



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 07:42 PM UTC

PDB ID : 3EIE / pdb_00003eie
Title : Crystal Structure of S.cerevisiae Vps4 in the SO4-bound state
Authors : Gonciarz, M.D.; Whitby, F.G.; Eckert, D.M.; Kieffer, C.; Heroux, A.; Sundquist, W.I.; Hill, C.P.
Deposited on : 2008-09-15
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

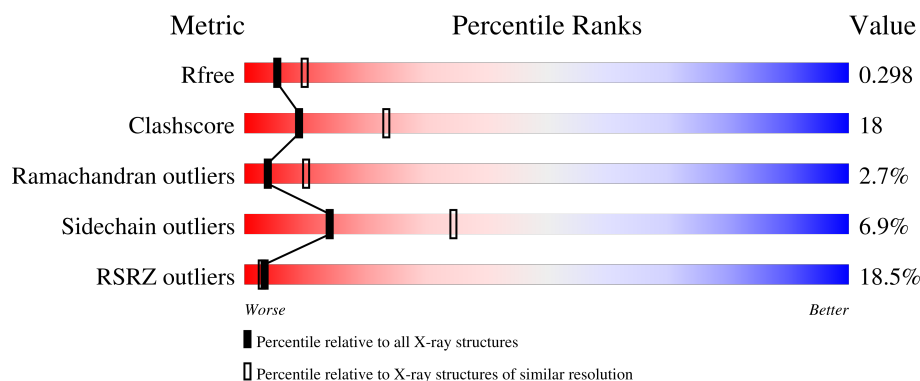
1 Overall quality at a glance

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	322	17% 65% 24% 5% • 6%

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 2396 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 Vacuolar protein sorting-associated protein 4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	303	2351	1488	398	456	9	0	0	0

There are 7 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	116	GLY	-	expression tag	UNP P52917
A	117	ILE	-	expression tag	UNP P52917
A	118	ASP	-	expression tag	UNP P52917
A	119	PRO	-	expression tag	UNP P52917
A	120	PHE	-	expression tag	UNP P52917
A	121	THR	-	expression tag	UNP P52917
A	233	GLN	GLU	engineered mutation	UNP P52917

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



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

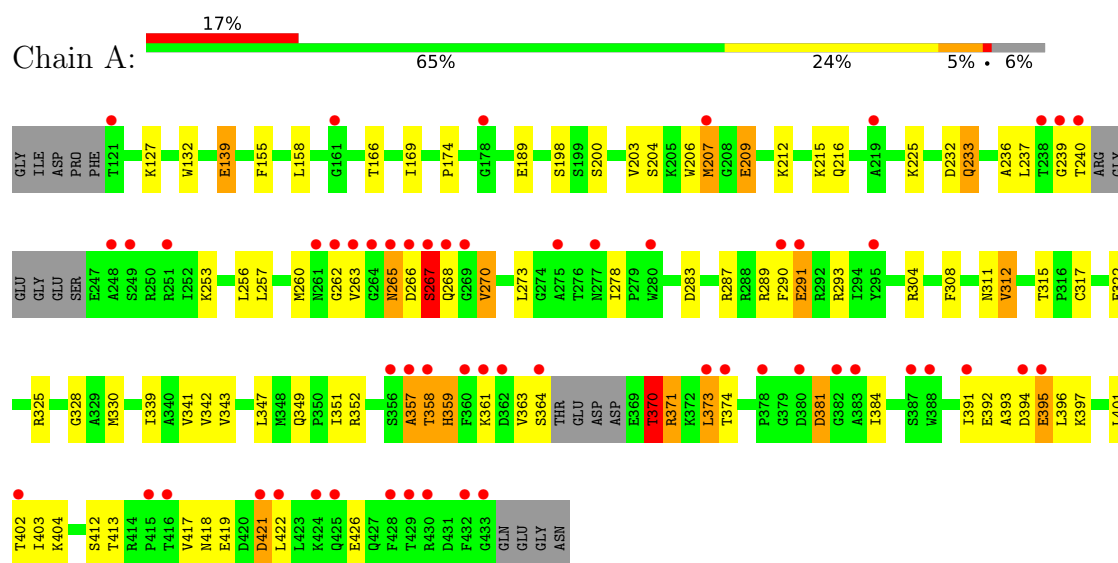
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	35	Total	O	0	0
			35	35		

