



# wwPDB X-ray Structure Validation Summary Report

Apr 25, 2026 – 03:12 PM EDT

PDB ID : 6F2R / pdb\_00006f2r  
Title : A heterotetramer of human HspB2 and HspB3  
Authors : Clark, A.R.; Cole, A.R.; Boelens, W.C.; Keep, N.H.; Slingsby, C.  
Deposited on : 2017-11-27  
Resolution : 3.90 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto: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>.

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

MolProbity : 4-5-2 with Phenix2.0  
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

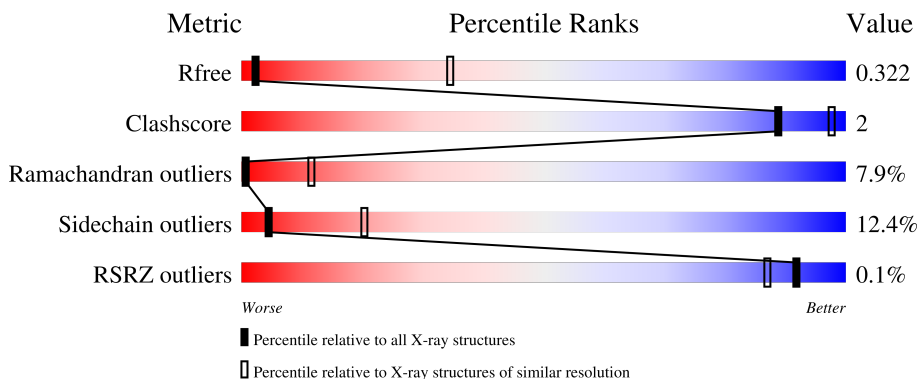
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.90 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.



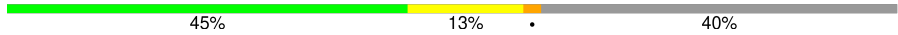




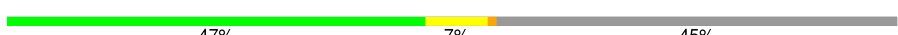
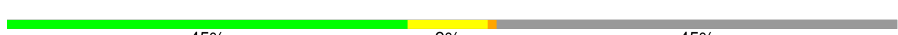








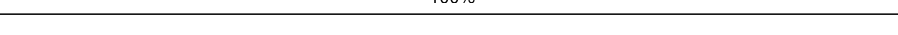
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	180053	1270 (4.10-3.70)
Clashscore	190562	1034 (4.08-3.72)
Ramachandran outliers	187476	1251 (4.10-3.70)
Sidechain outliers	187428	1243 (4.10-3.70)
RSRZ outliers	180081	1269 (4.10-3.70)

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  $\geq 3$ , 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	213	
1	E	213	
1	I	213	
2	C	203	
2	G	203	

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Mol	Chain	Length	Quality of chain
2	K	203	 45% 13% 40%
3	D	182	 41% 56%
3	F	182	 41% 57%
3	J	182	 37% 5% 57%
4	Q	161	 50% 5% 45%
4	T	161	 47% 7% 45%
4	V	161	 45% 9% 45%
5	M	10	 100%
6	N	7	 100%
7	O	6	 100%
8	1	5	 80% 20%
8	2	5	 60% 40%
8	3	5	 100%
9	W	12	 100%
9	X	12	 100%
9	Y	12	 100%

## 2 Entry composition

There are 9 unique types of molecules in this entry. The entry contains 7592 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 HspB2,Heat shock protein beta-2,Heat shock protein beta-2,Heat shock protein beta-2,Heat shock protein beta-2,Heat shock protein beta-2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	130	780	478	138	163	1	0	0	0
1	E	130	777	475	138	163	1	0	0	0
1	I	130	777	475	138	163	1	0	0	0

- Molecule 2 is a protein called HspB2,Heat shock protein beta-2,Heat shock protein beta-2,Heat shock protein beta-2,Heat shock protein beta-2,Heat shock protein beta-2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	C	121	796	498	141	156	1	0	0	0
2	G	121	794	496	141	156	1	0	0	0
2	K	121	796	498	141	156	1	0	0	0

- Molecule 3 is a protein called Heat shock protein beta-2.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	D	80	406	246	80	80	0	0	0
3	F	79	392	234	79	79	0	0	0
3	J	79	392	234	79	79	0	0	0

- Molecule 4 is a protein called Heat shock protein beta-3,Heat shock protein beta-3,Heat shock protein beta-3,Heat shock protein beta-3,Heat shock protein beta-2.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
4	T	88	Total	C	N	O	0	0	0
			437	261	88	88			
4	V	88	Total	C	N	O	0	0	0
			437	261	88	88			
4	Q	89	Total	C	N	O	0	0	0
			443	265	89	89			

