



Full wwPDB X-ray Structure Validation Report ⓘ

Nov 7, 2023 – 06:43 PM EST

PDB ID : 2A48
Title : Crystal structure of amFP486 E150Q
Authors : Henderson, J.N.; Remington, S.J.
Deposited on : 2005-06-28
Resolution : 2.00 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 : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.36
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) : 2.36

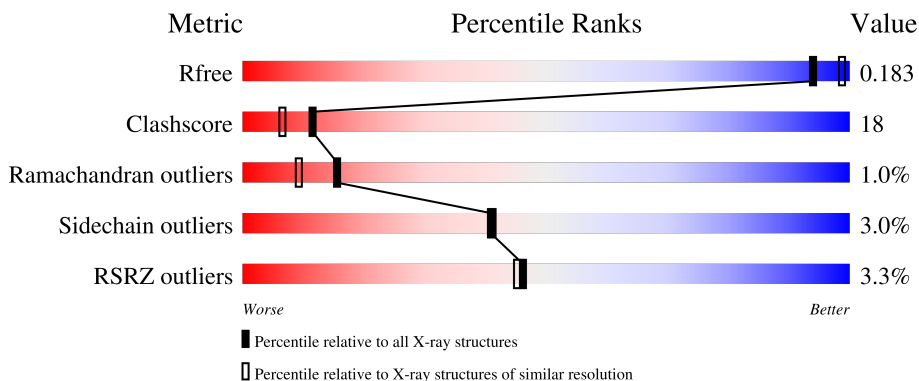
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 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	8085 (2.00-2.00)
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)
RSRZ outliers	127900	7900 (2.00-2.00)

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	238	

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 1719 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 GFP-like fluorescent chromoprotein amFP486.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	213	1635	1042	270	308	15	0	4	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-10	MET	-	expression tag	UNP Q9U6Y6
A	-9	ARG	-	expression tag	UNP Q9U6Y6
A	-8	GLY	-	expression tag	UNP Q9U6Y6
A	-7	SER	-	expression tag	UNP Q9U6Y6
A	-6	HIS	-	expression tag	UNP Q9U6Y6
A	-5	HIS	-	expression tag	UNP Q9U6Y6
A	-4	HIS	-	expression tag	UNP Q9U6Y6
A	-3	HIS	-	expression tag	UNP Q9U6Y6
A	-2	HIS	-	expression tag	UNP Q9U6Y6
A	-1	HIS	-	expression tag	UNP Q9U6Y6
A	0	GLY	-	expression tag	UNP Q9U6Y6
A	1	SER	-	expression tag	UNP Q9U6Y6
A	68	CR7	LYS	chromophore	UNP Q9U6Y6
A	68	CR7	TYR	chromophore	UNP Q9U6Y6
A	68	CR7	GLY	chromophore	UNP Q9U6Y6
A	150	GLN	GLU	engineered mutation	UNP Q9U6Y6

- Molecule 2 is BETA-MERCAPTOETHANOL (three-letter code: BME) (formula: C₂H₆OS).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	O	S	0	0
			4	2	1	1		
2	A	1	Total	C	O	S	0	0
			4	2	1	1		
2	A	1	Total	C	O	S	0	0
			4	2	1	1		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	72	Total	O	0	0
			72	72		

4 Data and refinement statistics

Property	Value	Source
Space group	I 41 2 2	Depositor
Cell constants a, b, c, α , β , γ	113.89Å 113.89Å 82.62Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	34.50 – 2.00 40.27 – 2.00	Depositor EDS
% Data completeness (in resolution range)	99.0 (34.50-2.00) 99.6 (40.27-2.00)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.25 (at 2.00Å)	Xtrriage
Refinement program	TNT	Depositor
R, R_{free}	0.180 , 0.249 0.194 , 0.183	Depositor DCC
R_{free} test set	1871 reflections (10.14%)	wwPDB-VP
Wilson B-factor (Å ²)	32.8	Xtrriage
Anisotropy	0.138	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 74.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	1719	wwPDB-VP
Average B, all atoms (Å ²)	40.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.93% 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: BME, CR7

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	0.69	3/1670 (0.2%)	1.24	19/2264 (0.8%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	198	GLU	CD-OE2	5.97	1.32	1.25
1	A	121	GLU	CD-OE2	5.28	1.31	1.25
1	A	39	GLU	CD-OE2	5.08	1.31	1.25

