



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 14, 2026 – 12:42 PM UTC

PDB ID : 7OCU / pdb_00007ocu
Title : Mannitol-1-phosphate bound to the phosphatase domain of the bifunctional mannitol-1-phosphate dehydrogenase/phosphatase MtlD-N374A from *Acinetobacter baumannii*
Authors : Tam, H.K.; Mueller, V.; Pos, K.M.
Deposited on : 2021-04-28
Resolution : 2.70 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

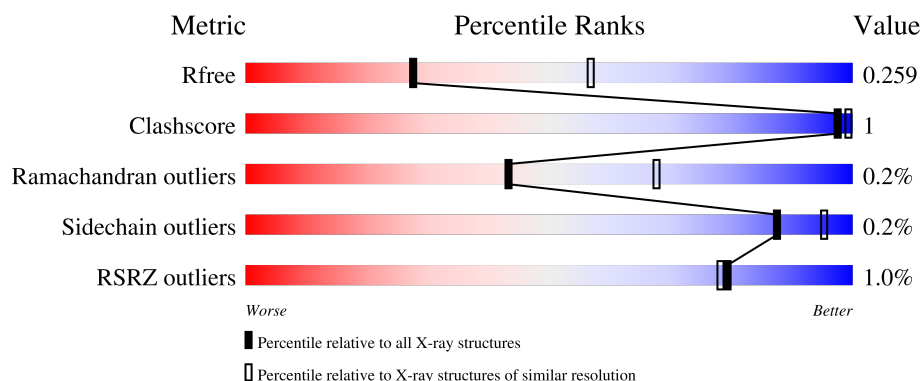
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.70 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	3538 (2.70-2.70)
Clashscore	190562	3843 (2.70-2.70)
Ramachandran outliers	187476	3778 (2.70-2.70)
Sidechain outliers	187428	3778 (2.70-2.70)
RSRZ outliers	180081	3538 (2.70-2.70)

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 ≥ 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	727	 91% 6%
1	B	727	 91% 7%

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 11157 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 Mannitol-1-phosphate dehydrogenase/phosphatase MtlD.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	687	Total	C	N	O	S	0	1	0
			5546	3524	948	1041	33			
1	B	679	Total	C	N	O	S	0	0	0
			5482	3485	937	1028	32			

There are 28 discrepancies between the modelled and reference sequences:

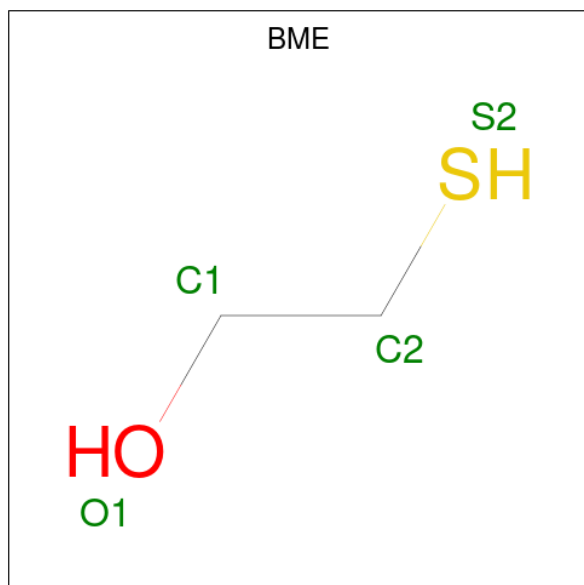
Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	initiating methionine	UNP D0C7J2
A	2	VAL	-	expression tag	UNP D0C7J2
A	374	ALA	ASN	engineered mutation	UNP D0C7J2
A	717	ALA	-	expression tag	UNP D0C7J2
A	718	ALA	-	expression tag	UNP D0C7J2
A	719	ALA	-	expression tag	UNP D0C7J2
A	720	LEU	-	expression tag	UNP D0C7J2
A	721	GLU	-	expression tag	UNP D0C7J2
A	722	HIS	-	expression tag	UNP D0C7J2
A	723	HIS	-	expression tag	UNP D0C7J2
A	724	HIS	-	expression tag	UNP D0C7J2
A	725	HIS	-	expression tag	UNP D0C7J2
A	726	HIS	-	expression tag	UNP D0C7J2
A	727	HIS	-	expression tag	UNP D0C7J2
B	1	MET	-	initiating methionine	UNP D0C7J2
B	2	VAL	-	expression tag	UNP D0C7J2
B	374	ALA	ASN	engineered mutation	UNP D0C7J2
B	717	ALA	-	expression tag	UNP D0C7J2
B	718	ALA	-	expression tag	UNP D0C7J2
B	719	ALA	-	expression tag	UNP D0C7J2
B	720	LEU	-	expression tag	UNP D0C7J2
B	721	GLU	-	expression tag	UNP D0C7J2
B	722	HIS	-	expression tag	UNP D0C7J2
B	723	HIS	-	expression tag	UNP D0C7J2
B	724	HIS	-	expression tag	UNP D0C7J2