- Molecule 5 is a protein called Unknown peptide from HspB2 or HspB3.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
5	M	10	Total	C	N	O	0	0	0
			46	26	10	10			

- Molecule 6 is a protein called Unknown peptide from HspB2 or HspB3.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
6	N	7	Total	C	N	O	0	0	0
			35	21	7	7			

- Molecule 7 is a protein called Unknown peptide from HspB2 or HspB3.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
7	O	6	Total	C	N	O	0	0	0
			30	18	6	6			

- Molecule 8 is a protein called Unknown peptide from HspB2 or HspB3.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
8	1	5	Total	C	N	O	0	0	0
			25	15	5	5			
8	2	5	Total	C	N	O	0	0	0
			24	15	4	5			
8	3	5	Total	C	N	O	0	0	0
			25	15	5	5			

- Molecule 9 is a protein called Unknown peptide from HspB2 or HspB3.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
9	W	12	Total	C	N	O	0	0	0
			60	36	12	12			
9	X	12	Total	C	N	O	0	0	0
			60	36	12	12			

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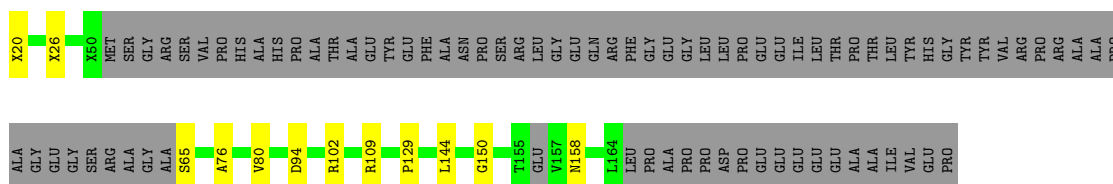
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
9	Y	12	60	36	12	12	0	0	0

### 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.

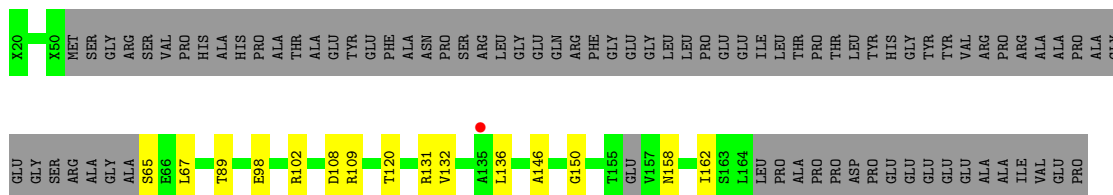
- Molecule 1: HspB2,Heat shock protein beta-2,Heat shock protein beta-2,Heat shock protein beta-2,Heat shock protein beta-2

Chain A: 



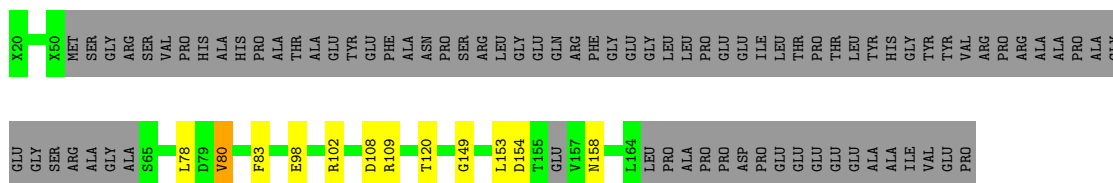
- Molecule 1: HspB2,Heat shock protein beta-2,Heat shock protein beta-2,Heat shock protein beta-2,Heat shock protein beta-2

Chain E: 



- Molecule 1: HspB2,Heat shock protein beta-2,Heat shock protein beta-2,Heat shock protein beta-2,Heat shock protein beta-2

Chain I: 

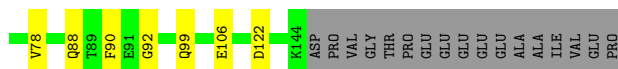


- Molecule 2: HspB2,Heat shock protein beta-2,Heat shock protein beta-2,Heat shock protein beta-2,Heat shock protein beta-2

Chain C: 







- Molecule 5: Unknown peptide from HspB2 or HspB3

Chain M: 100%

There are no outlier residues recorded for this chain.

- Molecule 6: Unknown peptide from HspB2 or HspB3

Chain N: 100%

There are no outlier residues recorded for this chain.