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	162	ASP	CB-CG-OD2	-7.95	111.15	118.30
1	A	146	ASP	CB-CG-OD2	-7.93	111.16	118.30
1	A	205	ASP	CB-CG-OD2	-7.93	111.16	118.30
1	A	10	ASP	CB-CG-OD2	-6.95	112.05	118.30
1	A	10	ASP	CB-CG-OD1	6.82	124.44	118.30
1	A	11	ASP	CB-CG-OD2	-6.76	112.22	118.30
1	A	19	ASP	CB-CG-OD2	-6.62	112.34	118.30
1	A	146	ASP	CB-CG-OD1	6.46	124.12	118.30
1	A	205	ASP	CB-CG-OD1	6.45	124.10	118.30
1	A	162	ASP	CB-CG-OD1	6.42	124.08	118.30
1	A	61	ASP	CB-CG-OD2	-6.12	112.79	118.30
1	A	97	ARG	NE-CZ-NH1	5.88	123.24	120.30
1	A	134	ASP	CB-CG-OD2	-5.85	113.04	118.30
1	A	83	ASP	CB-CG-OD2	-5.80	113.08	118.30
1	A	19	ASP	CB-CG-OD1	5.47	123.22	118.30
1	A	200	ARG	N-CA-CB	5.46	120.44	110.60
1	A	83	ASP	CB-CG-OD1	5.20	122.98	118.30
1	A	61	ASP	CB-CG-OD1	5.07	122.87	118.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	134	ASP	CB-CG-OD1	5.05	122.85	118.30

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	1635	0	1510	56	0
2	A	12	0	15	4	0
3	A	72	0	0	2	1
All	All	1719	0	1525	56	1

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 18.

All (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)
1:A:26:TYR:HB2	2:A:252:BME:H21	1.48	0.93
1:A:93:MET:HE3	1:A:183:TYR:HB3	1.58	0.85
1:A:93:MET:CE	1:A:183:TYR:HB3	2.14	0.78
1:A:83:ASP:O	1:A:87:GLN:HG3	1.87	0.75
1:A:147:PRO:HB3	1:A:200:ARG:HD3	1.68	0.75
1:A:120:PHE:CE2	2:A:251:BME:H22	2.23	0.74
1:A:41:THR:HG22	1:A:218:HIS:CD2	2.23	0.73
1:A:155:CYS:HB2	3:A:330:HOH:O	1.89	0.73
1:A:41:THR:HG22	1:A:218:HIS:HD2	1.53	0.72
1:A:26:TYR:HB2	2:A:252:BME:C2	2.20	0.70
1:A:206:LEU:HB2	1:A:212:SER:OG	1.94	0.67
1:A:12:MET:HE1	1:A:115:LEU:HD11	1.78	0.66
1:A:152:MET:HE2	1:A:159:LEU:HD21	1.78	0.65
1:A:17:HIS:ND1	1:A:30:LYS:HE2	2.15	0.62
1:A:158:ILE:CD1	1:A:182:SER:HB3	2.30	0.61
1:A:168:MET:SD	1:A:174:ASN:HB3	2.42	0.60

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:166:PHE:CE2	1:A:176:ARG:HG3	2.37	0.59
1:A:142:THR:HG21	1:A:167:LEU:HD13	1.88	0.56
1:A:92:GLY:O	1:A:186:LYS:HG2	2.05	0.55
1:A:48:VAL:HG11	1:A:56:LEU:HD13	1.88	0.54
1:A:158:ILE:HD11	1:A:182:SER:HB3	1.88	0.54
1:A:52:ASN:O	1:A:53:GLY:C	2.47	0.53
1:A:56:LEU:HG	1:A:58:PHE:O	2.08	0.52
1:A:164:THR:CG2	1:A:176:ARG:HD3	2.41	0.51
1:A:26:TYR:CB	2:A:252:BME:H21	2.31	0.51
1:A:52:ASN:O	1:A:53:GLY:O	2.30	0.50
1:A:95:TYR:CE2	1:A:113:ILE:HD12	2.46	0.50
1:A:186:LYS:N	3:A:349:HOH:O	2.38	0.50
1:A:81:MET:CE	1:A:193:PRO:HG2	2.43	0.49
1:A:41:THR:CG2	1:A:218:HIS:HD2	2.22	0.49
1:A:81:MET:HE1	1:A:193:PRO:HG2	1.95	0.49
1:A:22:VAL:HG23	1:A:27:PHE:HE2	1.78	0.49
1:A:163:VAL:CG1	1:A:179:PHE:HB2	2.43	0.48
1:A:12:MET:CE	1:A:115:LEU:HD11	2.43	0.48
1:A:83:ASP:OD2	1:A:86:LYS:HD2	2.15	0.47
1:A:158:ILE:HD11	1:A:182:SER:CB	2.45	0.47
1:A:149:PHE:CE2	1:A:198:GLU:HG3	2.50	0.46
1:A:67:PHE:C	1:A:68:CR7:HA31	2.35	0.46
1:A:217:GLU:HG2	1:A:218:HIS:N	2.31	0.46
1:A:17:HIS:CE1	1:A:30:LYS:HE2	2.50	0.46
1:A:150:GLN:HE21	1:A:161:GLY:HA3	1.80	0.46
1:A:111:TRP:HB3	1:A:124:SER:CB	2.46	0.46
1:A:26:TYR:CD2	1:A:51:ALA:HB2	2.52	0.45
1:A:19:ASP:O	1:A:125:THR:HA	2.18	0.44
1:A:55:PRO:O	1:A:56:LEU:C	2.56	0.44
1:A:93:MET:HG2	1:A:184:LYS:O	2.18	0.44
1:A:17:HIS:ND1	1:A:30:LYS:CE	2.81	0.43
1:A:167:LEU:HD23	1:A:167:LEU:HA	1.80	0.42
1:A:152:MET:HE2	1:A:159:LEU:CD2	2.48	0.41
1:A:163:VAL:HG12	1:A:179:PHE:HB2	2.01	0.41
1:A:61:ASP:HB3	1:A:167:LEU:HD21	2.03	0.41
1:A:67:PHE:O	1:A:68:CR7:HA31	2.21	0.40
1:A:21:CYS:HA	1:A:25:HIS:O	2.21	0.40
1:A:26:TYR:HD2	1:A:51:ALA:HB2	1.87	0.40
1:A:68:CR7:HD1	1:A:68:CR7:N2	2.36	0.40
1:A:93:MET:HE1	1:A:183:TYR:HB3	1.96	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the sym-

