



# Full wwPDB X-ray Structure Validation Report

Feb 28, 2014 – 04:15 PM GMT

PDB ID : 1WPW  
Title : Crystal Structure of IPMDH from Sulfolobus tokodaii  
Authors : Hirose, R.; Sakurai, M.; Suzuki, T.; Moriyama, H.; Sato, T.; Yamagishi, A.;  
Oshima, T.; Tanaka, N.  
Deposited on : 2004-09-14  
Resolution : 2.80 Å(reported)

This is a full wwPDB 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/ValidationPDFNotes.html>

---

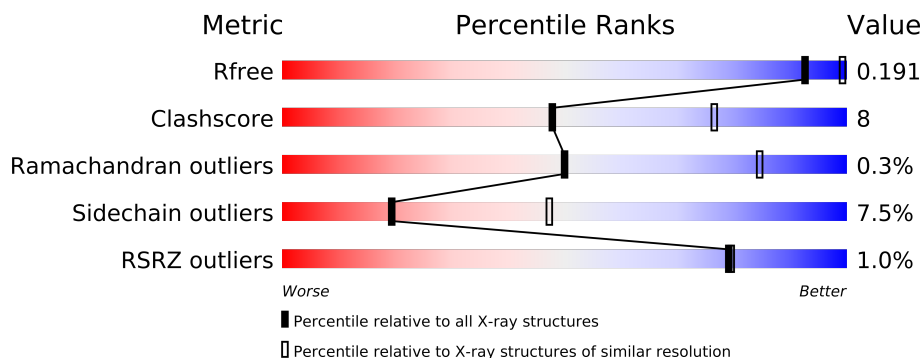
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.15 2013  
Xtriage (Phenix) : dev-1323  
EDS : stable22639  
Percentile statistics : 21963  
Refmac : 5.8.0049  
CCP4 : 6.3.0 (Settle)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)  
Validation Pipeline (wwPDB-VP) : stable22683

# 1 Overall quality at a glance

The reported resolution of this entry is 2.80 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))
$R_{free}$	66092	1799 (2.80-2.80)
Clashscore	79885	2295 (2.80-2.80)
Ramachandran outliers	78287	2252 (2.80-2.80)
Sidechain outliers	78261	2254 (2.80-2.80)
RSRZ outliers	66119	1802 (2.80-2.80)

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. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	336	
1	B	336	

The following table lists non-polymeric compounds that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
2	MG	A	401	-	X
2	MG	B	402	-	X

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 5265 atoms, of which 0 are hydrogen and 0 are deuterium.

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 3-isopropylmalate dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	336	Total	C	N	O	S	0	0	0
			2590	1645	442	493	10			
1	B	336	Total	C	N	O	S	0	0	0
			2590	1645	442	493	10			

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

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

- Molecule 3 is water.

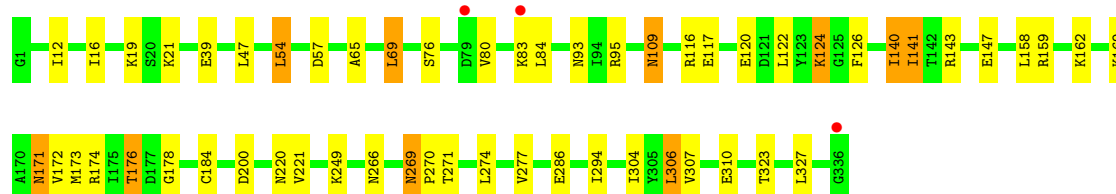
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	45	Total	O	0	0
			45	45		
3	B	38	Total	O	0	0
			38	38		

### 3 Residue-property plots i

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 ( $\text{RSRZ} > 2$ ). 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.

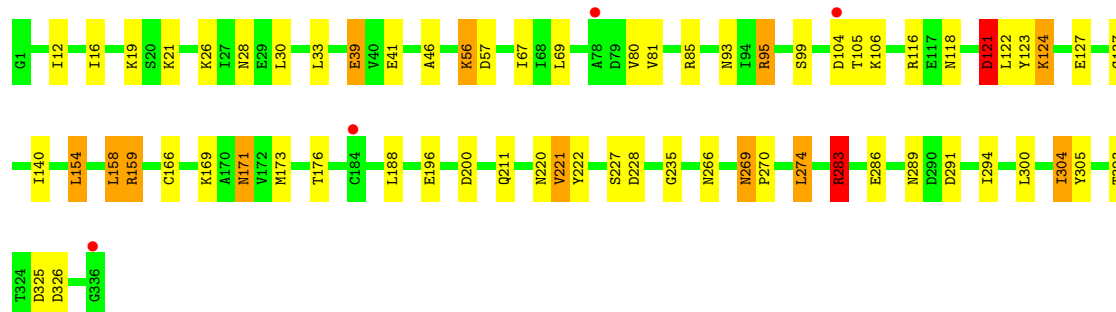
- Molecule 1: 3-isopropylmalate dehydrogenase

