



# Full wwPDB X-ray Structure Validation Report ⓘ

Sep 2, 2025 – 01:09 pm BST

PDB ID : 9SA2 / pdb\_00009sa2  
Title : The RING domain of IDOL  
Authors : Bradshaw, W.J.; He, L.; Guenther, F.; Murphy, E.J.  
Deposited on : 2025-08-07  
Resolution : 1.10 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](mailto: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>.

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

MolProbity : 4-5-2 with Phenix2.0rc1  
Mogul : 1.8.4, CSD as541be (2020)  
Xtriage (Phenix) : 2.0rc1  
EDS : 3.0  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.006 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.45.1

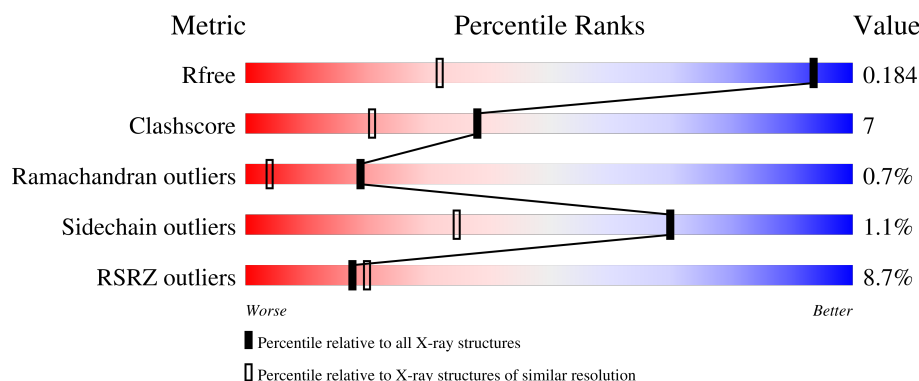
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.10 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))
$R_{free}$	164625	1365 (1.12-1.08)
Clashscore	180529	1561 (1.12-1.08)
Ramachandran outliers	177936	1524 (1.12-1.08)
Sidechain outliers	177891	1520 (1.12-1.08)
RSRZ outliers	164620	1365 (1.12-1.08)

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  $\geq 3$ , 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	78	<div> <div>12%</div> <div> <div></div> <div>86%</div> <div>9%</div> <div>• •</div> </div> </div>
1	B	78	<div> <div>5%</div> <div> <div></div> <div>79%</div> <div>12%</div> <div>9%</div> </div> </div>
1	C	78	<div> <div>9%</div> <div> <div></div> <div>71%</div> <div>19%</div> <div>• 6%</div> </div> </div>
1	D	78	<div> <div>6%</div> <div> <div></div> <div>77%</div> <div>12%</div> <div>• 10%</div> </div> </div>

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 2941 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 E3 ubiquitin-protein ligase MYLIP.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	75	Total	C	N	O	S	0	16	0
			668	411	122	123	12			
1	B	71	Total	C	N	O	S	0	7	0
			590	360	109	108	13			
1	C	73	Total	C	N	O	S	0	15	0
			657	413	113	118	13			
1	D	70	Total	C	N	O	S	0	9	0
			590	363	106	107	14			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	368	SER	-	expression tag	UNP Q8WY64
B	368	SER	-	expression tag	UNP Q8WY64
C	368	SER	-	expression tag	UNP Q8WY64
D	368	SER	-	expression tag	UNP Q8WY64

- Molecule 2 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	2	Total	Zn	0	0
			2	2		
2	B	2	Total	Zn	0	0
			2	2		
2	C	2	Total	Zn	0	0
			2	2		
2	D	2	Total	Zn	0	0
			2	2		

- Molecule 3 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	B	1	Total	C	O	0	0
			4	2	2		
3	D	1	Total	C	O	0	0
			4	2	2		

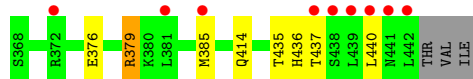
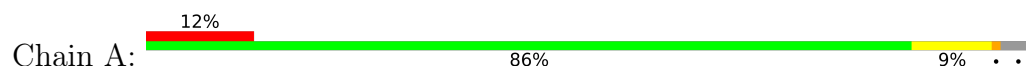
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	113	Total	O	0	1
			113	113		
4	B	104	Total	O	0	0
			104	104		
4	C	111	Total	O	0	0
			111	111		
4	D	91	Total	O	0	1
			92	92		

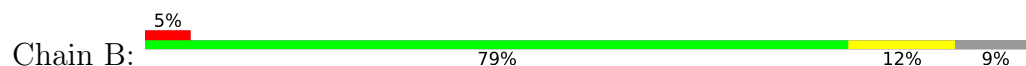
### 3 Residue-property plots [i](#)

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: E3 ubiquitin-protein ligase MYLIP



