



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 20, 2026 – 10:02 AM UTC

PDB ID : 6M76 / pdb_00006m76
Title : GH31 alpha-N-acetylgalactosaminidase from Enterococcus faecalis
Authors : Miyazaki, T.
Deposited on : 2020-03-17
Resolution : 1.40 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

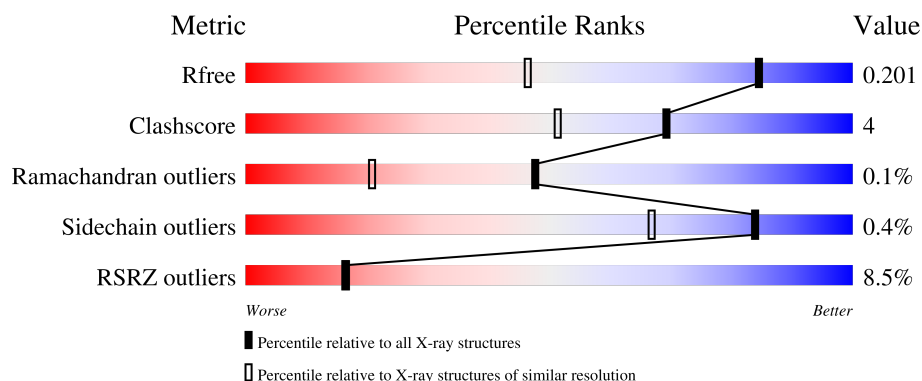
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.40 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	2563 (1.40-1.40)
Clashscore	190562	2660 (1.40-1.40)
Ramachandran outliers	187476	2611 (1.40-1.40)
Sidechain outliers	187428	2610 (1.40-1.40)
RSRZ outliers	180081	2561 (1.40-1.40)

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	963	8% 88% 7%

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 8406 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 LPXTG-motif cell wall anchor domain protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	923	7307	4616	1215	1459	17	0	12	0

- Molecule 2 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: C₂H₆O₂).



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

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

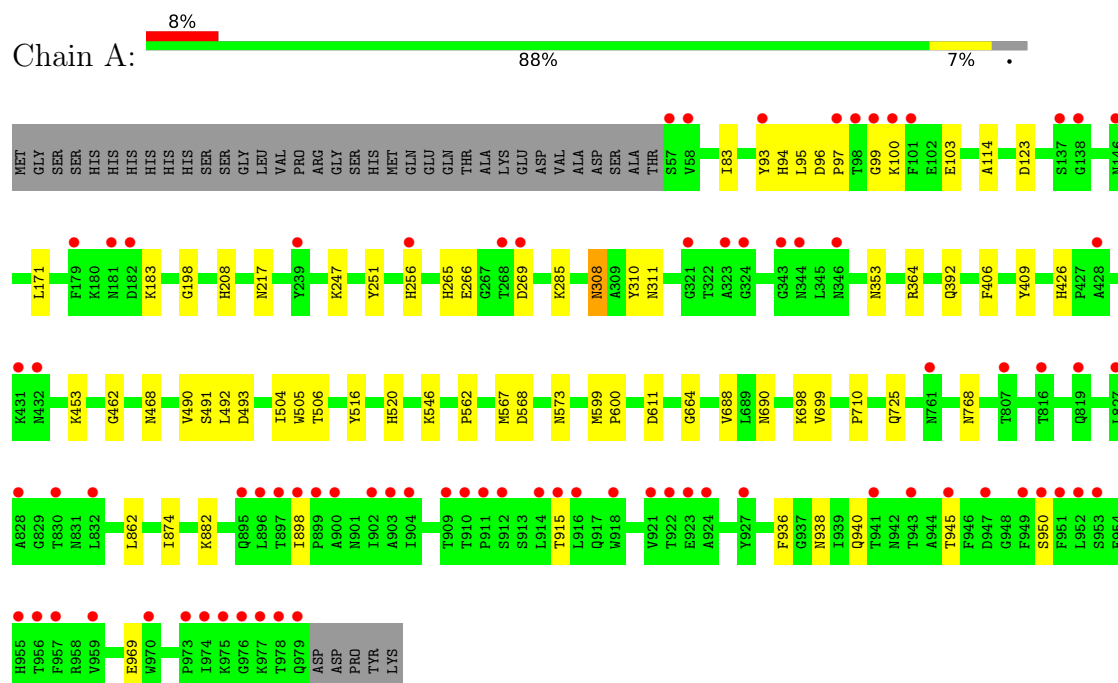
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1063	Total	O	0	0
			1063	1063		