Chain A:



- Molecule 1: 3-isopropylmalate dehydrogenase

Chain B:



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	67.91Å 91.50Å 132.98Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.73 – 2.80 29.73 – 2.80	Depositor EDS
% Data completeness (in resolution range)	98.3 (29.73-2.80) 98.4 (29.73-2.80)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	5.63 (at 2.80Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, $R_{free}$	0.190 , 0.247 0.195 , 0.191	Depositor DCC
$R_{free}$ test set	2104 reflections (10.15%)	DCC
Wilson B-factor (Å <sup>2</sup> )	42.0	Xtriage
Anisotropy	0.389	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 22.4	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	1 of 20726 reflections (0.005%)	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	5265	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	39.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 42.89 % of the origin peak, indicating pseudo translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo translational symmetry is equal to 1.9091e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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

## 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: MG

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	0/2628	0.77	2/3547 (0.1%)
1	B	0.81	1/2628 (0.0%)	0.82	9/3547 (0.3%)
All	All	0.79	1/5256 (0.0%)	0.80	11/7094 (0.2%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	221	VAL	CB-CG2	6.61	1.66	1.52

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	283	ARG	NE-CZ-NH2	-7.05	116.78	120.30
1	A	200	ASP	CB-CG-OD1	6.45	124.10	118.30
1	B	121	ASP	CB-CG-OD1	6.29	123.97	118.30
1	B	159	ARG	NE-CZ-NH2	-6.03	117.28	120.30
1	B	291	ASP	CB-CG-OD1	6.00	123.70	118.30
1	B	200	ASP	CB-CG-OD1	5.77	123.49	118.30
1	B	283	ARG	NE-CZ-NH1	5.34	122.97	120.30
1	B	159	ARG	NE-CZ-NH1	5.29	122.95	120.30
1	B	104	ASP	CB-CG-OD2	5.25	123.02	118.30
1	B	274	LEU	CA-CB-CG	5.21	127.27	115.30
1	A	57	ASP	CB-CG-OD1	5.08	122.87	118.30

There are no chirality outliers.

There are no planarity outliers.

## 5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2590	0	2650	45	0
1	B	2590	0	2650	42	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	45	0	0	1	0
3	B	38	0	0	1	0
All	All	5265	0	5300	83	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 8.

All (83) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:171:ASN:HD22	1:A:171:ASN:H	1.18	0.91
1:A:21:LYS:NZ	1:A:39:GLU:OE2	2.21	0.71
1:A:93:ASN:HD22	1:A:116:ARG:HD3	1.55	0.71
1:A:12:ILE:O	1:A:16:ILE:HG12	1.90	0.71
1:B:105:THR:O	1:B:106:LYS:HG2	1.91	0.71
1:A:109:ASN:H	1:A:109:ASN:HD22	1.40	0.70
1:B:304:ILE:HG13	1:B:305:TYR:N	2.08	0.69
1:B:171:ASN:N	1:B:171:ASN:HD22	1.91	0.68
1:A:141:ILE:HD13	1:A:141:ILE:C	2.13	0.68
1:B:93:ASN:HD22	1:B:116:ARG:HD3	1.59	0.67
1:B:85:ARG:HD2	3:B:430:HOH:O	1.96	0.64
1:A:171:ASN:ND2	1:A:171:ASN:H	1.94	0.63
1:A:221:VAL:HB	3:A:406:HOH:O	1.96	0.63
1:B:221:VAL:HG23	1:B:222:TYR:H	1.63	0.63
1:B:171:ASN:HD22	1:B:171:ASN:H	1.44	0.62
1:A:306:LEU:O	1:A:310:GLU:HG3	2.01	0.60
1:A:141:ILE:HG22	1:A:176:THR:HG22	1.83	0.60
1:A:171:ASN:HD22	1:A:171:ASN:N	1.91	0.59
1:B:221:VAL:HG23	1:B:222:TYR:N	2.18	0.59
1:A:83:LYS:NZ	1:A:83:LYS:HB3	2.18	0.59
1:A:124:LYS:HD3	1:A:140:ILE:HG23	1.85	0.58