metry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:A:470:HOH:O	3:A:470:HOH:O[10_665]	1.91	0.29

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	210/238 (88%)	204 (97%)	4 (2%)	2 (1%)	15 9

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	53	GLY
1	A	79	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	168/199 (84%)	163 (97%)	5 (3%)	41 41

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	81	MET
1	A	93	MET

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Mol	Chain	Res	Type
1	A	158	ILE
1	A	167	LEU
1	A	190	THR

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	150	GLN
1	A	178	GLN
1	A	218	HIS

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

1 non-standard protein/DNA/RNA residue is 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
1	CR7	A	68	1	25,25,26	2.68	5 (20%)	30,33,35	2.90	6 (20%)

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
1	CR7	A	68	1	-	2/13/32/33	0/2/2/2

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	68	CR7	C1-N2	9.61	1.46	1.32
1	A	68	CR7	OH-CZ	6.04	1.51	1.37
1	A	68	CR7	CA2-N2	3.36	1.45	1.38
1	A	68	CR7	CA2-C2	2.99	1.51	1.48
1	A	68	CR7	CE1-CD1	2.01	1.42	1.38

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	68	CR7	C2-N3-C1	12.03	114.06	107.97
1	A	68	CR7	N3-C1-N2	-6.66	106.84	111.45
1	A	68	CR7	CA3-N3-C1	-4.98	121.19	127.16
1	A	68	CR7	CA2-N2-C1	2.71	107.77	105.77
1	A	68	CR7	O3-C3-CA3	-2.59	118.58	126.39
1	A	68	CR7	CB2-CA2-C2	2.49	125.25	122.28

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	68	CR7	CA1-CB1-CG1-CD
1	A	68	CR7	CG1-CD-CE-NZ

There are no ring outliers.

1 monomer is involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	68	CR7	3	0

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

3 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	BME	A	252	1	3,3,3	0.69	0	1,2,2	0.06	0
2	BME	A	250	1	3,3,3	0.48	0	1,2,2	0.24	0
2	BME	A	251	1	3,3,3	0.42	0	1,2,2	0.31	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
2	BME	A	252	1	-	1/1/1/1	-
2	BME	A	250	1	-	0/1/1/1	-
2	BME	A	251	1	-	0/1/1/1	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	252	BME	O1-C1-C2-S2

There are no ring outliers.

2 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	252	BME	3	0
2	A	251	BME	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 [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	212/238 (89%)	0.40	7 (3%) 46 45	25, 37, 67, 84	0

All (7) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	80	SER	3.3
1	A	89	PHE	2.8
1	A	8	ILE	2.4
1	A	189	VAL	2.2
1	A	156	ASP	2.1
1	A	186	LYS	2.1
1	A	207	ASP	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [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
1	CR7	A	68	24/25	0.95	0.14	22,30,35,44	0

6.3 Carbohydrates [i](#)

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
2	BME	A	252	4/4	0.81	0.30	52,54,54,66	0
2	BME	A	250	4/4	0.88	0.35	44,46,50,63	0
2	BME	A	251	4/4	0.94	0.22	42,44,46,54	0

6.5 Other polymers

There are no such residues in this entry.