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: LPXTG-motif cell wall anchor domain protein



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	82.44Å 82.97Å 149.68Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.12 – 1.40 46.12 – 1.40	Depositor EDS
% Data completeness (in resolution range)	99.7 (46.12-1.40) 99.7 (46.12-1.40)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.40 (at 1.40Å)	Xtriage
Refinement program	REFMAC 5.8.0258	Depositor
R, R_{free}	0.172 , 0.195 0.181 , 0.201	Depositor DCC
R_{free} test set	9974 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å ²)	16.3	Xtriage
Anisotropy	0.028	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 31.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.012 for k,h,-l	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	8406	wwPDB-VP
Average B, all atoms (Å ²)	24.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.38% 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: EDO

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	0.92	0/7479	1.09	5/10151 (0.0%)

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	123	ASP	CA-CB-CG	6.67	119.27	112.60
1	A	308	ASN	CA-CB-CG	5.74	118.34	112.60
1	A	96	ASP	CA-CB-CG	5.57	118.17	112.60
1	A	568	ASP	CA-CB-CG	5.46	118.06	112.60
1	A	103	GLU	CB-CG-CD	5.15	121.35	112.60

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	7307	0	6986	51	0
2	A	36	0	54	5	0
3	A	1063	0	0	14	0
All	All	8406	0	7040	51	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 4.

All (51) 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:353:ASN:HD22	1:A:364:ARG:HE	1.37	0.71
1:A:768:ASN:HD22	1:A:882:LYS:HA	1.57	0.70
1:A:426:HIS:HD2	3:A:1533:HOH:O	1.77	0.68
1:A:251:TYR:OH	1:A:265:HIS:HE1	1.79	0.66
1:A:506:THR:OG1	1:A:520:HIS:HE1	1.78	0.66
1:A:915:THR:OG1	1:A:945:THR:HG22	1.97	0.64
1:A:256:HIS:CD2	3:A:1641:HOH:O	2.52	0.62
1:A:217:ASN:HD21	1:A:493:ASP:CB	2.14	0.61
1:A:364:ARG:HH11	2:A:1007:EDO:C2	2.14	0.61
1:A:546:LYS:H	1:A:573:ASN:HD21	1.47	0.60
1:A:266:GLU:HG2	3:A:1115:HOH:O	2.02	0.59
1:A:453:LYS:HE3	1:A:567:MET:HE1	1.84	0.58
1:A:699:VAL:HG23	3:A:1899:HOH:O	2.04	0.57
1:A:256:HIS:CG	3:A:1641:HOH:O	2.57	0.57
1:A:546:LYS:H	1:A:573:ASN:ND2	2.04	0.56
1:A:664:GLY:H	1:A:690:ASN:HD22	1.54	0.55
1:A:217:ASN:HD21	1:A:493:ASP:CG	2.15	0.54
1:A:308:ASN:HB3	1:A:310:TYR:CE2	2.43	0.54
1:A:247:LYS:O	1:A:265:HIS:HD2	1.92	0.53
1:A:94:HIS:HE2	1:A:269:ASP:CG	2.17	0.52
1:A:409:TYR:CE1	2:A:1007:EDO:H12	2.43	0.52
1:A:862:LEU:HD11	1:A:874:ILE:HD11	1.91	0.51
1:A:353:ASN:ND2	1:A:364:ARG:HE	2.06	0.50
1:A:208:HIS:HD2	3:A:1500:HOH:O	1.95	0.49
1:A:490[B]:VAL:HG12	1:A:505:TRP:CE3	2.48	0.48
1:A:99:GLY:N	3:A:1102:HOH:O	2.47	0.47
1:A:100:LYS:N	3:A:1102:HOH:O	2.31	0.47
1:A:491:SER:O	1:A:504:ILE:HA	2.14	0.46
1:A:945:THR:HG23	3:A:1936:HOH:O	2.16	0.46
1:A:311:ASN:HD21	1:A:392:GLN:HG3	1.81	0.46
1:A:462:GLY:HA2	3:A:1148:HOH:O	2.14	0.46
1:A:516:TYR:O	1:A:520:HIS:HD2	1.99	0.45
1:A:898:ILE:HD11	1:A:969:GLU:HB2	1.98	0.45
1:A:114:ALA:H	1:A:468:ASN:HD22	1.63	0.45
1:A:171:LEU:C	1:A:171:LEU:HD23	2.42	0.45
1:A:183:LYS:NZ	3:A:1115:HOH:O	2.48	0.45
1:A:285:LYS:HE2	1:A:611:ASP:O	2.17	0.45
1:A:426:HIS:HE1	3:A:2002:HOH:O	1.99	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:698:LYS:HE2	2:A:1008:EDO:H12	1.99	0.45
1:A:938:ASN:ND2	1:A:940:GLN:HE21	2.15	0.45
1:A:599:MET:HE2	3:A:1591:HOH:O	2.17	0.44
1:A:688:VAL:O	1:A:936:PHE:HA	2.18	0.44
1:A:364:ARG:HH11	2:A:1007:EDO:H21	1.82	0.43
1:A:217:ASN:HD21	1:A:493:ASP:HB3	1.82	0.43
1:A:725:GLN:NE2	3:A:1101:HOH:O	2.31	0.43
1:A:93:TYR:OH	1:A:95:LEU:HD12	2.19	0.43
1:A:600:PRO:HB2	1:A:710:PRO:HB2	2.01	0.42
1:A:698:LYS:HE2	2:A:1008:EDO:C1	2.50	0.42
1:A:353:ASN:HD21	1:A:406:PHE:CA	2.34	0.40
1:A:95:LEU:O	1:A:97:PRO:HD3	2.22	0.40
1:A:198:GLY:O	1:A:208:HIS:HE1	2.04	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	933/963 (97%)	899 (96%)	33 (4%)	1 (0%)	48 21

