



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 22, 2016 – 04:06 AM EDT

PDB ID : 4XCG  
Title : Crystal structure of a hexadecameric TF55 complex from *S. solfataricus*, crystal form I  
Authors : Stewart, A.G.; Smits, C.; Chaston, J.J.; Stock, D.  
Deposited on : 2014-12-18  
Resolution : 3.74 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](mailto: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.

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

MolProbity : 4.02b-467  
Mogul : 1.7.1 (RC1), CSD as537be (2016)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20027107  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Refmac : 5.8.0122  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : rb-20027107

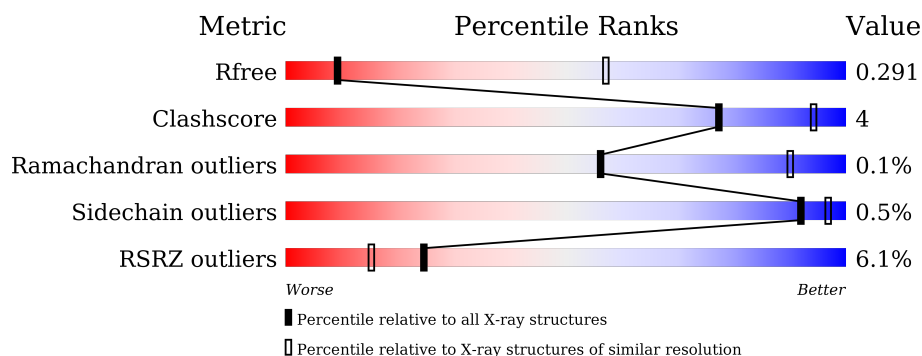
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 3.74 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	1154 (3.98-3.50)
Clashscore	102246	1279 (3.98-3.50)
Ramachandran outliers	100387	1226 (3.98-3.50)
Sidechain outliers	100360	1224 (3.98-3.50)
RSRZ outliers	91569	1161 (3.98-3.50)

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  $\geq 3$ , 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	B	557	
2	A	559	

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 15049 atoms, of which 7697 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 Thermosome subunit beta.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	B	472	Total	C	H	N	O	S	0	0	0
			7318	2257	3738	624	689	10			

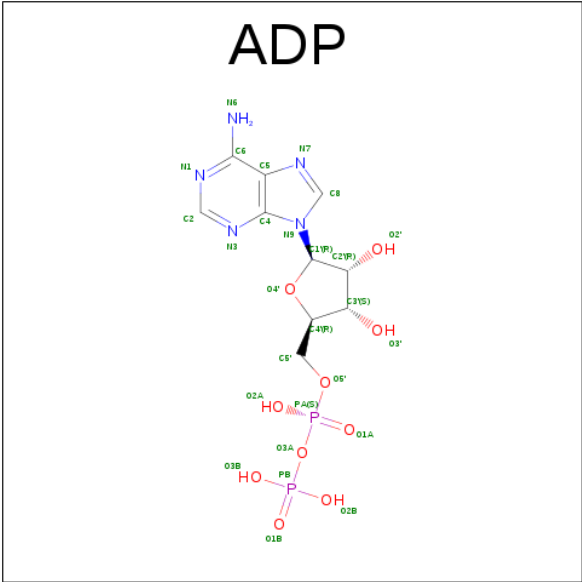
There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	1	MET	-	initiating methionine	UNP Q9V2T8
B	2	ARG	-	expression tag	UNP Q9V2T8
B	3	LYS	-	expression tag	UNP Q9V2T8

- Molecule 2 is a protein called Thermosome subunit alpha.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	A	497	Total	C	H	N	O	S	0	0	0
			7692	2368	3947	643	723	11			

- Molecule 3 is ADENOSINE-5'-DIPHOSPHATE (three-letter code: ADP) (formula: C<sub>10</sub>H<sub>15</sub>N<sub>5</sub>O<sub>10</sub>P<sub>2</sub>).

