



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 08:43 PM UTC

PDB ID : 2BFN / pdb_00002bfm
Title : The crystal structure of the complex of the haloalkane dehalogenase LinB with the product of dehalogenation reaction 1,2-dichloropropane.
Authors : Banas, P.; Otyepka, M.; Jerabek, P.; Vevodova, J.; Bohac, M.; Damborsky, J.
Deposited on : 2004-12-09
Resolution : 1.60 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 : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
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

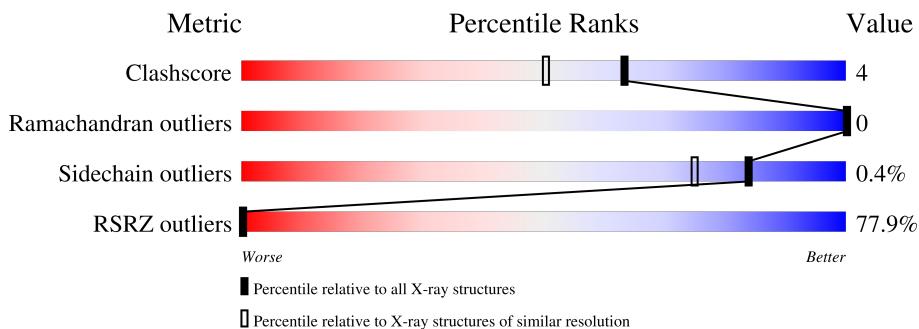
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.60 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))
Clashscore	190562	4931 (1.60-1.60)
Ramachandran outliers	187476	4831 (1.60-1.60)
Sidechain outliers	187428	4830 (1.60-1.60)
RSRZ outliers	180081	4672 (1.60-1.60)

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	296	

2 Entry composition [i](#)

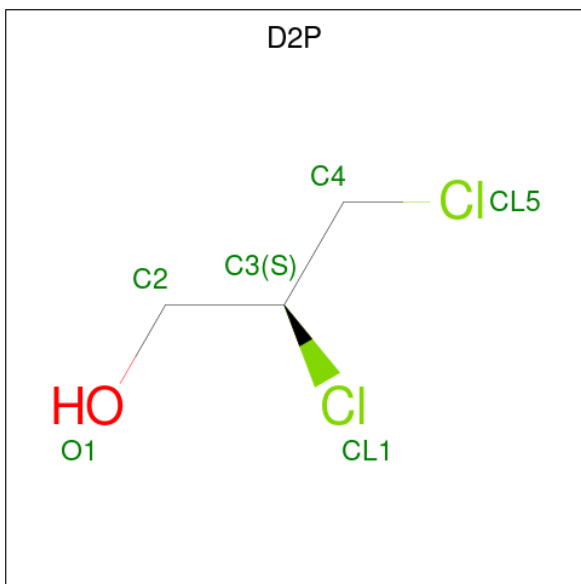
There are 5 unique types of molecules in this entry. The entry contains 2743 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 HALOGENALKANE DEHALOGENASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	294	2396	1514	426	446	10	8	17	0

- Molecule 2 is (2S)-2,3-DICHLOROPROPAN-1-OL (CCD ID: D2P) (formula: C₃H₆Cl₂O).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	Cl	O		
2	A	1	6	3	2	1	0	0

- Molecule 3 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total 1 Cl 1	0	0

- Molecule 4 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	3	Total 3	Ca 3	0	0

