



# Full wwPDB X-ray Structure Validation Report ⓘ

Jan 31, 2016 – 10:53 PM GMT

PDB ID : 1VLU  
Title : Crystal structure of Gamma-glutamyl phosphate reductase (yor323c) from *Saccharomyces cerevisiae* at 2.40 Å resolution  
Authors : Joint Center for Structural Genomics (JCSG)  
Deposited on : 2004-08-16  
Resolution : 2.29 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  
<http://wwpdb.org/validation/2016/XrayValidationReportHelp>  
with specific help available everywhere you see the ⓘ symbol.

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

MolProbity : 4.02b-467  
Mogul : 1.7 (RC4), CSD as536be (2015)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20026688  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Refmac : 5.8.0135  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk26865

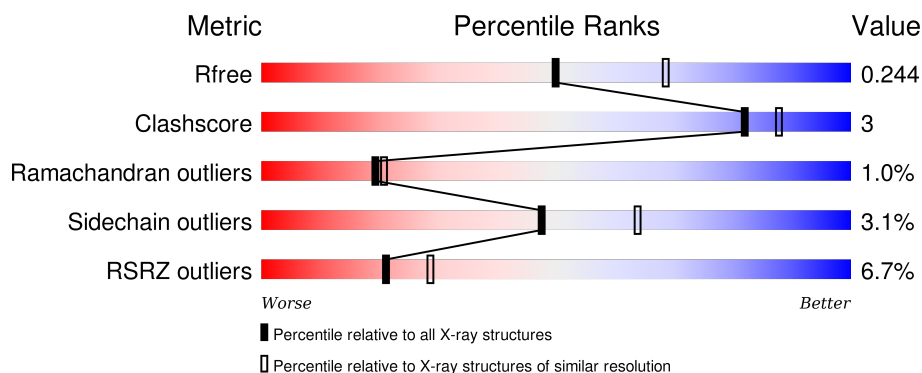
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.29 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))
$R_{free}$	91344	3852 (2.30-2.30)
Clashscore	102246	4452 (2.30-2.30)
Ramachandran outliers	100387	4410 (2.30-2.30)
Sidechain outliers	100360	4409 (2.30-2.30)
RSRZ outliers	91569	3857 (2.30-2.30)

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  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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	468	<div> <div>5%</div> <div>76%</div> <div>8%</div> <div>16%</div> </div>
1	B	468	<div> <div>6%</div> <div>74%</div> <div>10%</div> <div>15%</div> </div>

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 6039 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 Gamma-glutamyl phosphate reductase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	395	Total	C	N	O	S	Se	0	0	0
			2956	1863	494	591	2	6			
1	B	397	Total	C	N	O	S	Se	0	0	0
			2956	1860	493	595	2	6			

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-11	MSE	-	LEADER SEQUENCE	UNP P54885
A	-10	GLY	-	LEADER SEQUENCE	UNP P54885
A	-9	SER	-	LEADER SEQUENCE	UNP P54885
A	-8	ASP	-	LEADER SEQUENCE	UNP P54885
A	-7	LYS	-	LEADER SEQUENCE	UNP P54885
A	-6	ILE	-	LEADER SEQUENCE	UNP P54885
A	-5	HIS	-	LEADER SEQUENCE	UNP P54885
A	-4	HIS	-	LEADER SEQUENCE	UNP P54885
A	-3	HIS	-	LEADER SEQUENCE	UNP P54885
A	-2	HIS	-	LEADER SEQUENCE	UNP P54885
A	-1	HIS	-	LEADER SEQUENCE	UNP P54885
A	0	HIS	-	LEADER SEQUENCE	UNP P54885
A	1	MSE	MET	MODIFIED RESIDUE	UNP P54885
A	79	MSE	MET	MODIFIED RESIDUE	UNP P54885
A	98	MSE	MET	MODIFIED RESIDUE	UNP P54885
A	158	MSE	MET	MODIFIED RESIDUE	UNP P54885
A	261	MSE	MET	MODIFIED RESIDUE	UNP P54885
A	372	MSE	MET	MODIFIED RESIDUE	UNP P54885
B	-11	MSE	-	LEADER SEQUENCE	UNP P54885
B	-10	GLY	-	LEADER SEQUENCE	UNP P54885
B	-9	SER	-	LEADER SEQUENCE	UNP P54885
B	-8	ASP	-	LEADER SEQUENCE	UNP P54885
B	-7	LYS	-	LEADER SEQUENCE	UNP P54885
B	-6	ILE	-	LEADER SEQUENCE	UNP P54885
B	-5	HIS	-	LEADER SEQUENCE	UNP P54885

