Full wwPDB X-ray Structure Validation Report ⓘ

May 15, 2020 – 04:07 pm BST

PDB ID	:	5NOK
Title	:	Polysaccharide Lyase BACCELL_00875
Authors	:	Cartmell, A.; Munoz-Munoz, J.; Terrapon, N.; Basle, A.; Henrissat, B.; Gilbert, H.J.
Deposited on	:	2017-04-12
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 following versions of software and data (see references ①) were used in the production of this report:

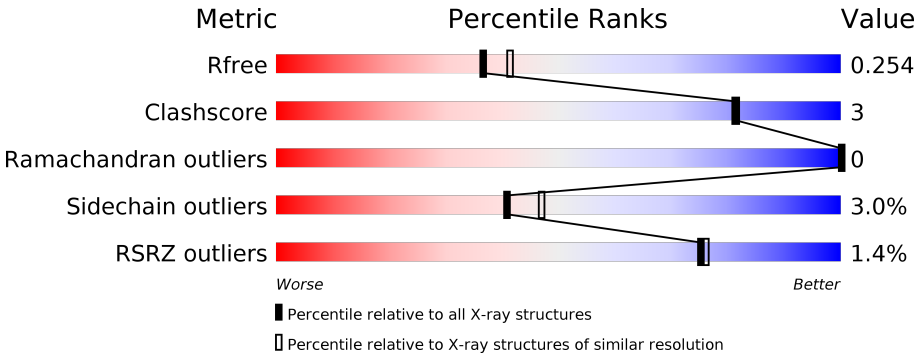
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

1 Overall quality at a glance (i)

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 on 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 <=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	694	2% 89% 7%
1	B	694	88% 8%

2 Entry composition

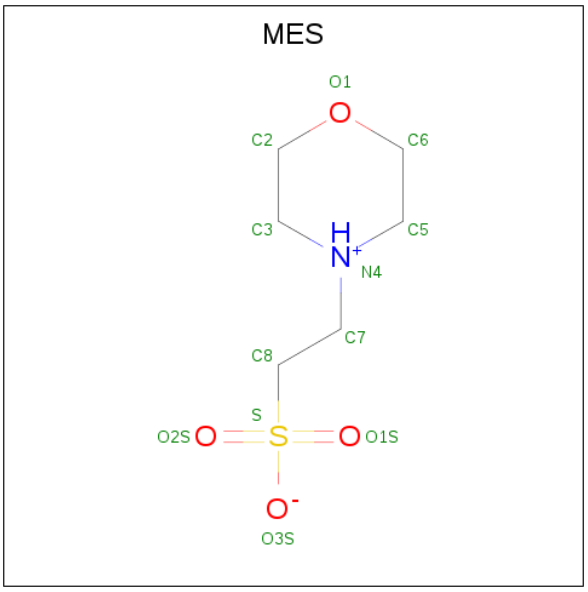
There are 3 unique types of molecules in this entry. The entry contains 10944 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 BACCELL_00875.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	668	Total	C	N	O	S	Se	0	0	0
			5307	3385	906	991	10	15			
1	B	669	Total	C	N	O	S	Se	0	0	0
			5381	3432	919	1005	10	15			

- Molecule 2 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (three-letter code: MES) (formula: $C_6H_{13}NO_4S$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	B	1	Total	C	N	O	S	0	0
			12	6	1	4	1		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	112	Total	O	0	0
			112	112		

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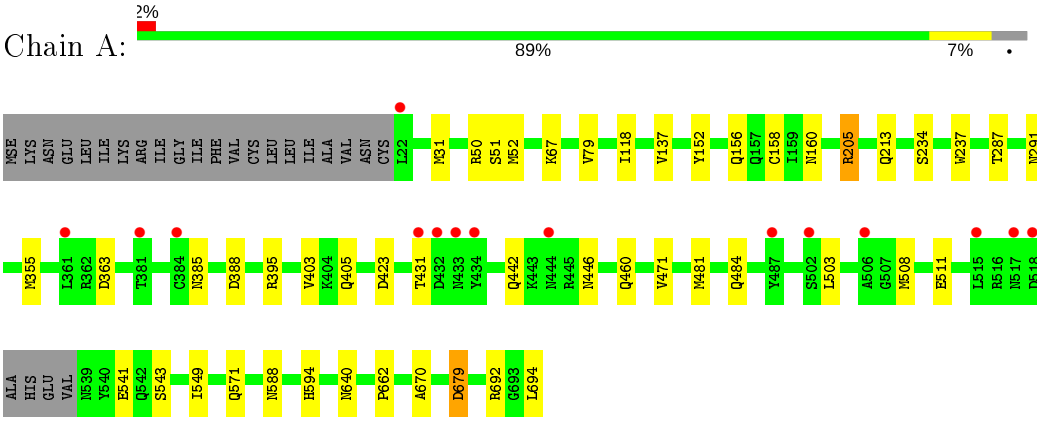
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	132	Total	O	0	0
			132	132		

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 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.