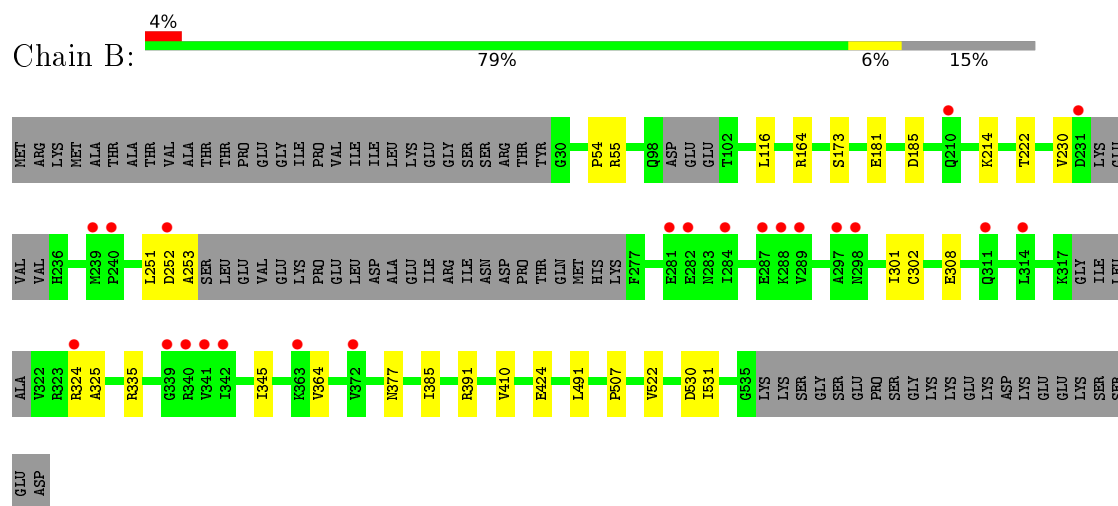


Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
3	B	1	Total	C	H	N	O	P	0	0
			39	10	12	5	10	2		

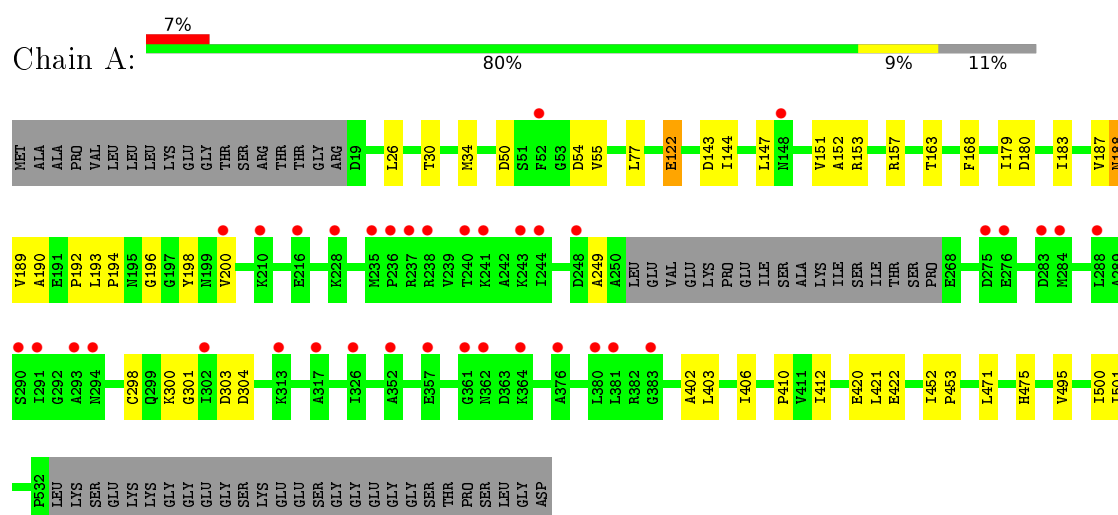
### 3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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: Thermosome subunit beta



- Molecule 2: Thermosome subunit alpha



## 4 Data and refinement statistics

Property	Value	Source
Space group	I 4 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	145.78 Å   145.78 Å   248.09 Å 90.00°   90.00°   90.00°	Depositor
Resolution (Å)	47.59 – 3.74 47.59 – 3.73	Depositor EDS
% Data completeness (in resolution range)	99.7 (47.59-3.74) 99.6 (47.59-3.73)	Depositor EDS
$R_{merge}$	0.68	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.76 (at 3.77 Å)	Xtriage
Refinement program	phenix	Depositor
R, $R_{free}$	0.247   ,   0.292 0.250   ,   0.291	Depositor DCC
$R_{free}$ test set	1339 reflections (5.07%)	DCC
Wilson B-factor (Å <sup>2</sup> )	95.0	Xtriage
Anisotropy	0.115	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 46.4	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.45$ , $\langle L^2 \rangle = 0.28$	Xtriage
Outliers	0 of 14243 reflections	Xtriage
$F_o, F_c$ correlation	0.89	EDS
Total number of atoms	15049	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	117.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.69% 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, 0.375 respectively for untwinned datasets, and 0.333, 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: ADP