- Molecule 7: Unknown peptide from HspB2 or HspB3

Chain O: 100%

There are no outlier residues recorded for this chain.

- Molecule 8: Unknown peptide from HspB2 or HspB3

Chain 1: 80% 20%



- Molecule 8: Unknown peptide from HspB2 or HspB3

Chain 2: 60% 40%



- Molecule 8: Unknown peptide from HspB2 or HspB3

Chain 3: 100%

There are no outlier residues recorded for this chain.

- Molecule 9: Unknown peptide from HspB2 or HspB3

Chain W: 100%

There are no outlier residues recorded for this chain.

- Molecule 9: Unknown peptide from HspB2 or HspB3

Chain X: 100%

There are no outlier residues recorded for this chain.

- Molecule 9: Unknown peptide from HspB2 or HspB3

Chain Y:  100%

There are no outlier residues recorded for this chain.

## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 31	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	177.14Å 177.14Å 126.46Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	78.00 – 3.90 78.00 – 3.90	Depositor EDS
% Data completeness (in resolution range)	99.8 (78.00-3.90) 99.8 (78.00-3.90)	Depositor EDS
$R_{merge}$	0.13	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.28 (at 3.89Å)	Xtrriage
Refinement program	BUSTER 2.10.2	Depositor
R, $R_{free}$	0.297 , 0.313 0.299 , 0.322	Depositor DCC
$R_{free}$ test set	2088 reflections (5.17%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	158.1	Xtrriage
Anisotropy	0.315	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.30 , 371.2	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.41$ , $\langle L^2 \rangle = 0.23$	Xtrriage
Estimated twinning fraction	0.086 for -h,-k,l 0.358 for h,-h-k,-l 0.087 for -k,-h,-l	Xtrriage
$F_o, F_c$ correlation	0.89	EDS
Total number of atoms	7592	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	144.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.58% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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](#)

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	0.77	0/632	1.18	0/876
1	E	0.77	0/632	1.15	0/876
1	I	0.83	0/632	1.18	0/876
2	C	0.80	0/708	1.28	2/975 (0.2%)
2	G	0.84	0/708	1.21	0/975
2	K	0.84	0/708	1.28	2/975 (0.2%)
3	D	0.76	0/408	1.18	0/568
3	F	0.92	0/393	1.52	2/546 (0.4%)
3	J	0.93	0/393	1.48	7/546 (1.3%)
4	Q	0.89	0/443	1.39	0/615
4	T	0.91	0/437	1.42	1/606 (0.2%)
4	V	0.92	0/437	1.34	0/606
All	All	0.84	0/6531	1.29	14/9040 (0.2%)

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
3	D	0	2
4	T	0	3
4	V	0	5
All	All	0	10

There are no bond length outliers.

The worst 5 of 14 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
3	F	129	PRO	N-CA-CB	13.10	111.43	102.79
2	C	156	GLU	CA-C-N	9.14	138.16	121.70
2	C	156	GLU	C-N-CA	9.14	138.16	121.70

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	K	156	GLU	CA-C-N	8.66	137.29	121.70
2	K	156	GLU	C-N-CA	8.66	137.29	121.70

There are no chirality outliers.

5 of 10 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
3	D	103	HIS	Mainchain
3	D	146	ALA	Mainchain
4	T	100	HIS	Peptide
4	T	143	VAL	Peptide,Mainchain
4	V	100	HIS	Mainchain

## 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	780	0	533	3	0
1	E	777	0	533	2	0
1	I	777	0	533	3	0
2	C	796	0	623	3	0
2	G	794	0	621	4	0
2	K	796	0	622	4	0
3	D	406	0	195	0	0
3	F	392	0	181	0	0
3	J	392	0	181	3	0
4	Q	443	0	204	1	0
4	T	437	0	201	0	0
4	V	437	0	201	2	0
5	M	46	0	10	0	0
6	N	35	0	9	0	0
7	O	30	0	8	0	0
8	1	25	0	7	1	0
8	2	24	0	7	1	0
8	3	25	0	7	0	0
9	W	60	0	15	0	0
9	X	60	0	17	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
9	Y	60	0	17	0	0
All	All	7592	0	4725	23	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 2.