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: Vacuolar protein sorting-associated protein 4



4 Data and refinement statistics

Property	Value	Source
Space group	P 65 2 2	Depositor
Cell constants a, b, c, α , β , γ	110.83Å 110.83Å 169.12Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	33.00 – 2.70 33.00 – 2.70	Depositor EDS
% Data completeness (in resolution range)	97.5 (33.00-2.70) 97.4 (33.00-2.70)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	0.10	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.81 (at 2.68Å)	Xtriage
Refinement program	REFMAC 5.4.0054	Depositor
R, R_{free}	0.241 , 0.287 0.251 , 0.298	Depositor DCC
R_{free} test set	1152 reflections (6.58%)	wwPDB-VP
Wilson B-factor (Å ²)	67.5	Xtriage
Anisotropy	0.184	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 65.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	2396	wwPDB-VP
Average B, all atoms (Å ²)	74.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.52% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: SO4

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	0.81	0/2391	0.99	4/3232 (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	1

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	239	GLY	N-CA-C	8.63	123.27	112.14
1	A	357	ALA	CA-C-N	5.76	132.06	121.70
1	A	357	ALA	C-N-CA	5.76	132.06	121.70
1	A	421	ASP	CB-CA-C	-5.25	101.92	110.85

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	267	SER	Peptide

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	2351	0	2381	87	1
2	A	10	0	0	0	0
3	A	35	0	0	1	0
All	All	2396	0	2381	87	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 18.