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Chain	Residue	Modelled	Actual	Comment	Reference
B	725	HIS	-	expression tag	UNP D0C7J2
B	726	HIS	-	expression tag	UNP D0C7J2
B	727	HIS	-	expression tag	UNP D0C7J2

- Molecule 2 is BETA-MERCAPTOETHANOL (CCD ID: BME) (formula: C₂H₆OS).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	O	S	0	0
			4	2	1	1		

- Molecule 3 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

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

- Molecule 4 is SULFATE ION (CCD ID: SO4) (formula: O₄S).

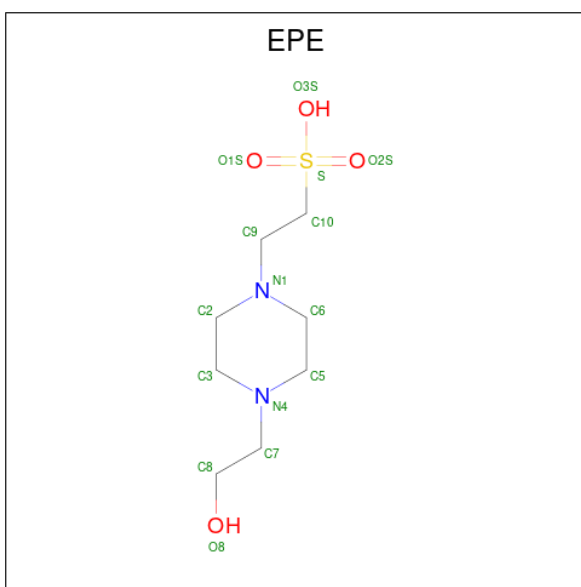


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		

- Molecule 5 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

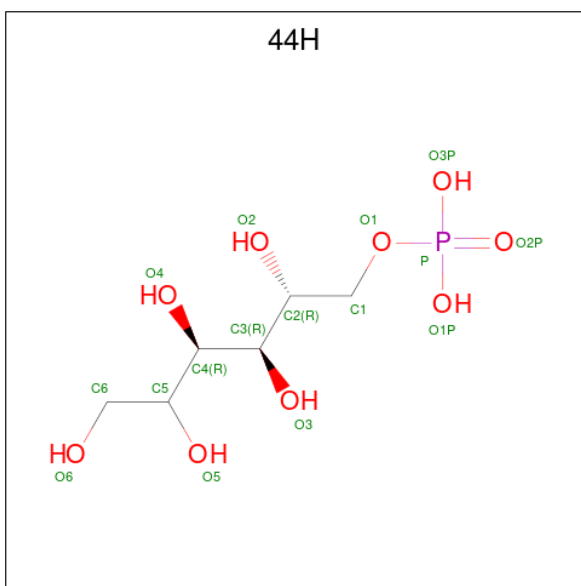
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total	Cl	0	0
			1	1		

- Molecule 6 is 4-(2-HYDROXYETHYL)-1-PIPERAZINE ETHANESULFONIC ACID (CCD ID: EPE) (formula: C₈H₁₈N₂O₄S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
6	B	1	Total	C	N	O	S	0	0
			15	8	2	4	1		

- Molecule 7 is D-Mannitol-1-phosphate (CCD ID: 44H) (formula: $C_6H_{15}O_9P$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	B	1	Total	C	O	P	0	0
			16	6	9	1		

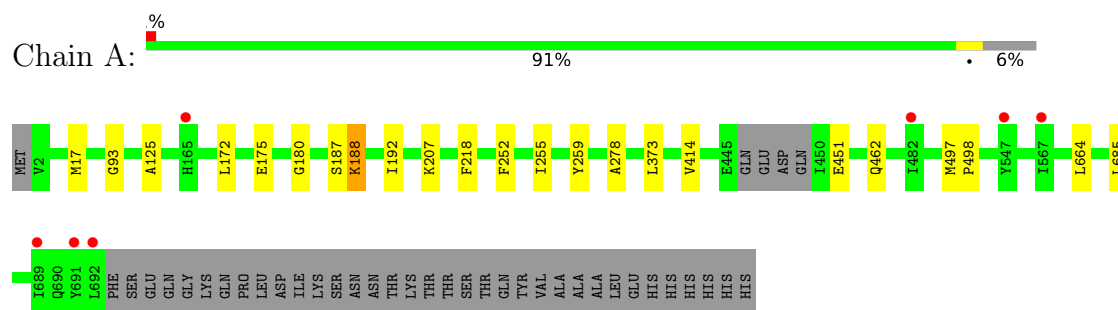
- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	39	Total 39	O 39	0	0
8	B	36	Total 36	O 36	0	0