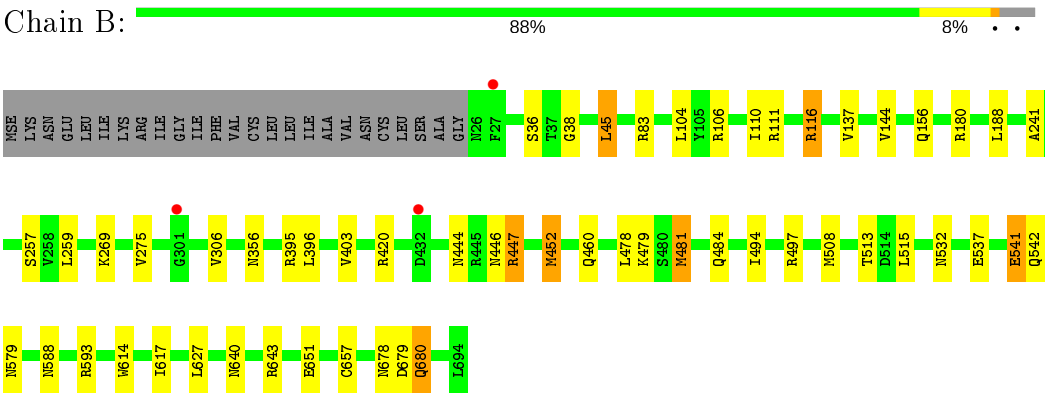
- Molecule 1: BACCELL_00875

Chain A:



- Molecule 1: BACCELL_00875

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α, β, γ	116.73Å 116.73Å 228.49Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.48 – 2.24 47.48 – 2.24	Depositor EDS
% Data completeness (in resolution range)	100.0 (47.48-2.24) 100.0 (47.48-2.24)	Depositor EDS
R_{merge}	0.01	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.88 (at 2.24Å)	Xtriage
Refinement program	REFMAC 5.8.0158	Depositor
R, R_{free}	0.195 , 0.249 0.208 , 0.254	Depositor DCC
R_{free} test set	3842 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å^2)	36.8	Xtriage
Anisotropy	0.382	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 28.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	10944	wwPDB-VP
Average B, all atoms (Å^2)	41.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.49% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 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: MES

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	0.59	0/5425	0.75	3/7342 (0.0%)
1	B	0.58	0/5504	0.78	9/7448 (0.1%)
All	All	0.58	0/10929	0.77	12/14790 (0.1%)

There are no bond length outliers.

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	205	ARG	NE-CZ-NH2	-8.65	115.97	120.30
1	A	205	ARG	NE-CZ-NH1	6.93	123.76	120.30
1	B	643	ARG	NE-CZ-NH1	-6.21	117.19	120.30
1	B	447	ARG	NE-CZ-NH1	5.94	123.27	120.30
1	B	679	ASP	CB-CG-OD1	5.92	123.63	118.30
1	B	643	ARG	NE-CZ-NH2	5.88	123.24	120.30
1	B	116	ARG	NE-CZ-NH1	5.64	123.12	120.30
1	B	180	ARG	NE-CZ-NH1	5.57	123.08	120.30
1	B	447	ARG	NE-CZ-NH2	-5.31	117.64	120.30
1	B	83	ARG	NE-CZ-NH1	5.13	122.87	120.30
1	B	180	ARG	NE-CZ-NH2	-5.08	117.76	120.30
1	A	52	MSE	CG-SE-CE	-5.07	87.74	98.90

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	A	5307	0	5025	25	0
1	B	5381	0	5124	30	0
2	B	12	0	13	0	0
3	A	112	0	0	0	0
3	B	132	0	0	1	0
All	All	10944	0	10162	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 3.