All (87) 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:253:LYS:HE3	1:A:283:ASP:OD2	1.47	1.11
1:A:373:LEU:HD12	1:A:391:ILE:HD13	1.38	1.04
1:A:361:LYS:HD2	1:A:381:ASP:O	1.61	1.01
1:A:373:LEU:HD12	1:A:391:ILE:CD1	1.89	1.00
1:A:317:CYS:HB3	1:A:401:LEU:HD23	1.49	0.94
1:A:268:GLN:HB2	1:A:270:VAL:H	1.35	0.92
1:A:232:ASP:C	1:A:233:GLN:HG3	1.98	0.87
1:A:204:SER:O	1:A:207:MET:SD	2.41	0.78
1:A:357:ALA:HA	1:A:358:THR:HG22	1.64	0.78
1:A:361:LYS:CD	1:A:381:ASP:O	2.33	0.76
1:A:394:ASP:O	1:A:396:LEU:N	2.24	0.71
1:A:349:GLN:OE1	1:A:352:ARG:HD2	1.92	0.70
1:A:253:LYS:HE3	1:A:283:ASP:CG	2.16	0.69
1:A:373:LEU:CD1	1:A:391:ILE:CD1	2.69	0.69
1:A:253:LYS:CE	1:A:283:ASP:OD2	2.34	0.68
1:A:266:ASP:CB	1:A:267:SER:HA	2.23	0.68
1:A:373:LEU:CD1	1:A:391:ILE:HD13	2.20	0.66
1:A:394:ASP:C	1:A:396:LEU:H	2.07	0.62
1:A:266:ASP:H	1:A:267:SER:HB3	1.64	0.62
1:A:169:ILE:HB	1:A:273:LEU:HD23	1.80	0.62
1:A:266:ASP:HB2	1:A:267:SER:HA	1.82	0.61
1:A:253:LYS:NZ	1:A:283:ASP:OD1	2.33	0.59
1:A:418:ASN:OD1	1:A:419:GLU:N	2.35	0.59
1:A:268:GLN:HB2	1:A:270:VAL:N	2.13	0.59
1:A:225:LYS:HZ2	1:A:268:GLN:HA	1.68	0.58
1:A:204:SER:O	1:A:207:MET:HG3	2.03	0.58
1:A:266:ASP:CB	1:A:267:SER:CA	2.83	0.57
1:A:232:ASP:O	1:A:233:GLN:HG3	2.04	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:308:PHE:O	1:A:312:VAL:HG13	2.04	0.56
1:A:204:SER:O	1:A:207:MET:CG	2.53	0.56
1:A:373:LEU:HD11	1:A:391:ILE:HG12	1.87	0.56
1:A:232:ASP:C	1:A:233:GLN:CG	2.71	0.55
1:A:266:ASP:HB2	1:A:267:SER:CA	2.36	0.55
1:A:349:GLN:OE1	1:A:352:ARG:NH1	2.39	0.55
1:A:304:ARG:NH1	1:A:328:GLY:O	2.40	0.54
1:A:373:LEU:HD12	1:A:391:ILE:HD11	1.84	0.54
1:A:392:GLU:HB2	1:A:395:GLU:CD	2.33	0.54
1:A:263:VAL:HA	1:A:268:GLN:OE1	2.07	0.54
1:A:393:ALA:O	1:A:394:ASP:CG	2.50	0.54
1:A:402:THR:HG22	1:A:403:ILE:N	2.23	0.54
1:A:339:ILE:HA	1:A:342:VAL:HG22	1.91	0.53
1:A:166:THR:HG23	1:A:291:GLU:CD	2.34	0.53
1:A:266:ASP:HB2	1:A:267:SER:CB	2.39	0.53
1:A:342:VAL:HG12	1:A:413:THR:HB	1.91	0.53
1:A:253:LYS:HZ1	1:A:283:ASP:CG	2.16	0.53
1:A:393:ALA:O	1:A:394:ASP:OD1	2.27	0.52
1:A:402:THR:HG22	1:A:404:LYS:H	1.76	0.51
1:A:262:GLY:O	1:A:265:ASN:HB2	2.10	0.51
1:A:266:ASP:HB2	1:A:267:SER:HB3	1.94	0.50
1:A:253:LYS:CE	1:A:283:ASP:CG	2.85	0.49
1:A:317:CYS:CB	1:A:401:LEU:HD23	2.33	0.49
1:A:166:THR:HG23	1:A:291:GLU:OE1	2.13	0.48
1:A:290:PHE:O	1:A:291:GLU:C	2.55	0.48
1:A:209:GLU:H	1:A:209:GLU:HG2	1.45	0.48
1:A:257:LEU:HD23	1:A:289:ARG:HG3	1.95	0.48
1:A:139:GLU:HB3	3:A:30:HOH:O	2.14	0.48
1:A:203:VAL:HG21	1:A:236:ALA:O	2.13	0.47
1:A:357:ALA:HA	1:A:358:THR:CG2	2.39	0.47
1:A:206:TRP:O	1:A:209:GLU:HG2	2.14	0.47
1:A:395:GLU:O	1:A:395:GLU:HG3	2.14	0.47
1:A:330:MET:HB2	1:A:330:MET:HE2	1.49	0.47
1:A:311:ASN:HB3	1:A:343:VAL:HG11	1.97	0.46
1:A:139:GLU:H	1:A:139:GLU:HG2	1.46	0.46
1:A:394:ASP:OD1	1:A:395:GLU:N	2.48	0.46
1:A:225:LYS:NZ	1:A:268:GLN:HA	2.30	0.46
1:A:266:ASP:HB3	1:A:267:SER:HA	1.96	0.45
1:A:212:LYS:HE3	1:A:216:GLN:HE21	1.81	0.45
1:A:315:THR:HG21	1:A:347:LEU:HD22	1.98	0.45
1:A:265:ASN:HD22	1:A:265:ASN:HA	1.55	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:370:THR:O	1:A:371:ARG:O	2.35	0.43
1:A:374:THR:HB	1:A:397:LYS:HB3	2.01	0.43
1:A:132:TRP:CE2	1:A:189:GLU:HG3	2.53	0.43
1:A:232:ASP:HB3	1:A:233:GLN:HG3	2.01	0.43
1:A:373:LEU:CD1	1:A:391:ILE:HG12	2.49	0.42
1:A:422:LEU:O	1:A:426:GLU:HG3	2.19	0.42
1:A:363:VAL:O	1:A:364:SER:HB3	2.18	0.42
1:A:358:THR:HG23	1:A:358:THR:O	2.20	0.42
1:A:260:MET:O	1:A:263:VAL:HG23	2.19	0.42
1:A:266:ASP:N	1:A:267:SER:HB3	2.34	0.41
1:A:174:PRO:HB3	1:A:421:ASP:OD2	2.19	0.41
1:A:198:SER:OG	1:A:233:GLN:NE2	2.54	0.41
1:A:155:PHE:HB3	1:A:158:LEU:HD23	2.01	0.41
1:A:287:ARG:HG2	1:A:293:ARG:NH2	2.36	0.41
1:A:359:HIS:HA	1:A:384:ILE:O	2.20	0.41
1:A:237:LEU:CD1	1:A:256:LEU:HD22	2.50	0.40
1:A:304:ARG:HG2	1:A:339:ILE:HD11	2.04	0.40
1:A:253:LYS:NZ	1:A:283:ASP:CG	2.79	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)
1:A:322:GLU:OE1	1:A:325:ARG:NH2[10_665]	1.64	0.56