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	562	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	783/805 (97%)	780 (100%)	3 (0%)	84	67

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

Mol	Chain	Res	Type
1	A	83	ILE
1	A	492	LEU
1	A	950	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (30) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	146	ASN
1	A	181	ASN
1	A	186	GLN
1	A	193	GLN
1	A	208	HIS
1	A	214	GLN
1	A	217	ASN
1	A	219	ASN
1	A	250	ASN
1	A	256	HIS
1	A	265	HIS
1	A	311	ASN
1	A	332	ASN
1	A	346	ASN
1	A	353	ASN
1	A	402	ASN
1	A	426	HIS
1	A	468	ASN
1	A	520	HIS
1	A	573	ASN
1	A	582	GLN
1	A	659	ASN
1	A	690	ASN
1	A	715	ASN
1	A	739	ASN
1	A	761	ASN
1	A	768	ASN

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Mol	Chain	Res	Type
1	A	855	GLN
1	A	901	ASN
1	A	938	ASN

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](#)

9 ligands are 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	EDO	A	1001	-	3,3,3	0.18	0	2,2,2	0.40	0
2	EDO	A	1003	-	3,3,3	0.18	0	2,2,2	0.07	0
2	EDO	A	1007	-	3,3,3	0.42	0	2,2,2	0.89	0
2	EDO	A	1008	-	3,3,3	0.27	0	2,2,2	0.43	0
2	EDO	A	1002	-	3,3,3	0.18	0	2,2,2	0.05	0
2	EDO	A	1005	-	3,3,3	0.34	0	2,2,2	0.08	0
2	EDO	A	1009	-	3,3,3	0.05	0	2,2,2	0.21	0
2	EDO	A	1004	-	3,3,3	0.07	0	2,2,2	0.11	0
2	EDO	A	1006	-	3,3,3	0.30	0	2,2,2	0.23	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
2	EDO	A	1001	-	-	0/1/1/1	-
2	EDO	A	1003	-	-	0/1/1/1	-
2	EDO	A	1007	-	-	1/1/1/1	-
2	EDO	A	1008	-	-	1/1/1/1	-
2	EDO	A	1002	-	-	0/1/1/1	-
2	EDO	A	1005	-	-	0/1/1/1	-
2	EDO	A	1009	-	-	0/1/1/1	-
2	EDO	A	1004	-	-	0/1/1/1	-
2	EDO	A	1006	-	-	1/1/1/1	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	1007	EDO	O1-C1-C2-O2
2	A	1006	EDO	O1-C1-C2-O2
2	A	1008	EDO	O1-C1-C2-O2

There are no ring outliers.

