percentile Ranks	Value

- Rfree — 0.266
- Clashscore — 4
- Ramachandran outliers — 0
- Sidechain outliers — 1.0%
- RSRZ outliers — 0.5%

Worse ... *Better*

▌ Percentile relative to all X-ray structures
▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1665 (3.20-3.12)
Clashscore	141614	1804 (3.20-3.12)
Ramachandran outliers	138981	1770 (3.20-3.12)
Sidechain outliers	138945	1769 (3.20-3.12)
RSRZ outliers	127900	1616 (3.20-3.12)

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	H	226	86% 9% · ·
2	L	215	92% 7%
3	A	223	83% 13% ·
4	B	216	% 88% 12%
5	E	202	88% 8% ·

2 Entry composition ⓘ

There are 7 unique types of molecules in this entry. The entry contains 8110 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 EY6A heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	H	217	Total 1646	C 1047	N 273	O 320	S 6	0	0	0

- Molecule 2 is a protein called EY6A light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	L	214	Total 1635	C 1023	N 272	O 335	S 5	0	1	0

- Molecule 3 is a protein called Omi-3 heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	A	214	Total 1594	C 1003	N 269	O 316	S 6	0	0	0

- Molecule 4 is a protein called Omi-3 light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	B	215	Total 1640	C 1025	N 278	O 333	S 4	0	0	0

- Molecule 5 is a protein called Spike protein S1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
5	E	195	Total 1563	C 1007	N 264	O 284	S 8	0	0	0

There are 23 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	327	HIS	-	expression tag	UNP P0DTC2
E	328	HIS	-	expression tag	UNP P0DTC2

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Chain	Residue	Modelled	Actual	Comment	Reference
E	329	HIS	-	expression tag	UNP P0DTC2
E	330	HIS	-	expression tag	UNP P0DTC2
E	331	HIS	-	expression tag	UNP P0DTC2
E	332	HIS	-	expression tag	UNP P0DTC2
E	339	ASP	GLY	variant	UNP P0DTC2
E	371	LEU	SER	variant	UNP P0DTC2
E	373	PRO	SER	variant	UNP P0DTC2
E	375	PHE	SER	variant	UNP P0DTC2
E	417	ASN	LYS	variant	UNP P0DTC2
E	440	LYS	ASN	variant	UNP P0DTC2
E	446	SER	GLY	variant	UNP P0DTC2
E	477	ASN	SER	variant	UNP P0DTC2
E	478	LYS	THR	variant	UNP P0DTC2
E	484	ALA	GLU	variant	UNP P0DTC2
E	493	ARG	GLN	variant	UNP P0DTC2
E	496	SER	GLY	variant	UNP P0DTC2
E	498	ARG	GLN	conflict	UNP P0DTC2
E	501	TYR	ASN	variant	UNP P0DTC2
E	505	HIS	TYR	variant	UNP P0DTC2
E	527	LYS	-	expression tag	UNP P0DTC2
E	528	LYS	-	expression tag	UNP P0DTC2

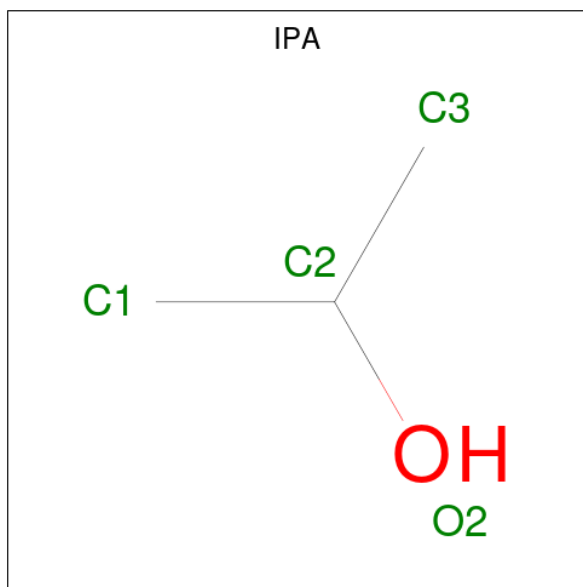- Molecule 6 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
6	L	1	6	3	3	0	0

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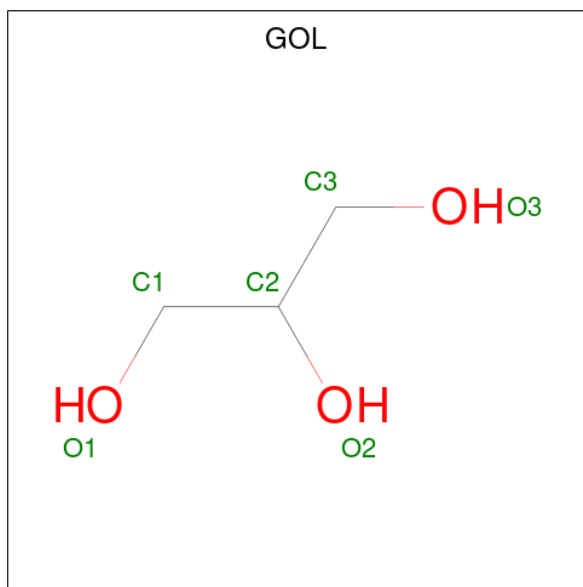
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	L	1	Total 6	C 3	O 3	0	0
6	A	1	Total 6	C 3	O 3	0	0
6	E	1	Total 6	C 3	O 3	0	0