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-4	HIS	-	LEADER SEQUENCE	UNP P54885
B	-3	HIS	-	LEADER SEQUENCE	UNP P54885
B	-2	HIS	-	LEADER SEQUENCE	UNP P54885
B	-1	HIS	-	LEADER SEQUENCE	UNP P54885
B	0	HIS	-	LEADER SEQUENCE	UNP P54885
B	1	MSE	MET	MODIFIED RESIDUE	UNP P54885
B	79	MSE	MET	MODIFIED RESIDUE	UNP P54885
B	98	MSE	MET	MODIFIED RESIDUE	UNP P54885
B	158	MSE	MET	MODIFIED RESIDUE	UNP P54885
B	261	MSE	MET	MODIFIED RESIDUE	UNP P54885
B	372	MSE	MET	MODIFIED RESIDUE	UNP P54885

- Molecule 2 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	3	Total Cl 3 3	0	0

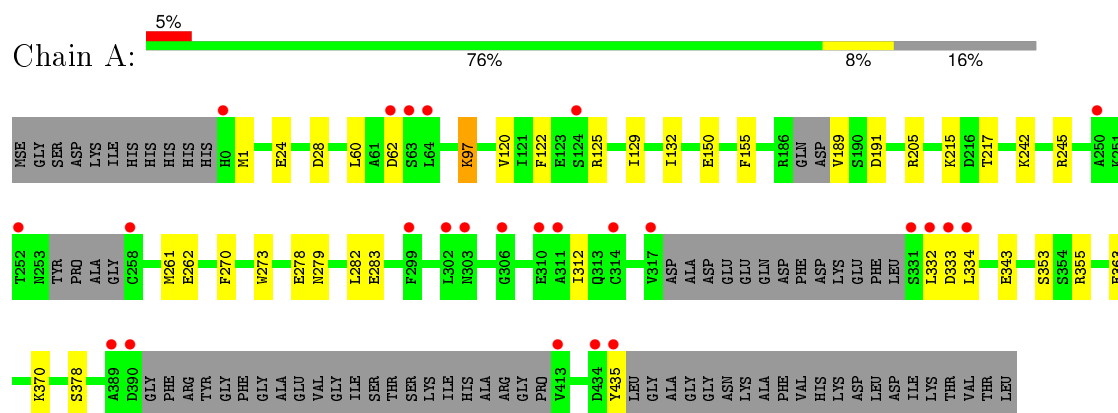
- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	57	Total O 57 57	0	0
3	B	67	Total O 67 67	0	0

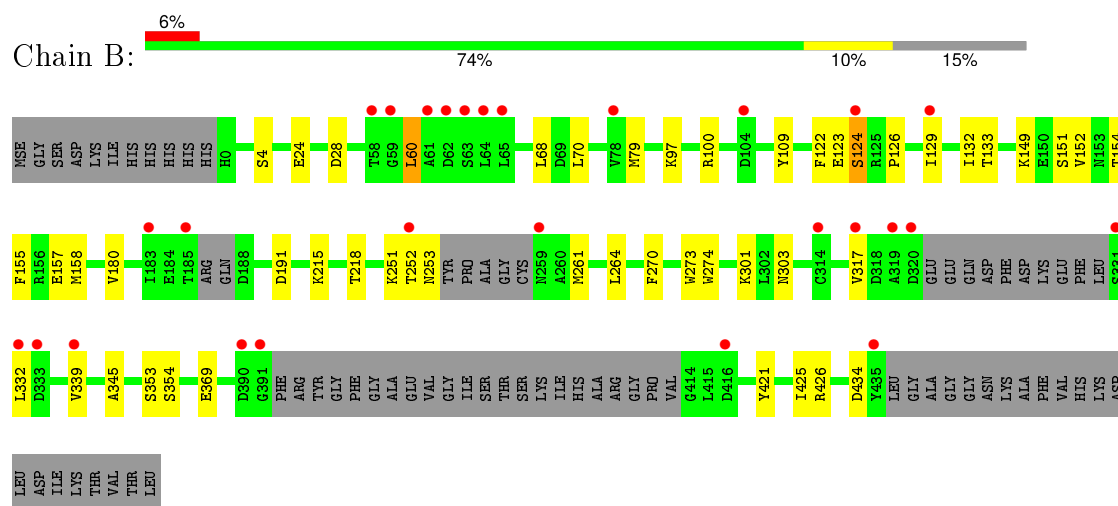
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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: Gamma-glutamyl phosphate reductase