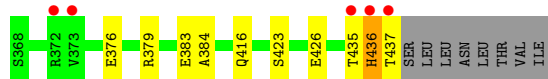
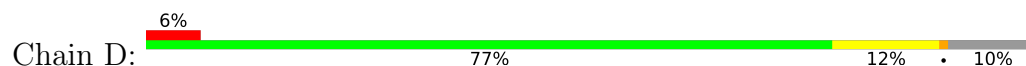
- Molecule 1: E3 ubiquitin-protein ligase MYLIP



- Molecule 1: E3 ubiquitin-protein ligase MYLIP



- Molecule 1: E3 ubiquitin-protein ligase MYLIP



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	44.19Å 47.61Å 70.54Å 90.00° 90.86° 90.00°	Depositor
Resolution (Å)	70.53 – 1.10 70.53 – 1.10	Depositor EDS
% Data completeness (in resolution range)	99.9 (70.53-1.10) 99.9 (70.53-1.10)	Depositor EDS
$R_{merge}$	0.49	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.23 (at 1.10Å)	Xtriage
Refinement program	REFMAC 5.8.0430	Depositor
R, $R_{free}$	0.142 , 0.174 0.152 , 0.184	Depositor DCC
$R_{free}$ test set	2014 reflections (1.70%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	9.0	Xtriage
Anisotropy	0.626	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 48.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.037 for h,-k,-l	Xtriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	2941	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	18.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 10.35% of the height of the origin peak. No significant pseudotranslation is detected.*

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

<sup>2</sup>Theoretical 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

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, 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	0.64	0/699	0.76	0/939
1	B	0.72	1/619 (0.2%)	0.83	3/832 (0.4%)
1	C	0.62	0/706	0.78	0/952
1	D	0.69	1/625 (0.2%)	0.79	0/839
All	All	0.66	2/2649 (0.1%)	0.79	3/3562 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	2
1	C	0	5
All	All	0	7

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	436	HIS	CE1-NE2	6.14	1.38	1.32
1	B	436	HIS	CE1-NE2	5.65	1.38	1.32

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	436	HIS	CB-CG-CD2	-7.01	122.09	131.20
1	B	436	HIS	CB-CG-ND1	5.68	131.22	122.70
1	B	436	HIS	CB-CA-C	5.51	118.58	109.70

There are no chirality outliers.

All (7) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	379[A]	ARG	Sidechain
1	A	379[B]	ARG	Sidechain
1	C	372	ARG	Sidechain
1	C	379[A]	ARG	Sidechain
1	C	379[B]	ARG	Sidechain
1	C	424[A]	ARG	Sidechain
1	C	424[B]	ARG	Sidechain

## 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	668	0	682	3	0
1	B	590	0	598	9	0
1	C	657	0	691	15	0
1	D	590	0	607	9	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
2	C	2	0	0	0	0
2	D	2	0	0	0	0
3	B	4	0	6	1	0
3	D	4	0	6	2	0
4	A	113	0	0	2	0
4	B	104	0	0	3	1
4	C	111	0	0	4	1
4	D	92	0	0	3	0
All	All	2941	0	2590	35	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 7.

All (35) 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:388[B]:MET:SD	4:B:669:HOH:O	2.33	0.86

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:376:GLU:OE2	1:D:379:ARG:NH2	2.13	0.82
1:B:376:GLU:OE2	1:B:379:ARG:NH2	2.12	0.81
4:A:705:HOH:O	1:B:385:MET:SD	2.45	0.74
1:C:430:HIS:CD2	1:C:432[A]:TYR:CZ	2.84	0.65
1:C:385[B]:MET:HE3	1:D:435:THR:HG23	1.82	0.59
1:C:439:LEU:O	1:C:440:LEU:CB	2.52	0.58
1:D:423[B]:SER:OG	3:D:503:EDO:H12	2.06	0.56
1:D:426:GLU:OE2	4:D:601:HOH:O	2.18	0.56
1:A:414[A]:GLN:OE1	4:A:601:HOH:O	2.18	0.55
1:D:436:HIS:O	1:D:437:THR:O	2.23	0.55
1:C:430:HIS:CD2	1:C:432[A]:TYR:CE1	2.94	0.54
1:D:416[B]:GLN:OE1	4:D:688[B]:HOH:O	2.19	0.53
1:C:385[B]:MET:HA	1:C:385[B]:MET:HE2	1.92	0.51
1:C:440:LEU:HD13	4:C:703:HOH:O	2.09	0.51
1:A:376:GLU:HG3	1:A:379[A]:ARG:NH2	2.25	0.51
1:C:382:LYS:HA	1:C:385[A]:MET:HE2	1.93	0.50
1:B:376:GLU:CD	1:B:379:ARG:HH21	2.11	0.49
1:A:435:THR:O	1:A:437[A]:THR:HG23	2.16	0.46
1:B:393:GLU:HB3	3:B:503:EDO:H21	1.98	0.46
1:B:382:LYS:HA	1:B:385:MET:HE2	1.97	0.46
1:C:431[B]:VAL:HG12	1:C:433:LEU:HG	1.98	0.45
1:D:379:ARG:NH1	1:D:383:GLU:OE2	2.42	0.45
1:D:436:HIS:O	1:D:437:THR:C	2.61	0.44
1:C:376:GLU:HG3	1:C:379[A]:ARG:NH2	2.33	0.43
1:C:439:LEU:O	1:C:440:LEU:HB2	2.18	0.42
1:B:388[B]:MET:SD	4:B:603:HOH:O	2.62	0.42
1:B:422[B]:ARG:HD2	4:B:613:HOH:O	2.20	0.41
3:D:503:EDO:C1	4:D:604:HOH:O	2.69	0.41
1:C:380:LYS:HE2	4:C:685:HOH:O	2.20	0.41
1:C:424[B]:ARG:NH1	4:C:606:HOH:O	2.54	0.40
1:C:435[B]:THR:HG22	1:D:384:ALA:HB1	2.03	0.40
1:C:375:GLN:HG2	4:C:697:HOH:O	2.20	0.40
1:B:379:ARG:NH1	1:B:383:GLU:OE2	2.47	0.40
1:C:436:HIS:O	1:C:438:SER:N	2.54	0.40