- Molecule 7 is ISOPROPYL ALCOHOL (three-letter code: IPA) (formula: C_3H_8O).

| Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	A	1	Total 4	C 3	O 1	0	0
7	A	1	Total 4	C 3	O 1	0	0

3 Residue-property plots ⓘ

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.
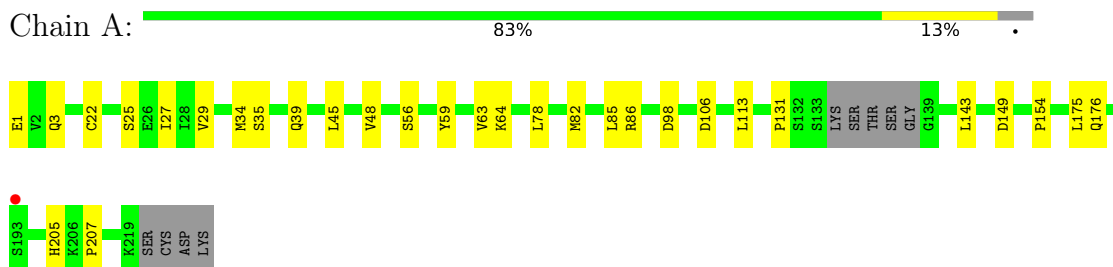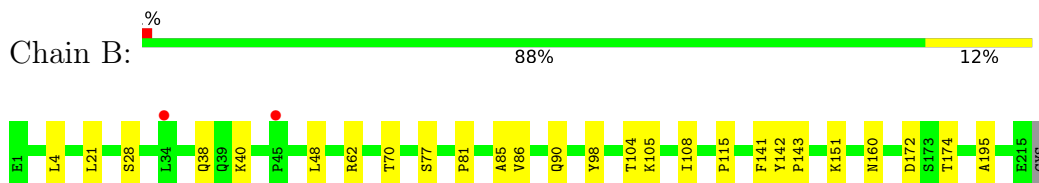
- Molecule 1: EY6A heavy chain
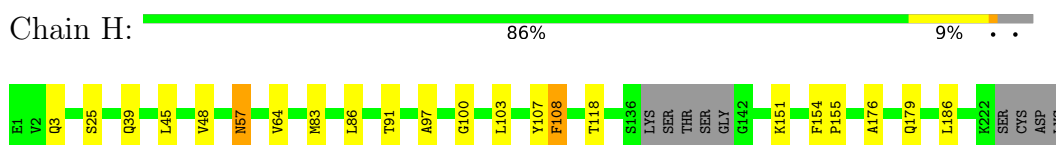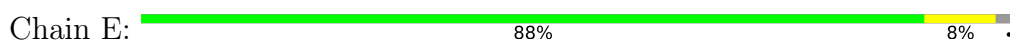
Chain H:

- Molecule 2: EY6A light chain
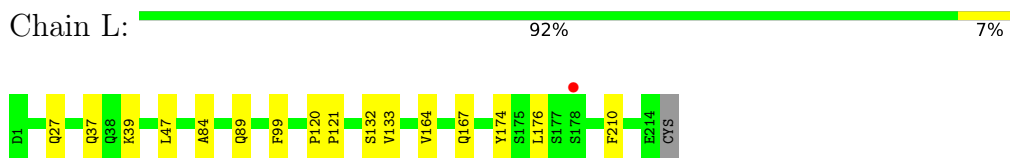
Chain L:

- Molecule 3: Omi-3 heavy chain

Chain A:

- Molecule 4: Omi-3 light chain

Chain B:

- Molecule 5: Spike protein S1

Chain E:

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	87.52Å 119.89Å 134.02Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	73.28 – 3.15 73.28 – 3.15	Depositor EDS
% Data completeness (in resolution range)	99.9 (73.28-3.15) 99.9 (73.28-3.15)	Depositor EDS
R_{merge}	0.49	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.11 (at 3.13Å)	Xtriage
Refinement program	PHENIX 1.19_4092	Depositor
R, R_{free}	0.208 , 0.266 0.208 , 0.266	Depositor DCC
R_{free} test set	1234 reflections (4.92%)	wwPDB-VP
Wilson B-factor (Å^2)	76.8	Xtriage
Anisotropy	0.153	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	(Not available) , (Not available)	EDS
L-test for twinning[2]	$< |L| > = 0.46, < L^2 > = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	8110	wwPDB-VP
Average B, all atoms (Å^2)	77.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.45% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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 ⓘ

