



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 16, 2023 – 02:52 PM EDT

PDB ID : 1ZOR
Title : Isocitrate dehydrogenase from the hyperthermophile *Thermotoga maritima*
Authors : Karlstrom, M.; Steen, I.H.; Birkeland, N.-K.; Ladenstein, R.
Deposited on : 2005-05-13
Resolution : 2.24 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
Xtriage (Phenix) : 1.13
EDS : 2.35
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) : 2.35

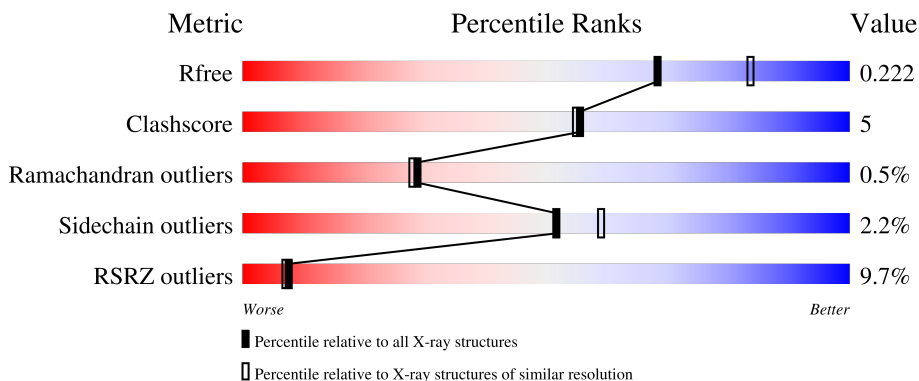
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

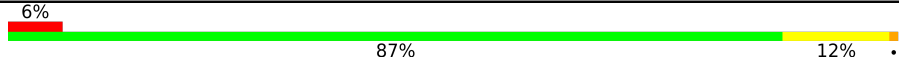
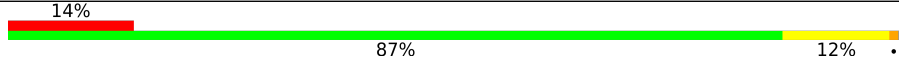
The reported resolution of this entry is 2.24 Å.

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	2391 (2.26-2.22)
Clashscore	141614	2539 (2.26-2.22)
Ramachandran outliers	138981	2489 (2.26-2.22)
Sidechain outliers	138945	2490 (2.26-2.22)
RSRZ outliers	127900	2353 (2.26-2.22)

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	399	 6% 87% 12% .
1	B	399	 14% 87% 12% ..

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 6966 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 isocitrate dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	399	3315	2123	563	612	17	0	13	0
1	B	396	3221	2064	538	603	16	3	6	0

- Molecule 2 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Na	0	0
			1	1		
2	B	1	Total	Na	0	0
			1	1		

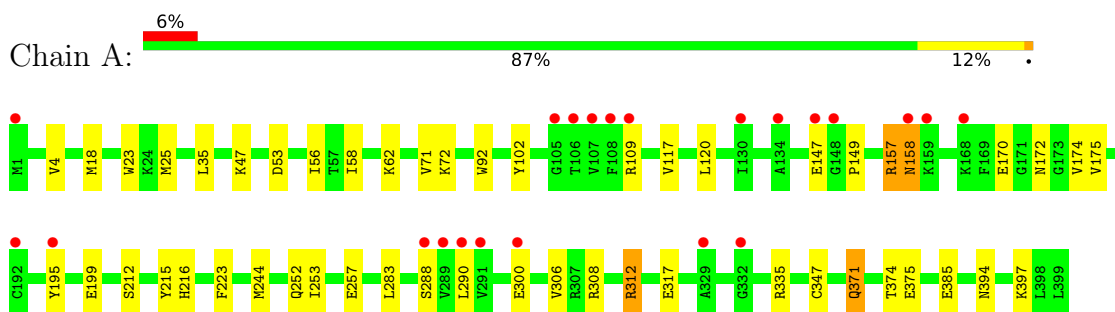
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	347	Total	O	0	0
			347	347		
3	B	81	Total	O	0	0
			81	81		