*Continued on next page...*

*Continued from previous page...*

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:B:26:LYS:O	1:B:30:LEU:HB2	2.04	0.58
1:B:124:LYS:HD3	1:B:140:ILE:HD12	1.86	0.57
1:B:266:ASN:ND2	1:B:323:THR:OG1	2.36	0.57
1:A:122:LEU:HD11	1:B:122:LEU:HD11	1.86	0.57
1:A:54:LEU:HD11	1:A:84:LEU:HD13	1.87	0.55
1:A:269:ASN:HD22	1:A:270:PRO:N	2.03	0.55
1:B:121:ASP:OD2	1:B:221:VAL:HG22	2.06	0.55
1:A:80:VAL:O	1:A:84:LEU:HB2	2.08	0.54
1:A:172:VAL:HG11	1:B:123:TYR:CD1	2.43	0.54
1:A:269:ASN:C	1:A:269:ASN:HD22	2.10	0.53
1:A:65:ALA:O	1:A:249:LYS:HE2	2.09	0.53
1:A:169:LYS:HD2	1:A:171:ASN:HD21	1.74	0.52
1:B:269:ASN:HD22	1:B:270:PRO:HD2	1.75	0.51
1:B:93:ASN:ND2	1:B:116:ARG:HH11	2.09	0.51
1:B:80:VAL:HG13	1:B:81:VAL:H	1.77	0.50
1:B:80:VAL:HG13	1:B:81:VAL:N	2.27	0.50
1:B:323:THR:HG23	1:B:325:ASP:H	1.77	0.50
1:B:95:ARG:NH2	1:B:228:ASP:OD1	2.43	0.50
1:B:19:LYS:HE3	1:B:266:ASN:OD1	2.12	0.49
1:B:283:ARG:HD3	1:B:283:ARG:O	2.13	0.49
1:A:124:LYS:HE3	1:A:126:PHE:CE2	2.48	0.49
1:A:143:ARG:O	1:A:147:GLU:HG3	2.13	0.47
1:B:166:CYS:HB3	1:B:196:GLU:HG2	1.96	0.47
1:A:109:ASN:N	1:A:109:ASN:HD22	2.06	0.47
1:B:21:LYS:NZ	1:B:39:GLU:OE2	2.43	0.47
1:A:120:GLU:OE2	1:A:141:ILE:HA	2.14	0.47
1:A:269:ASN:ND2	1:A:271:THR:H	2.13	0.47
1:B:171:ASN:ND2	1:B:171:ASN:H	2.13	0.45
1:B:12:ILE:O	1:B:16:ILE:HG12	2.17	0.45
1:A:76:SER:O	1:A:80:VAL:HG23	2.16	0.45
1:A:141:ILE:CG2	1:A:176:THR:HG22	2.47	0.45
1:A:174:ARG:O	1:A:178:GLY:HA3	2.16	0.45
1:A:47:LEU:O	1:A:47:LEU:HD23	2.17	0.45
1:A:270:PRO:HD2	1:A:327:LEU:HD23	1.98	0.45
1:A:124:LYS:CB	1:A:124:LYS:NZ	2.80	0.45
1:B:124:LYS:HD3	1:B:140:ILE:CD1	2.46	0.44
1:B:269:ASN:HD22	1:B:270:PRO:CD	2.30	0.44
1:B:171:ASN:N	1:B:171:ASN:ND2	2.63	0.44
1:A:269:ASN:HD22	1:A:270:PRO:CD	2.31	0.44
1:B:323:THR:HG23	1:B:325:ASP:N	2.33	0.44
1:B:56:LYS:HD3	1:B:56:LYS:H	1.83	0.43
1:A:124:LYS:HD3	1:A:140:ILE:CG2	2.47	0.43

*Continued on next page...*



Continued from previous page...