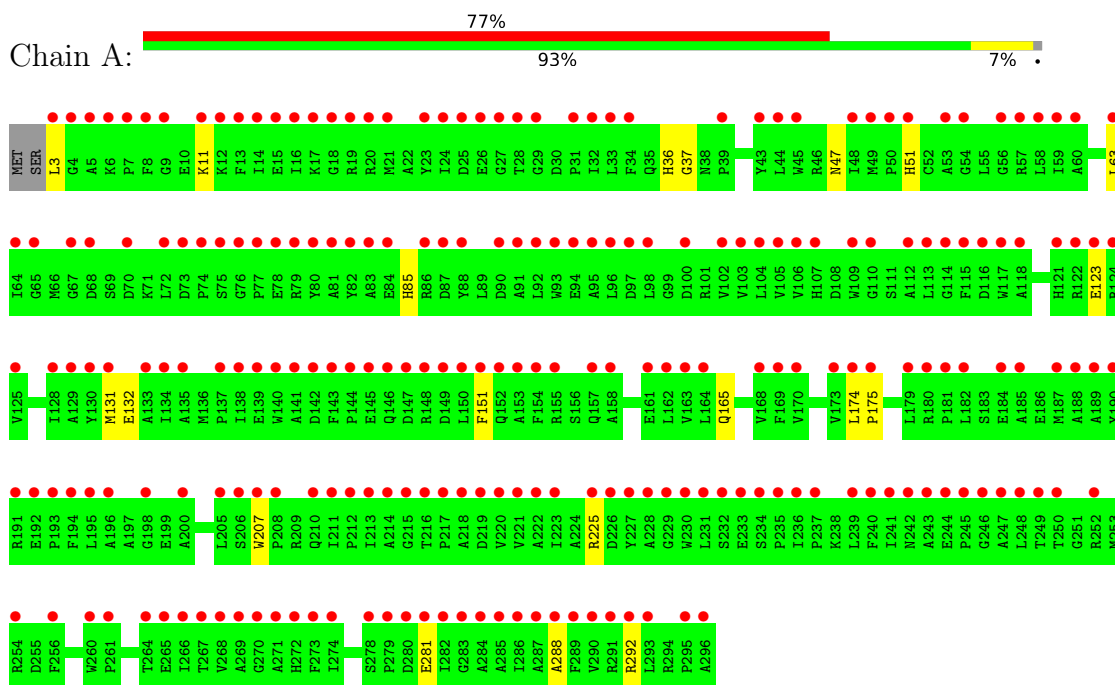
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	337	Total 337	O 337	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: HALOGENALKANE DEHALOGENASE



4 Data and refinement statistics i

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	50.57Å 72.14Å 73.31Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	72.55 – 1.60 51.42 – 1.60	Depositor EDS
% Data completeness (in resolution range)	99.7 (72.55-1.60) 99.7 (51.42-1.60)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.23 (at 1.60Å)	Xtrriage
Refinement program	REFMAC 5.1.24	Depositor
R, R_{free}	0.149 , 0.171 0.378 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å ²)	8.3	Xtrriage
Anisotropy	0.239	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 50.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.018 for -h,l,k	Xtrriage
F_o, F_c correlation	0.65	EDS
Total number of atoms	2743	wwPDB-VP
Average B, all atoms (Å ²)	10.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.18% 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: D2P, CL, CA

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	0.70	0/2543	0.79	0/3452

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 [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	2396	0	2295	19	0
2	A	6	0	3	1	0
3	A	1	0	0	0	0
4	A	3	0	0	0	0
5	A	337	0	0	9	1
All	All	2743	0	2298	19	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 4.

All (19) 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:292[B]:ARG:CD	5:A:2331:HOH:O	2.03	1.02
1:A:292[B]:ARG:NE	5:A:2331:HOH:O	1.96	0.96
1:A:281[B]:GLU:OE1	5:A:2319:HOH:O	1.91	0.89
1:A:292[B]:ARG:NH2	5:A:2330:HOH:O	2.16	0.79
1:A:36:HIS:HE1	1:A:63:LEU:H	1.45	0.63
1:A:165:GLN:NE2	5:A:2202:HOH:O	2.20	0.59
1:A:36:HIS:HD2	1:A:37:GLY:O	1.85	0.58
1:A:36:HIS:CE1	1:A:63:LEU:H	2.23	0.57
1:A:123[B]:GLU:OE2	5:A:2163:HOH:O	2.20	0.49
1:A:3:LEU:HD23	1:A:47:ASN:HB3	1.94	0.48
1:A:151:PHE:HZ	2:A:1297:D2P:H2C1	1.79	0.47
1:A:292[B]:ARG:HD3	5:A:2331:HOH:O	1.94	0.46
1:A:225[A]:ARG:HD3	5:A:2264:HOH:O	2.16	0.46
1:A:288:ALA:O	1:A:292[B]:ARG:HD3	2.17	0.44
1:A:174:LEU:HB3	1:A:175:PRO:HD3	1.99	0.44
1:A:51:HIS:HD2	5:A:2026:HOH:O	2.01	0.43
1:A:85:HIS:CD2	1:A:207:TRP:CZ2	3.08	0.42
1:A:131:MET:O	1:A:132:GLU:C	2.63	0.41

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:A:2086:HOH:O	5:A:2130:HOH:O[3_645]	2.16	0.04

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	309/296 (104%)	299 (97%)	10 (3%)	0	100 100

There are no Ramachandran outliers to report.

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	251/236 (106%)	250 (100%)	1 (0%)	84 75

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	11	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	36	HIS
1	A	51	HIS
1	A	121	HIS
1	A	146	GLN
1	A	263	GLN

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](#)

Of 5 ligands modelled in this entry, 4 are monoatomic - leaving 1 for Mogul analysis.