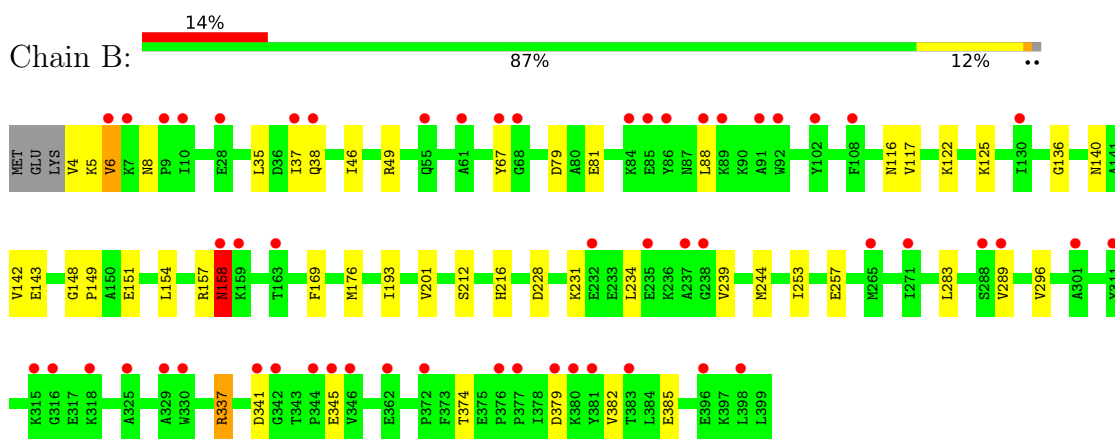
3 Residue-property plots [i](#)

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: isocitrate dehydrogenase



- Molecule 1: isocitrate dehydrogenase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	62.47Å 88.05Å 180.93Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	35.56 – 2.24 35.56 – 2.24	Depositor EDS
% Data completeness (in resolution range)	99.7 (35.56-2.24) 99.7 (35.56-2.24)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.68 (at 2.24Å)	Xtrriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.184 , 0.223 0.184 , 0.222	Depositor DCC
R_{free} test set	2477 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	37.1	Xtrriage
Anisotropy	0.495	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 42.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	6966	wwPDB-VP
Average B, all atoms (Å ²)	45.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.83% 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: NA

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	0.62	0/3379	0.65	1/4548 (0.0%)
1	B	0.51	0/3284	0.62	1/4430 (0.0%)
All	All	0.57	0/6663	0.63	2/8978 (0.0%)

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
1	A	0	1

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	B	337	ARG	NE-CZ-NH2	-8.24	116.18	120.30
1	A	312	ARG	NE-CZ-NH1	5.29	122.95	120.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	157	ARG	Peptide

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	3315	0	3383	40	0
1	B	3221	0	3260	32	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	347	0	0	9	0
3	B	81	0	0	6	0
All	All	6966	0	6643	67	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 5.