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)
1:A:588:ASN:HD22	1:A:640:ASN:HD21	1.16	0.90
1:B:588:ASN:HD22	1:B:640:ASN:HD21	1.27	0.78
1:A:446:ASN:HD21	1:A:484:GLN:HE22	1.39	0.71
1:B:588:ASN:ND2	1:B:640:ASN:HD21	1.88	0.71
1:A:588:ASN:ND2	1:A:640:ASN:HD21	1.87	0.69
1:B:657:CYS:HA	1:B:680:GLN:HE21	1.57	0.69
1:B:452:MSE:CE	1:B:478:LEU:HD23	2.25	0.67
1:A:79:VAL:HG23	1:A:137:VAL:CG2	2.25	0.67
1:B:678:ASN:H	1:B:680:GLN:HE22	1.42	0.67
1:B:403:VAL:HG11	1:B:460:GLN:HB3	1.80	0.63
1:B:478:LEU:HD13	1:B:515:LEU:HD11	1.81	0.63
1:B:446:ASN:HD21	1:B:484:GLN:HE22	1.48	0.62
1:B:252:LEU:HD23	1:B:259:LEU:HD21	1.82	0.61
1:A:403:VAL:HG11	1:A:460:GLN:HB3	1.81	0.61
1:A:355:MSE:O	1:A:363:ASP:O	2.19	0.60
1:B:446:ASN:HD21	1:B:484:GLN:NE2	1.98	0.60
1:A:79:VAL:HG23	1:A:137:VAL:HG21	1.85	0.59
1:B:614:TRP:CE3	1:B:617:ILE:HD11	2.39	0.57
1:A:446:ASN:HD21	1:A:484:GLN:NE2	2.01	0.57
1:B:110:ILE:HD11	1:B:137:VAL:HG11	1.87	0.57
1:B:104:LEU:HD11	1:B:111:ARG:HD2	1.87	0.56
1:B:356:ASN:HD22	1:B:420:ARG:HH22	1.54	0.56
1:A:541:GLU:OE2	1:A:543:SER:OG	2.25	0.55
1:B:452:MSE:HG3	1:B:494:ILE:HA	1.89	0.54
1:B:541:GLU:OE1	1:B:543:SER:OG	2.17	0.54
1:B:452:MSE:HE3	1:B:478:LEU:HD23	1.90	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:447:ARG:HD2	1:B:537:GLU:OE2	2.08	0.53
1:A:291:ASN:ND2	1:A:317:ARG:H	2.08	0.52
1:B:452:MSE:CE	1:B:478:LEU:CD2	2.88	0.51
1:A:385:ASN:ND2	1:A:388:ASP:OD2	2.43	0.51
1:A:50:ARG:HE	1:A:160:ASN:HD22	1.58	0.51
1:B:588:ASN:HD22	1:B:640:ASN:ND2	2.04	0.50
1:A:471:VAL:CG1	1:A:503:LEU:HD12	2.43	0.49
1:A:205:ARG:NH2	1:A:594:HIS:O	2.43	0.49
1:A:346:VAL:HG21	1:A:405:GLN:HG2	1.94	0.48
1:B:38:GLY:O	1:B:116:ARG:NH2	2.45	0.46
1:B:156:GLN:HE22	1:B:532:ASN:HD22	1.61	0.46
1:A:152:TYR:HA	1:A:158:CYS:SG	2.56	0.46
1:A:31:MSE:HE1	1:A:118:ILE:HD11	1.99	0.45
1:B:45:LEU:HG	1:B:241:ALA:HB2	1.98	0.45
1:B:452:MSE:SE	1:B:481:MSE:HE2	2.67	0.45
1:B:579:ASN:ND2	3:B:801:HOH:O	2.49	0.45
1:A:31:MSE:CE	1:A:118:ILE:HD11	2.46	0.44
1:A:679:ASP:OD1	1:A:679:ASP:N	2.47	0.44
1:B:497:ARG:H	1:B:554:GLN:HE21	1.66	0.44
1:A:471:VAL:HG13	1:A:503:LEU:HD12	1.99	0.43
1:B:252:LEU:HD12	1:B:257:SER:HB3	2.00	0.43
1:B:588:ASN:ND2	1:B:640:ASN:ND2	2.64	0.43
1:A:431:THR:HG22	1:A:442:GLN:HE22	1.83	0.43
1:A:662:PRO:O	1:A:670:ALA:HB3	2.19	0.43
1:A:508:MSE:HE2	1:A:511:GLU:HG3	2.00	0.43
1:A:549:ILE:HD11	1:A:571:GLN:HB3	2.01	0.42
1:B:678:ASN:N	1:B:680:GLN:HE22	2.13	0.42
1:B:542:GLN:HE21	1:B:593:ARG:NH1	2.18	0.41
1:A:156:GLN:HE22	1:A:532:ASN:HA	1.86	0.41