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	D2P	A	1297	-	5,5,5	2.37	2 (40%)	4,5,5	1.51	1 (25%)

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	D2P	A	1297	-	-	2/4/4/4	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1297	D2P	C3-CL1	-4.90	1.70	1.81
2	A	1297	D2P	C4-CL5	-2.03	1.68	1.78

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1297	D2P	C4-C3-C2	-2.31	107.97	113.13

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	1297	D2P	C2-C3-C4-CL5
2	A	1297	D2P	CL1-C3-C4-CL5

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	1297	D2P	1	0

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 [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	294/296 (99%)	3.10	229 (77%) 0 0	4, 7, 14, 29	22 (7%)

All (229) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	3	LEU	13.8
1	A	266	ILE	8.7
1	A	73[A]	ASP	6.9
1	A	141	ALA	6.6
1	A	144	PRO	6.0
1	A	20[A]	ARG	6.0
1	A	214	ALA	5.8
1	A	295	PRO	5.8
1	A	146	GLN	5.8
1	A	221	VAL	5.8
1	A	117	TRP	5.7
1	A	244[A]	GLU	5.7
1	A	72[A]	LEU	5.6
1	A	260	TRP	5.6
1	A	185	ALA	5.3
1	A	16	ILE	5.3
1	A	170	VAL	5.3
1	A	193	PRO	5.1
1	A	8	PHE	5.1
1	A	17	LYS	5.0
1	A	93	TRP	4.9
1	A	216	THR	4.9
1	A	7	PRO	4.8
1	A	5	ALA	4.8
1	A	14	ILE	4.8
1	A	19	ARG	4.7
1	A	95	ALA	4.7

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Mol	Chain	Res	Type	RSRZ
1	A	283	GLY	4.7
1	A	134	ILE	4.6
1	A	282	ILE	4.6
1	A	53	ALA	4.6
1	A	105	VAL	4.6
1	A	32	ILE	4.6
1	A	145	GLU	4.6
1	A	274	ILE	4.6
1	A	4	GLY	4.4
1	A	208	PRO	4.4
1	A	233[A]	GLU	4.4
1	A	24	ILE	4.4
1	A	211	ILE	4.4
1	A	229	GLY	4.3
1	A	48	ILE	4.3
1	A	151	PHE	4.3
1	A	137	PRO	4.3
1	A	182	LEU	4.2
1	A	83	ALA	4.2
1	A	45	TRP	4.2
1	A	157[A]	GLN	4.2
1	A	228	ALA	4.2
1	A	206	SER	4.1
1	A	296	ALA	4.1
1	A	195	LEU	4.1
1	A	264	THR	4.1
1	A	129	ALA	4.1
1	A	245	PRO	4.1
1	A	102	VAL	4.1
1	A	250	THR	4.1
1	A	217	PRO	4.1
1	A	226[A]	ASP	4.1
1	A	57	ARG	4.0
1	A	293	LEU	4.0
1	A	18	GLY	4.0
1	A	70	ASP	4.0
1	A	194	PHE	4.0
1	A	271	ALA	4.0
1	A	241	ILE	3.9
1	A	162	LEU	3.9
1	A	232	SER	3.9
1	A	98	LEU	3.9

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Mol	Chain	Res	Type	RSRZ
1	A	288	ALA	3.9
1	A	143	PHE	3.9
1	A	273	PHE	3.9
1	A	236	ILE	3.8
1	A	12	LYS	3.8
1	A	15	GLU	3.8
1	A	189	ALA	3.8
1	A	292[A]	ARG	3.8
1	A	289	PHE	3.8
1	A	219	ASP	3.8
1	A	74	PRO	3.8
1	A	77	PRO	3.8
1	A	82	TYR	3.7
1	A	142	ASP	3.7
1	A	213	ILE	3.7
1	A	286	ILE	3.7
1	A	92	LEU	3.7
1	A	121	HIS	3.7
1	A	169	PHE	3.6
1	A	97[A]	ASP	3.6
1	A	79[A]	ARG	3.6
1	A	196	ALA	3.6
1	A	26	GLU	3.6
1	A	130	TYR	3.6
1	A	269	ALA	3.5
1	A	281[A]	GLU	3.5
1	A	81	ALA	3.5
1	A	109	TRP	3.5
1	A	207	TRP	3.5
1	A	13	PHE	3.5
1	A	33	LEU	3.5
1	A	64	ILE	3.5
1	A	174	LEU	3.5
1	A	103	VAL	3.5
1	A	249	THR	3.5
1	A	252	ARG	3.4
1	A	23	TYR	3.4
1	A	88	TYR	3.4
1	A	91	ALA	3.4
1	A	158	ALA	3.4
1	A	104	LEU	3.4
1	A	248	LEU	3.4