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:83:LYS:HZ3	1:A:83:LYS:HB3	1.82	0.43
1:A:173:MET:HE1	1:B:122:LEU:HD13	2.01	0.43
1:B:323:THR:HG22	1:B:326:ASP:CG	2.39	0.43
1:B:154:LEU:HD22	1:B:158:LEU:HD22	2.00	0.43
1:B:85:ARG:HD3	1:B:118:ASN:ND2	2.35	0.42
1:A:304:ILE:O	1:A:307:VAL:HG22	2.20	0.42
1:B:159:ARG:HH22	1:B:286:GLU:HG2	1.85	0.42
1:B:41:GLU:HG3	1:B:46:ALA:HB2	2.01	0.42
1:A:122:LEU:HD13	1:B:173:MET:HE1	2.01	0.42
1:B:93:ASN:HD22	1:B:116:ARG:HH11	1.67	0.41
1:A:83:LYS:NZ	1:A:83:LYS:CB	2.84	0.41
1:A:269:ASN:C	1:A:269:ASN:ND2	2.72	0.41
1:B:127:GLU:HB3	1:B:137:GLY:HA2	2.02	0.41
1:B:269:ASN:HD22	1:B:270:PRO:N	2.19	0.41
1:A:69:LEU:HD11	1:A:277:VAL:HG22	2.02	0.41
1:A:266:ASN:ND2	1:A:323:THR:HB	2.35	0.41
1:B:169:LYS:HE3	1:B:171:ASN:HD21	1.86	0.41
1:A:19:LYS:HE3	1:A:266:ASN:OD1	2.21	0.41
1:A:159:ARG:HH22	1:A:286:GLU:HG2	1.86	0.40
1:A:117:GLU:O	1:A:220:ASN:HA	2.20	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles

### 5.3.1 Protein backbone ⓘ

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	334/336 (99%)	313 (94%)	21 (6%)	0	100	100
1	B	334/336 (99%)	307 (92%)	25 (8%)	2 (1%)	33	72
All	All	668/672 (99%)	620 (93%)	46 (7%)	2 (0%)	50	84

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	121	ASP
1	B	235	GLY

### 5.3.2 Protein sidechains ⓘ

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	274/274 (100%)	258 (94%)	16 (6%)	28	63
1	B	274/274 (100%)	249 (91%)	25 (9%)	14	37
All	All	548/548 (100%)	507 (92%)	41 (8%)	19	47

All (41) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	54	LEU
1	A	69	LEU
1	A	95	ARG
1	A	109	ASN
1	A	124	LYS
1	A	140	ILE
1	A	141	ILE
1	A	158	LEU
1	A	162	LYS
1	A	171	ASN
1	A	176	THR
1	A	184	CYS
1	A	269	ASN
1	A	274	LEU
1	A	294	ILE
1	A	306	LEU
1	B	28	ASN
1	B	33	LEU
1	B	39	GLU
1	B	56	LYS
1	B	57	ASP
1	B	67	ILE
1	B	69	LEU
1	B	95	ARG

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type
1	B	99	SER
1	B	124	LYS
1	B	154	LEU
1	B	158	LEU
1	B	171	ASN
1	B	176	THR
1	B	188	LEU
1	B	211	GLN
1	B	220	ASN
1	B	227	SER
1	B	269	ASN
1	B	274	LEU
1	B	283	ARG
1	B	289	ASN
1	B	294	ILE
1	B	300	LEU
1	B	304	ILE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	28	ASN
1	A	93	ASN
1	A	109	ASN
1	A	155	ASN
1	A	171	ASN
1	A	211	GLN
1	A	232	GLN
1	A	269	ASN
1	B	28	ASN
1	B	93	ASN
1	B	118	ASN
1	B	171	ASN
1	B	220	ASN
1	B	269	ASN

### 5.3.3 RNA ⓘ

There are no RNA chains in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 5.6 Ligand geometry ⓘ

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.

## 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	A	336/336 (100%)	-0.51	3 (0%) 81 81	20, 39, 66, 77	0
1	B	336/336 (100%)	-0.53	4 (1%) 75 76	18, 34, 67, 83	0
All	All	672/672 (100%)	-0.52	7 (1%) 79 79	18, 36, 66, 83	0

All (7) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	336	GLY	3.7
1	A	336	GLY	3.4
1	B	104	ASP	2.7
1	A	79	ASP	2.5
1	B	184	CYS	2.2
1	B	78	ALA	2.2
1	A	83	LYS	2.1

### 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 ⓘ

There are no carbohydrates 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. 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	RSR	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
2	MG	B	402	1/1	0.34	15.79	32,32,32,32	0
2	MG	A	401	1/1	0.33	5.01	31,31,31,31	0

## 6.5 Other polymers ⓘ

There are no such residues in this entry.