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)
4:B:603:HOH:O	4:C:680:HOH:O[2_555]	2.14	0.06

## 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	86/78 (110%)	80 (93%)	4 (5%)	2 (2%)	5	0
1	B	76/78 (97%)	73 (96%)	3 (4%)	0	100	100
1	C	87/78 (112%)	81 (93%)	5 (6%)	1 (1%)	12	1
1	D	77/78 (99%)	74 (96%)	3 (4%)	0	100	100
All	All	326/312 (104%)	308 (94%)	15 (5%)	3 (1%)	19	1

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	436[A]	HIS
1	A	436[B]	HIS
1	C	437	THR

### 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	84/74 (114%)	82 (98%)	2 (2%)	44	9
1	B	74/74 (100%)	74 (100%)	0	100	100
1	C	85/74 (115%)	84 (99%)	1 (1%)	67	31
1	D	75/74 (101%)	75 (100%)	0	100	100
All	All	318/296 (107%)	315 (99%)	3 (1%)	70	45

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

Mol	Chain	Res	Type
1	A	385	MET
1	A	440[B]	LEU
1	C	439	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	D	429	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 10 ligands modelled in this entry, 8 are monoatomic - leaving 2 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	$\# Z  > 2$
3	EDO	D	503	-	3,3,3	0.16	0	2,2,2	0.18	0
3	EDO	B	503	-	3,3,3	0.71	0	2,2,2	0.42	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
3	EDO	D	503	-	-	1/1/1/1	-
3	EDO	B	503	-	-	0/1/1/1	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	D	503	EDO	O1-C1-C2-O2

There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	D	503	EDO	2	0
3	B	503	EDO	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

### 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	75/78 (96%)	0.81	9 (12%) 10 11	6, 11, 27, 31	16 (21%)
1	B	71/78 (91%)	0.26	4 (5%) 31 33	5, 11, 28, 54	7 (9%)
1	C	73/78 (93%)	0.53	7 (9%) 15 17	6, 11, 29, 58	15 (20%)
1	D	70/78 (89%)	0.30	5 (7%) 23 26	5, 11, 30, 47	9 (12%)
All	All	289/312 (92%)	0.48	25 (8%) 17 20	5, 11, 29, 58	47 (16%)

All (25) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	439[A]	LEU	12.7
1	A	442[B]	LEU	11.8
1	C	440	LEU	9.2
1	A	437[A]	THR	8.6
1	B	437	THR	5.7
1	D	437	THR	5.6
1	B	438	SER	5.6
1	A	441[B]	ASN	5.4
1	A	440[B]	LEU	5.2
1	C	437	THR	5.2
1	A	385	MET	4.1
1	D	436	HIS	3.9
1	B	436	HIS	3.8
1	C	439	LEU	3.7
1	A	438[A]	SER	3.5
1	C	435[A]	THR	3.4
1	D	435	THR	3.2
1	C	436	HIS	2.9
1	C	438	SER	2.7
1	A	372	ARG	2.6
1	B	435	THR	2.6

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Mol	Chain	Res	Type	RSRZ
1	D	373	VAL	2.4
1	D	372	ARG	2.3
1	C	372	ARG	2.3
1	A	381	LEU	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, 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	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
3	EDO	D	503	4/4	0.87	0.12	26,30,31,35	0
3	EDO	B	503	4/4	0.90	0.12	17,18,18,30	0
2	ZN	B	501	1/1	1.00	0.01	7,7,7,7	0
2	ZN	B	502	1/1	1.00	0.01	8,8,8,8	0
2	ZN	C	501	1/1	1.00	0.01	7,7,7,7	0
2	ZN	C	502	1/1	1.00	0.01	8,8,8,8	0
2	ZN	D	501	1/1	1.00	0.01	8,8,8,8	0
2	ZN	D	502	1/1	1.00	0.01	8,8,8,8	0
2	ZN	A	501	1/1	1.00	0.01	6,6,6,6	0
2	ZN	A	502	1/1	1.00	0.02	9,9,9,9	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.