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	B	0.26	0/3612	0.40	0/4870
2	A	0.28	0/3777	0.43	0/5095
All	All	0.27	0/7389	0.42	0/9965

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	B	3580	3738	3733	21	0
2	A	3745	3947	3948	36	0
3	B	27	12	12	0	0
All	All	7352	7697	7693	55	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 (55) 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)
2:A:144:ILE:HD11	2:A:410:PRO:HB3	1.60	0.83
2:A:147:LEU:CD1	2:A:187:VAL:HG22	2.08	0.82
2:A:147:LEU:HD12	2:A:187:VAL:HG22	1.68	0.74
2:A:157:ARG:NH2	2:A:180:ASP:OD1	2.22	0.73
1:B:335:ARG:O	1:B:377:ASN:ND2	2.21	0.73
2:A:26:LEU:O	2:A:30:THR:HG23	1.95	0.65
2:A:249:ALA:HB2	2:A:300:LYS:CB	2.29	0.62
1:B:424:GLU:OE1	1:B:424:GLU:N	2.31	0.62
2:A:303:ASP:OD1	2:A:304:ASP:N	2.32	0.62
2:A:298:CYS:SG	2:A:301:GLY:N	2.76	0.58
2:A:249:ALA:HB2	2:A:300:LYS:HB2	1.86	0.57
2:A:153:ARG:HG3	2:A:183:ILE:HD13	1.86	0.56
1:B:252:ASP:OD1	1:B:253:ALA:N	2.39	0.55
2:A:147:LEU:HD23	2:A:152:ALA:HB3	1.89	0.55
1:B:181:GLU:N	1:B:181:GLU:OE1	2.40	0.54
1:B:308:GLU:N	1:B:308:GLU:OE1	2.41	0.54
2:A:189:VAL:HG11	2:A:200:VAL:HA	1.90	0.53
2:A:422:GLU:OE1	2:A:475:HIS:NE2	2.41	0.53
1:B:164:ARG:NH2	1:B:185:ASP:OD1	2.39	0.52
2:A:249:ALA:HB1	2:A:301:GLY:O	2.10	0.52
2:A:163:THR:HG21	2:A:402:ALA:CB	2.41	0.51
2:A:144:ILE:HD11	2:A:410:PRO:CB	2.37	0.51
2:A:452:ILE:HB	2:A:453:PRO:HD3	1.94	0.49
1:B:55:ARG:NH2	2:A:122:GLU:OE1	2.46	0.49
2:A:157:ARG:HD3	2:A:179:ILE:HG21	1.94	0.48
1:B:530:ASP:OD1	1:B:531:ILE:N	2.47	0.47
2:A:54:ASP:OD1	2:A:55:VAL:N	2.47	0.47
1:B:230:VAL:HB	1:B:324:ARG:NH1	2.30	0.47
2:A:192:PRO:HD2	2:A:198:TYR:HA	1.96	0.46
1:B:164:ARG:NH1	1:B:185:ASP:OD1	2.48	0.46
2:A:412:ILE:HB	2:A:501:ILE:HG23	1.97	0.46
2:A:188:ASN:N	2:A:188:ASN:OD1	2.50	0.45
1:B:251:LEU:HD13	1:B:345:ILE:HG22	2.00	0.44
1:B:391:ARG:NH1	2:A:77:LEU:HD11	2.33	0.44
2:A:420:GLU:OE1	2:A:420:GLU:N	2.47	0.44
2:A:144:ILE:HD12	2:A:196:GLY:O	2.18	0.43
1:B:54:PRO:HA	1:B:173:SER:HB2	2.00	0.43
1:B:54:PRO:HG2	1:B:491:LEU:HD12	1.99	0.43
2:A:189:VAL:HG12	2:A:190:ALA:N	2.32	0.43
2:A:193:LEU:N	2:A:194:PRO:CD	2.81	0.43
2:A:298:CYS:SG	2:A:300:LYS:N	2.92	0.43
1:B:214:LYS:HG2	1:B:364:VAL:HG11	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:144:ILE:HG22	2:A:144:ILE:O	2.19	0.42
2:A:495:VAL:HB	2:A:500:ILE:HB	1.99	0.42
2:A:421:LEU:HD11	2:A:471:LEU:HD13	2.02	0.42
1:B:116:LEU:HB2	1:B:522:VAL:HG21	2.00	0.42
1:B:301:ILE:HG23	1:B:324:ARG:CG	2.49	0.42
2:A:403:LEU:HA	2:A:406:ILE:HG22	2.02	0.41
1:B:251:LEU:O	1:B:302:CYS:HA	2.20	0.41
1:B:222:THR:HG22	1:B:385:ILE:HA	2.02	0.41
2:A:193:LEU:N	2:A:194:PRO:HD2	2.35	0.41
2:A:50:ASP:N	2:A:54:ASP:O	2.54	0.41
1:B:410:VAL:HG23	1:B:507:PRO:HG3	2.03	0.41
2:A:143:ASP:HB2	2:A:151:VAL:HG11	2.03	0.41
1:B:54:PRO:C	1:B:173:SER:HB2	2.42	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	B	462/557 (83%)	434 (94%)	27 (6%)	1 (0%)	52	87
2	A	493/559 (88%)	463 (94%)	30 (6%)	0	100	100
All	All	955/1116 (86%)	897 (94%)	57 (6%)	1 (0%)	56	90