5.1 Standard geometry ⓘ

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

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	H	0.25	0/1688	0.48	0/2300
2	L	0.26	0/1671	0.48	0/2268
3	A	0.25	0/1628	0.51	0/2219
4	B	0.25	0/1676	0.48	0/2276
5	E	0.26	0/1609	0.48	0/2190
All	All	0.26	0/8272	0.49	0/11253

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	H	1646	0	1598	12	0
2	L	1635	0	1600	10	0
3	A	1594	0	1563	16	0
4	B	1640	0	1588	11	0
5	E	1563	0	1489	11	0
6	A	6	0	8	0	0
6	E	6	0	8	0	0
6	L	12	0	16	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
7	A	8	0	15	0	0
All	All	8110	0	7885	56	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.

The worst 5 of 56 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)
5:E:366:SER:HA	5:E:369:TYR:HB2	1.72	0.69
3:A:29:VAL:HG13	3:A:34:MET:HG3	1.78	0.65
1:H:103:LEU:O	5:E:386:LYS:NZ	2.29	0.64
3:A:82:MET:HB3	3:A:85:LEU:HD21	1.83	0.60
1:H:97:ALA:HB1	1:H:108:PHE:HB3	1.84	0.59

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	H	213/226 (94%)	205 (96%)	8 (4%)	0	100	100
2	L	213/215 (99%)	207 (97%)	6 (3%)	0	100	100
3	A	210/223 (94%)	196 (93%)	14 (7%)	0	100	100
4	B	213/216 (99%)	203 (95%)	10 (5%)	0	100	100
5	E	193/202 (96%)	179 (93%)	14 (7%)	0	100	100
All	All	1042/1082 (96%)	990 (95%)	52 (5%)	0	100	100

There are no Ramachandran outliers to report.

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	H	182/191 (95%)	180 (99%)	2 (1%)	73	88
2	L	188/188 (100%)	188 (100%)	0	100	100
3	A	179/188 (95%)	177 (99%)	2 (1%)	73	88
4	B	184/186 (99%)	180 (98%)	4 (2%)	52	77
5	E	169/177 (96%)	168 (99%)	1 (1%)	86	94
All	All	902/930 (97%)	893 (99%)	9 (1%)	76	89

5 of 9 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
4	B	160	ASN
5	E	369	TYR
3	A	175	LEU
4	B	4	LEU
4	B	90	GLN

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

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 monosaccharides in this entry.

5.6 Ligand geometry (i)

6 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	#$|Z| > 2$
6	GOL	L	302	-	5,5,5	0.95	0	5,5,5	0.99	0
6	GOL	L	301	-	5,5,5	0.92	0	5,5,5	0.99	0
7	IPA	A	302	3	3,3,3	0.51	0	3,3,3	0.27	0
6	GOL	E	601	-	5,5,5	0.97	0	5,5,5	0.91	0
7	IPA	A	301	-	3,3,3	0.55	0	3,3,3	0.32	0
6	GOL	A	303	-	5,5,5	0.95	0	5,5,5	0.95	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
6	GOL	L	302	-	-	1/4/4/4	-
6	GOL	L	301	-	-	2/4/4/4	-
6	GOL	E	601	-	-	2/4/4/4	-
6	GOL	A	303	-	-	0/4/4/4	-

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
6	L	301	GOL	O1-C1-C2-C3
6	E	601	GOL	C1-C2-C3-O3
6	L	301	GOL	O1-C1-C2-O2
6	L	302	GOL	O2-C2-C3-O3
6	E	601	GOL	O2-C2-C3-O3

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 ⓘ

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(Å²)	Q<0.9
1	H	217/226 (96%)	0.32	0	100	100	58, 75, 103, 133	0
2	L	214/215 (99%)	0.27	1 (0%)	91	86	54, 72, 117, 147	0
3	A	214/223 (95%)	0.28	1 (0%)	91	86	53, 76, 126, 189	0
4	B	215/216 (99%)	0.44	2 (0%)	84	75	59, 76, 101, 136	0
5	E	195/202 (96%)	0.28	1 (0%)	91	86	52, 71, 110, 143	0
All	All	1055/1082 (97%)	0.32	5 (0%)	91	86	52, 74, 115, 189	0

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	A	193	SER	2.8
4	B	34	LEU	2.7
2	L	178	SER	2.5
4	B	45	PRO	2.1
5	E	374	PHE	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 ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

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
7	IPA	A	302	4/4	0.77	0.28	83,86,93,100	0
6	GOL	L	302	6/6	0.86	0.21	66,74,78,79	0
6	GOL	E	601	6/6	0.88	0.20	56,61,70,71	0
6	GOL	A	303	6/6	0.88	0.22	70,81,84,86	0
7	IPA	A	301	4/4	0.89	0.26	76,76,86,86	0
6	GOL	L	301	6/6	0.90	0.33	64,67,72,73	0

6.5 Other polymers ⓘ

There are no such residues in this entry.