All (67) 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:25:MET:HE1	1:A:385:GLU:HG2	1.46	0.98
1:A:175:VAL:HG12	1:B:154:LEU:HD21	1.75	0.68
1:A:175:VAL:CG1	1:B:154:LEU:HD21	2.27	0.65
1:A:62[A]:LYS:HD3	3:A:1093:HOH:O	1.99	0.63
1:B:8:ASN:ND2	1:B:341:ASP:OD1	2.32	0.63
1:A:25:MET:CE	1:A:385:GLU:HG2	2.26	0.61
1:A:72:LYS:O	1:A:300[B]:GLU:HG3	2.02	0.60
1:A:58:ILE:O	1:A:62[A]:LYS:HG3	2.04	0.57
1:B:79:ASP:OD1	1:B:81[B]:GLU:HG2	2.05	0.57
1:A:288:SER:HB3	1:A:300[B]:GLU:O	2.04	0.56
1:B:143:GLU:HG2	1:B:176:MET:HG3	1.87	0.55
1:A:244:MET:HE3	3:A:1094:HOH:O	2.06	0.55
1:A:394:ASN:HA	1:A:397:LYS:HD3	1.89	0.55
1:A:147:GLU:O	1:A:172:ASN:ND2	2.39	0.54
1:A:257:GLU:HG2	3:A:1127:HOH:O	2.06	0.54
1:B:4:VAL:HG13	1:B:345:GLU:HG2	1.90	0.54
1:B:46:ILE:HD11	1:B:88:LEU:HD11	1.90	0.53
1:A:157:ARG:NH2	1:B:151:GLU:OE1	2.42	0.53
1:A:62[A]:LYS:CD	3:A:1093:HOH:O	2.54	0.53
1:A:117:VAL:HG12	3:A:1066:HOH:O	2.09	0.52
1:A:335[B]:ARG:NH1	1:A:347:CYS:HB3	2.24	0.52
1:A:25:MET:HE1	1:A:385:GLU:CG	2.30	0.52
1:A:374:THR:O	1:A:375:GLU:HG2	2.09	0.52
1:B:193:ILE:HG23	1:B:234:LEU:HD21	1.91	0.52
1:A:157:ARG:O	1:A:158:ASN:HB2	2.11	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:49:ARG:HD2	3:B:1021:HOH:O	2.10	0.51
1:B:337:ARG:O	1:B:337:ARG:HD3	2.11	0.51
1:B:212:SER:HB3	1:B:216:HIS:HB2	1.94	0.50
1:A:23:TRP:HH2	1:A:71:VAL:HG22	1.77	0.50
1:B:289:VAL:HG23	3:B:1027:HOH:O	2.12	0.49
1:B:157:ARG:O	1:B:158:ASN:HB2	2.12	0.49
1:A:4:VAL:HB	1:A:35:LEU:HD23	1.95	0.49
1:A:53:ASP:HA	1:A:92:TRP:CH2	2.48	0.48
1:A:195:TYR:CZ	1:A:199:GLU:HG3	2.48	0.48
1:A:244:MET:CE	3:A:1094:HOH:O	2.60	0.48
1:A:62[A]:LYS:HG2	1:A:102:TYR:OH	2.15	0.47
1:B:257[A]:GLU:HG2	3:B:1068:HOH:O	2.13	0.47
1:B:136:GLY:HA2	1:B:140:ASN:HD22	1.80	0.47
1:B:67:TYR:O	1:B:337:ARG:NH2	2.48	0.46
1:A:308[A]:ARG:HD3	3:A:1227:HOH:O	2.15	0.46
1:B:201:VAL:O	1:B:239:VAL:HG13	2.15	0.46
1:B:244:MET:HE3	3:B:1074:HOH:O	2.16	0.46
1:A:212:SER:HB3	1:A:216:HIS:HB2	1.97	0.46
1:A:62[A]:LYS:CE	3:A:1093:HOH:O	2.64	0.46
1:B:37:ILE:HG22	1:B:38:GLN:N	2.30	0.46
1:B:283:LEU:O	1:B:283:LEU:HG	2.16	0.45
1:B:5:LYS:O	1:B:6:VAL:HB	2.17	0.45
1:A:58:ILE:HG22	1:A:62[A]:LYS:HE2	1.98	0.45
1:A:371:GLN:HE21	1:A:371:GLN:HB3	1.55	0.45
1:B:148:GLY:HA2	3:B:1014:HOH:O	2.17	0.44
1:B:244:MET:CE	3:B:1074:HOH:O	2.66	0.44
1:A:47:LYS:HA	1:A:47:LYS:HD2	1.81	0.44
1:B:149:PRO:HA	1:B:169:PHE:O	2.18	0.44
1:A:312:ARG:HD3	1:A:317:GLU:OE1	2.18	0.43
1:A:244:MET:HE1	1:A:252:GLN:HG3	2.01	0.43
1:B:117:VAL:HG22	1:B:374:THR:HG22	2.01	0.42
1:A:120:LEU:O	1:B:122:LYS:HG2	2.20	0.42
1:A:290:LEU:C	1:A:290:LEU:HD23	2.40	0.42
1:B:228:ASP:O	1:B:231:LYS:HG2	2.20	0.42
1:B:4:VAL:HB	1:B:35:LEU:HD23	2.01	0.42
1:A:23:TRP:CH2	1:A:71:VAL:HG22	2.56	0.41
1:A:18:MET:HB3	1:A:306:VAL:HB	2.03	0.41
1:B:116:ASN:O	1:B:374:THR:HA	2.20	0.41
1:A:215:TYR:CD2	1:B:176:MET:HB2	2.56	0.41
1:A:109[A]:ARG:NH1	3:A:1029:HOH:O	2.34	0.41
1:A:195:TYR:CE1	1:A:199:GLU:HG3	2.56	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:37:ILE:CG2	1:B:38:GLN:N	2.84	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	410/399 (103%)	399 (97%)	9 (2%)	2 (0%)	29	28
1	B	400/399 (100%)	383 (96%)	15 (4%)	2 (0%)	29	28
All	All	810/798 (102%)	782 (96%)	24 (3%)	4 (0%)	29	28