The worst 5 of 23 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)
8:2:3:UNK:C	8:2:4:UNK:CA	2.56	0.83
3:J:75:GLN:HA	3:J:145:GLU:HA	1.81	0.62
2:G:131:ARG:HH22	1:I:154:ASP:H	1.51	0.57
4:Q:88:GLN:HA	8:1:1:UNK:HA	1.85	0.57
2:K:66:GLU:N	2:K:121:TYR:HH	2.02	0.56

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	95/213 (45%)	76 (80%)	15 (16%)	4 (4%)	2	20
1	E	95/213 (45%)	75 (79%)	14 (15%)	6 (6%)	1	15
1	I	95/213 (45%)	76 (80%)	14 (15%)	5 (5%)	1	17
2	C	98/203 (48%)	76 (78%)	12 (12%)	10 (10%)	0	7
2	G	98/203 (48%)	76 (78%)	14 (14%)	8 (8%)	0	11
2	K	98/203 (48%)	70 (71%)	16 (16%)	12 (12%)	0	4
3	D	78/182 (43%)	67 (86%)	7 (9%)	4 (5%)	1	17
3	F	77/182 (42%)	60 (78%)	14 (18%)	3 (4%)	2	21

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
3	J	77/182 (42%)	59 (77%)	13 (17%)	5 (6%)	1	15
4	Q	85/161 (53%)	63 (74%)	15 (18%)	7 (8%)	0	11
4	T	84/161 (52%)	59 (70%)	15 (18%)	10 (12%)	0	4
4	V	84/161 (52%)	62 (74%)	12 (14%)	10 (12%)	0	4
All	All	1064/2277 (47%)	819 (77%)	161 (15%)	84 (8%)	1	11

5 of 84 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	C	157	VAL
4	T	124	VAL
2	G	160	VAL
4	V	69	SER
2	K	157	VAL

### 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	52/151 (34%)	50 (96%)	2 (4%)	29	52
1	E	52/151 (34%)	47 (90%)	5 (10%)	8	29
1	I	52/151 (34%)	49 (94%)	3 (6%)	18	44
2	C	62/151 (41%)	54 (87%)	8 (13%)	4	20
2	G	62/151 (41%)	50 (81%)	12 (19%)	1	9
2	K	62/151 (41%)	48 (77%)	14 (23%)	1	5
3	D	3/151 (2%)	3 (100%)	0	100	100
3	F	2/151 (1%)	2 (100%)	0	100	100
3	J	2/151 (1%)	2 (100%)	0	100	100
4	Q	2/140 (1%)	2 (100%)	0	100	100
4	T	2/140 (1%)	2 (100%)	0	100	100
4	V	2/140 (1%)	2 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	355/1779 (20%)	311 (88%)	44 (12%)	4 20

5 of 44 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	I	80	VAL
2	K	105	GLN
1	I	158	ASN
2	K	89	THR
2	K	123	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	158	ASN
2	C	103	HIS
1	I	158	ASN
2	K	110	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](#)

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](#)

There are no ligands in this entry.

### 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues

The following chains have linkage breaks:

Mol	Chain	Number of breaks
2	K	1
2	C	1
2	G	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	K	32:UNK	C	36:UNK	N	10.50
1	C	32:UNK	C	36:UNK	N	10.44
1	G	32:UNK	C	36:UNK	N	8.90

## 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	99/213 (46%)	-0.72	0 100 100	86, 126, 176, 199	0
1	E	99/213 (46%)	-0.71	1 (1%) 79 59	84, 140, 194, 213	0
1	I	99/213 (46%)	-0.80	0 100 100	116, 158, 196, 210	0
2	C	100/203 (49%)	-0.72	0 100 100	100, 174, 205, 220	0
2	G	100/203 (49%)	-0.74	0 100 100	86, 150, 194, 211	0
2	K	100/203 (49%)	-0.74	0 100 100	115, 155, 211, 249	0
3	D	80/182 (43%)	-0.72	0 100 100	100, 164, 213, 221	0
3	F	79/182 (43%)	-1.04	0 100 100	71, 106, 147, 158	0
3	J	79/182 (43%)	-0.84	0 100 100	86, 113, 155, 172	0
4	Q	89/161 (55%)	-1.03	0 100 100	65, 93, 160, 192	0
4	T	88/161 (54%)	-0.78	0 100 100	92, 148, 200, 229	0
4	V	88/161 (54%)	-0.83	0 100 100	106, 147, 205, 221	0
5	M	0/10	-	-	-	-
6	N	0/7	-	-	-	-
7	O	0/6	-	-	-	-
8	1	0/5	-	-	-	-
8	2	0/5	-	-	-	-
8	3	0/5	-	-	-	-
9	W	0/12	-	-	-	-
9	X	0/12	-	-	-	-
9	Y	0/12	-	-	-	-
All	All	1100/2351 (46%)	-0.80	1 (0%) 92 87	65, 143, 201, 249	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	135	ALA	2.4

## 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](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.