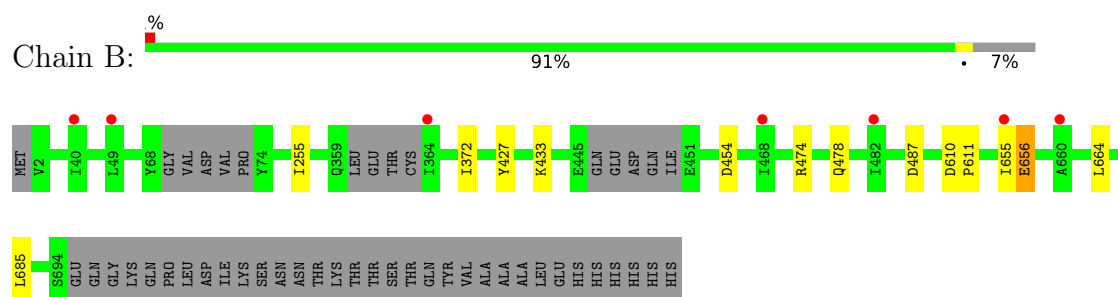
3 Residue-property plots [i](#)

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: Mannitol-1-phosphate dehydrogenase/phosphatase MtlD



- Molecule 1: Mannitol-1-phosphate dehydrogenase/phosphatase MtlD



4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	99.44Å 157.43Å 219.82Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.49 – 2.70 48.49 – 2.70	Depositor EDS
% Data completeness (in resolution range)	100.0 (48.49-2.70) 100.0 (48.49-2.70)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.04 (at 2.69Å)	Xtriage
Refinement program	REFMAC 5.8.0258	Depositor
R, R_{free}	0.227 , 0.264 0.227 , 0.259	Depositor DCC
R_{free} test set	2380 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å ²)	67.4	Xtriage
Anisotropy	0.664	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 43.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	11157	wwPDB-VP
Average B, all atoms (Å ²)	96.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.02% 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: EPE, CL, MG, BME, SO4, 44H

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	1.01	0/5651	1.53	1/7630 (0.0%)
1	B	1.01	0/5584	1.53	0/7533
All	All	1.01	0/11235	1.53	1/15163 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	93	GLY	CA-C-O	-5.75	118.26	122.23

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	5546	0	5524	11	0
1	B	5482	0	5458	7	0
2	A	4	0	6	0	0
3	A	2	0	0	0	0
3	B	1	0	0	0	0
4	A	5	0	0	0	0
4	B	10	0	0	0	0
5	A	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	B	15	0	17	0	0
7	B	16	0	0	0	0
8	A	39	0	0	0	0
8	B	36	0	0	0	0
All	All	11157	0	11005	17	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 1.

All (17) 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:B:255:ILE:HG21	1:B:372:ILE:HG21	1.86	0.58
1:A:175:GLU:HG2	1:A:180:GLY:C	2.34	0.53
1:B:664:LEU:CD1	1:B:685:LEU:HD23	2.41	0.51
1:B:433:LYS:NZ	1:B:487:ASP:O	2.41	0.49
1:A:172:LEU:HD22	1:A:192:ILE:HD11	1.94	0.48
1:B:474:ARG:O	1:B:478:GLN:HB2	2.15	0.47
1:A:664:LEU:HD11	1:A:685:LEU:HD23	1.97	0.46
1:A:259:TYR:CE2	1:A:414:VAL:HG13	2.51	0.46
1:B:655:ILE:O	1:B:656:GLU:HB2	2.17	0.45
1:A:17:MET:HE1	1:A:125:ALA:HB1	2.00	0.43
1:A:255:ILE:HD11	1:A:414:VAL:HG11	2.00	0.43
1:A:252:PHE:HB2	1:A:278:ALA:HB1	2.02	0.42
1:B:610:ASP:N	1:B:611:PRO:HD3	2.34	0.42
1:A:192:ILE:HD13	1:A:218:PHE:CE1	2.55	0.42
1:A:497:MET:HB2	1:A:498:PRO:HD3	2.02	0.41
1:A:187:SER:O	1:A:188:LYS:HB2	2.21	0.40
1:A:462:GLN:HB2	1:B:427:TYR:CZ	2.56	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	684/727 (94%)	653 (96%)	30 (4%)	1 (0%)	48	73
1	B	671/727 (92%)	645 (96%)	24 (4%)	2 (0%)	36	60
All	All	1355/1454 (93%)	1298 (96%)	54 (4%)	3 (0%)	43	68