2 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	1007	EDO	3	0
2	A	1008	EDO	2	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 ⓘ

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	923/963 (95%)	0.38	78 (8%) 16 16	7, 20, 46, 76	12 (1%)

All (78) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	951	PHE	5.4
1	A	952	LEU	5.4
1	A	98	THR	5.0
1	A	949	PHE	5.0
1	A	58	VAL	4.9
1	A	428	ALA	4.4
1	A	921	VAL	4.4
1	A	99	GLY	4.2
1	A	900	ALA	4.2
1	A	57	SER	4.1
1	A	902	ILE	3.9
1	A	898	ILE	3.8
1	A	256	HIS	3.6
1	A	432	ASN	3.5
1	A	974	ILE	3.5
1	A	137	SER	3.4
1	A	323	ALA	3.4
1	A	97	PRO	3.4
1	A	101	PHE	3.4
1	A	945	THR	3.3
1	A	827	LEU	3.2
1	A	914	LEU	3.2
1	A	922	THR	3.2
1	A	909	THR	3.1
1	A	977	LYS	3.1
1	A	816	THR	3.1
1	A	100	LYS	3.0

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Mol	Chain	Res	Type	RSRZ
1	A	903	ALA	2.9
1	A	146	ASN	2.9
1	A	324	GLY	2.9
1	A	959	VAL	2.9
1	A	904	ILE	2.9
1	A	916	LEU	2.8
1	A	918	TRP	2.8
1	A	978	THR	2.7
1	A	346	ASN	2.7
1	A	957	PHE	2.7
1	A	950	SER	2.7
1	A	896	LEU	2.7
1	A	431	LYS	2.7
1	A	970	TRP	2.6
1	A	956	THR	2.6
1	A	807	THR	2.6
1	A	911	PRO	2.5
1	A	912	SER	2.5
1	A	953	SER	2.5
1	A	344	ASN	2.5
1	A	943	THR	2.5
1	A	828	ALA	2.5
1	A	955	HIS	2.5
1	A	895	GLN	2.4
1	A	138	GLY	2.4
1	A	181	ASN	2.4
1	A	899	PRO	2.4
1	A	927	TYR	2.4
1	A	93	TYR	2.3
1	A	976	GLY	2.3
1	A	924	ALA	2.3
1	A	915	THR	2.3
1	A	947	ASP	2.3
1	A	923	GLU	2.3
1	A	910	THR	2.2
1	A	975	LYS	2.2
1	A	973	PRO	2.2
1	A	321	GLY	2.2
1	A	941	THR	2.2
1	A	182	ASP	2.2
1	A	979	GLN	2.1
1	A	268	THR	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	897	THR	2.1
1	A	761	ASN	2.1
1	A	269	ASP	2.1
1	A	343	GLY	2.1
1	A	179	PHE	2.0
1	A	830	THR	2.0
1	A	832	LEU	2.0
1	A	819	GLN	2.0
1	A	239	TYR	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($\text{\AA}^2$)	Q<0.9
2	EDO	A	1009	4/4	0.80	0.16	30,36,39,44	0
2	EDO	A	1006	4/4	0.81	0.19	29,33,34,37	0
2	EDO	A	1008	4/4	0.84	0.14	31,32,33,34	0
2	EDO	A	1007	4/4	0.85	0.14	29,30,30,37	0
2	EDO	A	1004	4/4	0.87	0.12	28,28,29,29	0
2	EDO	A	1003	4/4	0.93	0.10	25,29,29,32	0
2	EDO	A	1001	4/4	0.95	0.08	16,17,19,19	0
2	EDO	A	1002	4/4	0.95	0.08	21,23,23,26	0
2	EDO	A	1005	4/4	0.96	0.08	21,30,30,31	0

6.5 Other polymers [i](#)

There are no such residues in this entry.