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Mol	Chain	Res	Type	RSRZ
1	A	28	THR	3.4
1	A	230	TRP	3.4
1	A	87	ASP	3.4
1	A	179	LEU	3.4
1	A	240	PHE	3.4
1	A	256	PHE	3.4
1	A	56	GLY	3.4
1	A	190	TYR	3.3
1	A	78[A]	GLU	3.3
1	A	11	LYS	3.3
1	A	128	ILE	3.3
1	A	280	ASP	3.3
1	A	218	ALA	3.3
1	A	284	ALA	3.3
1	A	227	TYR	3.3
1	A	65	GLY	3.3
1	A	140	TRP	3.3
1	A	270	GLY	3.3
1	A	25	ASP	3.3
1	A	115	PHE	3.3
1	A	9	GLY	3.2
1	A	6	LYS	3.2
1	A	44	LEU	3.2
1	A	247	ALA	3.2
1	A	80	TYR	3.2
1	A	223	ILE	3.2
1	A	287	ALA	3.2
1	A	290	VAL	3.2
1	A	246	GLY	3.1
1	A	188	ALA	3.1
1	A	163	VAL	3.1
1	A	110	GLY	3.1
1	A	116	ASP	3.1
1	A	267	THR	3.1
1	A	54	GLY	3.0
1	A	153	ALA	3.0
1	A	68	ASP	3.0
1	A	147	ASP	3.0
1	A	131	MET	3.0
1	A	220	VAL	3.0
1	A	192	GLU	3.0
1	A	59	ILE	3.0

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Mol	Chain	Res	Type	RSRZ
1	A	75	SER	3.0
1	A	21	MET	3.0
1	A	261	PRO	3.0
1	A	237	PRO	2.9
1	A	154	PHE	2.9
1	A	161[A]	GLU	2.9
1	A	234	SER	2.9
1	A	135	ALA	2.8
1	A	243	ALA	2.8
1	A	205	LEU	2.8
1	A	222	ALA	2.8
1	A	51	HIS	2.8
1	A	148	ARG	2.8
1	A	254	ARG	2.8
1	A	58	LEU	2.8
1	A	113	LEU	2.8
1	A	67	GLY	2.8
1	A	149[A]	ASP	2.7
1	A	150	LEU	2.7
1	A	155	ARG	2.7
1	A	31	PRO	2.7
1	A	39	PRO	2.7
1	A	225[A]	ARG	2.7
1	A	181	PRO	2.6
1	A	215	GLY	2.6
1	A	94	GLU	2.6
1	A	96	LEU	2.6
1	A	112	ALA	2.6
1	A	76	GLY	2.6
1	A	285	ALA	2.6
1	A	279	PRO	2.6
1	A	106	VAL	2.5
1	A	173	VAL	2.5
1	A	86	ARG	2.5
1	A	184	GLU	2.5
1	A	60	ALA	2.5
1	A	125	VAL	2.5
1	A	122	ARG	2.5
1	A	152	GLN	2.5
1	A	187	MET	2.5
1	A	291[A]	ARG	2.5
1	A	198	GLY	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	138	ILE	2.4
1	A	168	VAL	2.4
1	A	272	HIS	2.4
1	A	29	GLY	2.4
1	A	63	LEU	2.4
1	A	124	ARG	2.3
1	A	164	LEU	2.3
1	A	231	LEU	2.3
1	A	49	MET	2.3
1	A	210	GLN	2.3
1	A	114	GLY	2.3
1	A	50	PRO	2.3
1	A	200	ALA	2.3
1	A	139	GLU	2.3
1	A	278	SER	2.3
1	A	175	PRO	2.2
1	A	84	GLU	2.2
1	A	235	PRO	2.2
1	A	27	GLY	2.2
1	A	268	VAL	2.2
1	A	100	ASP	2.2
1	A	239	LEU	2.2
1	A	107	HIS	2.2
1	A	191	ARG	2.2
1	A	180	ARG	2.1
1	A	90	ASP	2.1
1	A	212	PRO	2.1
1	A	43	TYR	2.1
1	A	118	ALA	2.1
1	A	133	ALA	2.1
1	A	242	ASN	2.1
1	A	123[A]	GLU	2.1
1	A	265	GLU	2.1
1	A	34	PHE	2.1

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](#)

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	D2P	A	1297	6/6	0.39	0.39	61,62,62,63	0
3	CL	A	1298	1/1	0.77	0.19	16,16,16,16	1
4	CA	A	1301	1/1	0.89	0.16	12,12,12,12	1
4	CA	A	1300	1/1	0.92	0.10	12,12,12,12	0
4	CA	A	1299	1/1	0.97	0.07	5,5,5,5	0

6.5 Other polymers [i](#)

There are no such residues in this entry.