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	325	ALA

### 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	B	374/449 (83%)	374 (100%)	0	100	100
2	A	399/448 (89%)	395 (99%)	4 (1%)	82	92
All	All	773/897 (86%)	769 (100%)	4 (0%)	92	97

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	A	34	MET
2	A	122	GLU
2	A	168	PHE
2	A	188	ASN

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

### 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 carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

1 ligand 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	$\# Z  > 2$
3	ADP	B	600	-	24,29,29	1.04	1 (4%)	23,45,45	1.82	1 (4%)

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
3	ADP	B	600	-	-	0/12/32/32	0/3/3/3

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	600	ADP	C5-C4	3.14	1.47	1.40

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	600	ADP	N3-C2-N1	-7.21	123.21	128.87

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

## 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, 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	B	472/557 (84%)	0.19	22 (4%)	35 24	50, 91, 165, 199	0
2	A	497/559 (88%)	0.41	37 (7%)	17 11	48, 113, 157, 183	0
All	All	969/1116 (86%)	0.30	59 (6%)	25 15	48, 99, 160, 199	0

All (59) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	324	ARG	7.9
2	A	148	ASN	5.4
2	A	291	ILE	5.1
2	A	241	LYS	4.6
2	A	362	ASN	4.3
1	B	311	GLN	4.2
2	A	228	LYS	4.0
1	B	297	ALA	4.0
1	B	239	MET	3.9
1	B	240	PRO	3.7
2	A	238	ARG	3.7
2	A	244	ILE	3.4
2	A	376	ALA	3.3
2	A	381	LEU	3.2
2	A	275	ASP	3.1
2	A	288	LEU	3.1
2	A	243	LYS	3.1
1	B	231	ASP	2.8
1	B	341	VAL	2.7
2	A	364	LYS	2.6
1	B	372	VAL	2.6
2	A	283	ASP	2.6
2	A	380	LEU	2.5
2	A	352	ALA	2.5

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Mol	Chain	Res	Type	RSRZ
2	A	326	ILE	2.4
1	B	288	LYS	2.4
1	B	252	ASP	2.4
1	B	287	GLU	2.3
2	A	240	THR	2.3
2	A	52	PHE	2.3
2	A	313	LYS	2.3
2	A	216	GLU	2.3
1	B	342	ILE	2.3
2	A	235	MET	2.3
1	B	340	ARG	2.2
2	A	357	GLU	2.2
1	B	210	GLN	2.2
2	A	237	ARG	2.2
1	B	298	ASN	2.2
1	B	314	LEU	2.2
1	B	339	GLY	2.2
2	A	284	MET	2.2
2	A	200	VAL	2.2
2	A	317	ALA	2.2
1	B	282	GLU	2.2
2	A	294	ASN	2.1
2	A	210	LYS	2.1
2	A	236	PRO	2.1
2	A	290	SER	2.1
2	A	383	GLY	2.1
1	B	281	GLU	2.1
2	A	293	ALA	2.0
2	A	302	ILE	2.0
2	A	361	GLY	2.0
1	B	363	LYS	2.0
2	A	248	ASP	2.0
1	B	284	ILE	2.0
1	B	289	VAL	2.0
2	A	276	GLU	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, 95<sup>th</sup> 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( $\text{\AA}^2$ )	Q<0.9
3	ADP	B	600	27/27	0.82	0.37	1.84	81,103,123,129	0

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

There are no such residues in this entry.