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	188	LYS
1	B	656	GLU
1	B	454	ASP

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	606/641 (94%)	603 (100%)	3 (0%)	81	92
1	B	598/641 (93%)	598 (100%)	0	100	100
All	All	1204/1282 (94%)	1201 (100%)	3 (0%)	87	95

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	207	LYS
1	A	373	LEU
1	A	451	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	133	ASN
1	A	149	GLN

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Mol	Chain	Res	Type
1	A	439	GLN
1	A	528	ASN
1	B	282	ASN
1	B	301	GLN
1	B	395	ASN
1	B	423	ASN
1	B	462	GLN
1	B	476	ASN
1	B	492	HIS
1	B	590	GLN
1	B	617	HIS
1	B	637	ASN
1	B	663	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](#)

Of 10 ligands modelled in this entry, 4 are monoatomic - leaving 6 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	$\# Z > 2$
6	EPE	B	801	-	15,15,15	1.28	2 (13%)	19,20,20	2.00	5 (26%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
4	SO4	B	804	-	4,4,4	0.34	0	6,6,6	0.08	0
2	BME	A	801	-	3,3,3	0.17	0	2,2,2	0.21	0
7	44H	B	805	-	15,15,15	0.76	0	20,21,21	0.59	0
4	SO4	A	803	-	4,4,4	0.34	0	6,6,6	0.07	0
4	SO4	B	803	3	4,4,4	0.34	0	6,6,6	0.07	0

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
6	EPE	B	801	-	-	6/9/19/19	0/1/1/1
7	44H	B	805	-	-	0/20/20/20	-
2	BME	A	801	-	-	0/1/1/1	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	B	801	EPE	O1S-S	3.36	1.54	1.45
6	B	801	EPE	C10-S	3.22	1.82	1.77

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	B	801	EPE	O2S-S-C10	6.12	115.98	106.73
6	B	801	EPE	O3S-S-O1S	-2.83	104.31	111.40
6	B	801	EPE	O3S-S-O2S	2.75	118.29	111.40
6	B	801	EPE	O1S-S-C10	-2.66	102.72	106.73
6	B	801	EPE	C6-N1-C2	2.53	114.29	108.84

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	B	801	EPE	N4-C7-C8-O8
6	B	801	EPE	C10-C9-N1-C2
6	B	801	EPE	C10-C9-N1-C6
6	B	801	EPE	C9-C10-S-O1S
6	B	801	EPE	C9-C10-S-O2S
6	B	801	EPE	S-C10-C9-N1

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 [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	687/727 (94%)	0.16	7 (1%) 79 78	32, 88, 140, 163	1 (0%)
1	B	679/727 (93%)	0.23	7 (1%) 79 78	59, 95, 152, 191	0
All	All	1366/1454 (93%)	0.19	14 (1%) 79 78	32, 92, 147, 191	1 (0%)

All (14) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	364	ILE	4.4
1	A	691	TYR	3.1
1	B	655	ILE	2.6
1	B	49	LEU	2.6
1	B	482	ILE	2.5
1	A	482	ILE	2.2
1	B	660	ALA	2.2
1	A	547	TYR	2.2
1	A	692	LEU	2.2
1	A	165[A]	HIS	2.1
1	A	689	ILE	2.1
1	B	468	ILE	2.1
1	B	40	ILE	2.0
1	A	567	ILE	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 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(Å ²)	Q<0.9
6	EPE	B	801	15/15	0.71	0.24	112,115,118,120	0
4	SO4	A	803	5/5	0.72	0.11	122,122,123,123	0
2	BME	A	801	4/4	0.73	0.21	113,115,117,118	0
3	MG	A	804	1/1	0.76	0.14	66,66,66,66	0
4	SO4	B	804	5/5	0.84	0.12	103,103,104,104	0
3	MG	B	802	1/1	0.89	0.09	104,104,104,104	0
4	SO4	B	803	5/5	0.89	0.07	132,132,132,133	0
3	MG	A	802	1/1	0.91	0.14	66,66,66,66	0
7	44H	B	805	16/16	0.93	0.07	61,63,67,67	0
5	CL	A	805	1/1	0.95	0.10	67,67,67,67	0

6.5 Other polymers [i](#)

There are no such residues in this entry.