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	664/694 (96%)	633 (95%)	31 (5%)	0	100	100
1	B	667/694 (96%)	640 (96%)	27 (4%)	0	100	100
All	All	1331/1388 (96%)	1273 (96%)	58 (4%)	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	548/586 (94%)	536 (98%)	12 (2%)	52	59
1	B	563/586 (96%)	542 (96%)	21 (4%)	34	38
All	All	1111/1172 (95%)	1078 (97%)	33 (3%)	41	47

All (33) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	51	SER
1	A	67	LYS
1	A	213	GLN
1	A	234	SER
1	A	237	TRP
1	A	287	THR
1	A	395	ARG
1	A	423	ASP
1	A	481	MSE
1	A	679	ASP
1	A	692	ARG
1	A	694	LEU
1	B	36	SER
1	B	45	LEU
1	B	106	ARG
1	B	144	VAL
1	B	188	LEU
1	B	243	ASN

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Mol	Chain	Res	Type
1	B	269	LYS
1	B	275	VAL
1	B	306	VAL
1	B	395	ARG
1	B	396	LEU
1	B	444	ASN
1	B	452	MSE
1	B	479	LYS
1	B	481	MSE
1	B	508	MSE
1	B	513	THR
1	B	541	GLU
1	B	627	LEU
1	B	651	GLU
1	B	680	GLN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (28) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	156	GLN
1	A	160	ASN
1	A	187	HIS
1	A	211	ASN
1	A	245	ASN
1	A	291	ASN
1	A	353	GLN
1	A	371	ASN
1	A	442	GLN
1	A	484	GLN
1	A	588	ASN
1	B	131	ASN
1	B	156	GLN
1	B	211	ASN
1	B	245	ASN
1	B	291	ASN
1	B	312	GLN
1	B	353	GLN
1	B	356	ASN
1	B	484	GLN
1	B	532	ASN
1	B	542	GLN
1	B	554	GLN

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Mol	Chain	Res	Type
1	B	562	GLN
1	B	579	ASN
1	B	588	ASN
1	B	644	ASN
1	B	680	GLN

5.3.3 RNA

There are no RNA molecules 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

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	$\#\|Z\| > 2$
2	MES	B	701	-	12,12,12	1.95	1 (8%)	14,16,16	1.88	3 (21%)

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	MES	B	701	-	-	4/6/14/14	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	701	MES	C8-S	-6.10	1.68	1.77

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	701	MES	O2S-S-C8	5.45	113.48	106.92
2	B	701	MES	O1S-S-C8	2.18	109.54	106.92
2	B	701	MES	O3S-S-O2S	-2.02	106.35	111.27

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	701	MES	N4-C7-C8-S
2	B	701	MES	C7-C8-S-O1S
2	B	701	MES	C7-C8-S-O2S
2	B	701	MES	C7-C8-S-O3S

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^{th} 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	653/694 (94%)	0.00	15 (2%) 60 61	20, 38, 73, 93	0
1	B	654/694 (94%)	-0.07	3 (0%) 91 91	23, 38, 60, 80	0
All	All	1307/1388 (94%)	-0.03	18 (1%) 75 76	20, 38, 69, 93	0

All (18) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	432	ASP	3.7
1	A	22	LEU	3.5
1	B	301	GLY	3.5
1	A	487	TYR	3.4
1	A	433	ASN	2.9
1	A	384	CYS	2.9
1	A	381	THR	2.8
1	A	432	ASP	2.7
1	A	444	ASN	2.6
1	A	518	ASP	2.5
1	A	517	ASN	2.5
1	A	506	ALA	2.5
1	A	502	SER	2.5
1	A	431	THR	2.4
1	A	434	TYR	2.3
1	A	515	LEU	2.3
1	A	361	LEU	2.2
1	B	27	PHE	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 (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. The B-factors column lists the minimum, median, 95^{th} 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
2	MES	B	701	12/12	0.61	0.28	68,82,120,124	0

6.5 Other polymers (i)

There are no such residues in this entry.