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	158	ASN
1	B	6	VAL
1	A	158	ASN
1	A	149	PRO

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	357/344 (104%)	350 (98%)	7 (2%)	55	62

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	347/344 (101%)	338 (97%)	9 (3%)	46	52
All	All	704/688 (102%)	688 (98%)	16 (2%)	52	57

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	56	ILE
1	A	170	GLU
1	A	174	VAL
1	A	223	PHE
1	A	253	ILE
1	A	283	LEU
1	A	371	GLN
1	B	125	LYS
1	B	142	VAL
1	B	158	ASN
1	B	253	ILE
1	B	296	VAL
1	B	379	ASP
1	B	382	VAL
1	B	385[A]	GLU
1	B	385[B]	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	55	GLN
1	A	140	ASN
1	A	167	HIS
1	A	172	ASN
1	A	371	GLN
1	B	140	ASN
1	B	371	GLN

5.3.3 RNA

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

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 [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(Å ²)	Q<0.9
1	A	399/399 (100%)	0.29	22 (5%) 25 24	37, 44, 51, 66	0
1	B	396/399 (99%)	0.78	55 (13%) 2 2	37, 45, 53, 61	1 (0%)
All	All	795/798 (99%)	0.53	77 (9%) 7 7	37, 44, 52, 66	1 (0%)

All (77) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	67	TYR	6.8
1	B	379	ASP	5.3
1	B	237	ALA	4.5
1	B	28	GLU	4.3
1	A	109[A]	ARG	4.2
1	B	301	ALA	4.2
1	A	1	MET	4.1
1	B	341	ASP	4.0
1	A	148	GLY	3.9
1	B	92	TRP	3.8
1	B	102	TYR	3.8
1	B	316	GLY	3.6
1	B	38	GLN	3.6
1	B	130	ILE	3.5
1	B	342	GLY	3.5
1	B	6	VAL	3.4
1	B	235	GLU	3.4
1	B	61	ALA	3.2
1	B	315	LYS	3.2
1	B	325	ALA	3.2
1	A	159	LYS	3.1
1	B	377	PRO	3.1
1	A	290	LEU	3.1
1	B	398	LEU	3.1

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Mol	Chain	Res	Type	RSRZ
1	B	89	LYS	3.0
1	A	158	ASN	3.0
1	B	329	ALA	2.9
1	A	106	THR	2.8
1	A	289	VAL	2.8
1	B	344	PRO	2.8
1	B	318	LYS	2.8
1	B	84	LYS	2.8
1	B	232	GLU	2.7
1	B	380	LYS	2.7
1	A	107	VAL	2.7
1	B	311	TYR	2.7
1	B	381	TYR	2.6
1	A	291	VAL	2.6
1	B	37	ILE	2.6
1	A	108	PHE	2.6
1	B	346	VAL	2.6
1	B	289	VAL	2.5
1	B	86	TYR	2.5
1	B	396	GLU	2.5
1	B	362	GLU	2.5
1	B	376	PRO	2.5
1	B	159	LYS	2.5
1	B	372	PRO	2.4
1	A	332	GLY	2.4
1	A	147	GLU	2.4
1	B	288	SER	2.4
1	A	300[A]	GLU	2.3
1	A	134	ALA	2.3
1	B	265	MET	2.3
1	A	105	GLY	2.2
1	B	271	ILE	2.2
1	B	68	GLY	2.2
1	B	85	GLU	2.2
1	A	192	CYS	2.2
1	B	7	LYS	2.2
1	A	288	SER	2.2
1	B	108	PHE	2.2
1	B	383	THR	2.2
1	B	55	GLN	2.2
1	B	238	GLY	2.2
1	B	91	ALA	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	88	LEU	2.1
1	A	195	TYR	2.1
1	A	329	ALA	2.1
1	B	163	THR	2.1
1	A	130	ILE	2.1
1	B	10	ILE	2.1
1	B	330	TRP	2.1
1	B	158	ASN	2.0
1	B	345	GLU	2.0
1	B	9	PRO	2.0
1	A	168	LYS	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 monosaccharides 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(\AA^2)	Q<0.9
2	NA	B	1002	1/1	0.93	0.07	42,42,42,42	0
2	NA	A	1001	1/1	0.97	0.06	41,41,41,41	0

6.5 Other polymers [i](#)

There are no such residues in this entry.