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	297/322 (92%)	272 (92%)	17 (6%)	8 (3%)	4 10

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	371	ARG
1	A	395	GLU
1	A	207	MET
1	A	267	SER
1	A	358	THR
1	A	381	ASP
1	A	359	HIS
1	A	370	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	259/274 (94%)	241 (93%)	18 (7%)	14	34

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	127	LYS
1	A	139	GLU
1	A	200	SER
1	A	209	GLU
1	A	215	LYS
1	A	233	GLN
1	A	240	THR
1	A	265	ASN
1	A	270	VAL
1	A	278	ILE
1	A	291	GLU
1	A	312	VAL
1	A	341	VAL
1	A	351	ILE
1	A	370	THR
1	A	373	LEU
1	A	412	SER
1	A	417	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	216	GLN
1	A	233	GLN
1	A	265	ASN
1	A	427	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](#)

2 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	SO4	A	601	-	4,4,4	0.23	0	6,6,6	0.75	0
2	SO4	A	602	-	4,4,4	0.31	0	6,6,6	0.57	0

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.

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, 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	303/322 (94%)	1.06	56 (18%) 3 3	41, 67, 112, 137	0

All (56) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	263	VAL	6.3
1	A	266	ASP	5.8
1	A	433	GLY	5.2
1	A	261	ASN	4.9
1	A	280	TRP	4.8
1	A	262	GLY	4.6
1	A	240	THR	4.4
1	A	432	PHE	4.4
1	A	391	ILE	4.4
1	A	388	TRP	4.3
1	A	424	LYS	4.0
1	A	267	SER	3.7
1	A	291	GLU	3.7
1	A	248	ALA	3.7
1	A	416	THR	3.6
1	A	428	PHE	3.6
1	A	265	ASN	3.5
1	A	121	THR	3.5
1	A	264	GLY	3.4
1	A	268	GLN	3.4
1	A	356	SER	3.4
1	A	357	ALA	3.4
1	A	415	PRO	3.4
1	A	207	MET	3.3
1	A	421	ASP	3.3
1	A	362	ASP	3.3
1	A	360	PHE	3.2

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Mol	Chain	Res	Type	RSRZ
1	A	378	PRO	3.1
1	A	239	GLY	3.1
1	A	364	SER	3.0
1	A	395	GLU	3.0
1	A	358	THR	3.0
1	A	380	ASP	3.0
1	A	430	ARG	2.8
1	A	178	GLY	2.8
1	A	429	THR	2.8
1	A	402	THR	2.8
1	A	269	GLY	2.7
1	A	383	ALA	2.7
1	A	374	THR	2.5
1	A	161	GLY	2.5
1	A	295	TYR	2.5
1	A	290	PHE	2.5
1	A	387	SER	2.5
1	A	394	ASP	2.5
1	A	219	ALA	2.4
1	A	422	LEU	2.4
1	A	238	THR	2.3
1	A	277	ASN	2.3
1	A	251	ARG	2.2
1	A	425	GLN	2.2
1	A	275	ALA	2.1
1	A	249	SER	2.1
1	A	361	LYS	2.1
1	A	373	LEU	2.1
1	A	382	GLY	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	SO4	A	601	5/5	0.91	0.22	71,71,73,74	0
2	SO4	A	602	5/5	0.94	0.18	74,76,77,78	0

6.5 Other polymers [i](#)

There are no such residues in this entry.