- Molecule 1: Gamma-glutamyl phosphate reductase



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	123.04Å 191.08Å 125.57Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.83 – 2.29 47.83 – 2.29	Depositor EDS
% Data completeness (in resolution range)	91.2 (47.83-2.29) 91.2 (47.83-2.29)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.42 (at 2.29Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, $R_{free}$	0.210 , 0.248 0.208 , 0.244	Depositor DCC
$R_{free}$ test set	3075 reflections (5.35%)	DCC
Wilson B-factor (Å <sup>2</sup> )	53.5	Xtriage
Anisotropy	0.321	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.30 , 52.5	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	0 of 60560 reflections	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	6039	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	61.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 12.92% 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, 0.375 respectively for untwinned datasets, and 0.333, 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: CL

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	0.52	1/2984 (0.0%)	0.62	0/4033
1	B	0.50	0/2983	0.60	0/4031
All	All	0.51	1/5967 (0.0%)	0.61	0/8064

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	B	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	435	TYR	C-O	8.28	1.39	1.23

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	123	GLU	Peptide

### 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	2956	0	2900	16	0
1	B	2956	0	2902	22	0
2	A	3	0	0	0	0
3	A	57	0	0	0	0
3	B	67	0	0	1	0
All	All	6039	0	5802	38	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 (38) 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:339:VAL:HG11	1:B:345:ALA:HB2	1.73	0.69
1:A:215:LYS:HG3	1:A:261:MSE:HE1	1.78	0.64
1:B:126:PRO:O	1:B:129:ILE:HG22	2.00	0.61
1:B:215:LYS:HG2	1:B:261:MSE:HE1	1.84	0.58
1:A:150:GLU:H	1:A:150:GLU:CD	2.09	0.56
1:A:262:GLU:HG3	1:A:332:LEU:HD11	1.87	0.55
1:B:369:GLU:HG3	3:B:472:HOH:O	2.07	0.55
1:B:97:LYS:HG3	1:B:421:TYR:HE1	1.75	0.50
1:A:97:LYS:HE2	1:A:97:LYS:HA	1.94	0.50
1:A:343:GLU:HG3	1:A:370:LYS:HE2	1.93	0.50
1:B:68:LEU:HD11	1:B:151:SER:HB3	1.94	0.49
1:A:189:VAL:HG23	1:A:191:ASP:H	1.78	0.49
1:B:251:LYS:O	1:B:253:ASN:N	2.46	0.48
1:A:120:VAL:HG21	1:A:132:ILE:HG21	1.93	0.48
1:A:242:LYS:NZ	1:A:363:GLU:OE2	2.44	0.47
1:A:24:GLU:O	1:A:28:ASP:HB2	2.14	0.47
1:B:154:THR:O	1:B:158:MSE:HG3	2.14	0.47
1:B:122:PHE:HE2	1:B:155:PHE:CE2	2.32	0.46
1:B:133:THR:HG23	1:B:180:VAL:HG21	1.97	0.46
1:A:129:ILE:HD11	1:A:155:PHE:CD2	2.51	0.46
1:A:270:PHE:O	1:A:273:TRP:HD1	2.00	0.45
1:A:122:PHE:HB3	1:A:205:ARG:HB2	1.98	0.45
1:A:189:VAL:HG23	1:A:191:ASP:HB2	1.99	0.45
1:B:149:LYS:O	1:B:152:VAL:HG23	2.18	0.44
1:B:124:SER:HB3	1:B:151:SER:OG	2.18	0.43
1:B:126:PRO:HA	1:B:155:PHE:CE1	2.53	0.43
1:A:278:GLU:O	1:A:282:LEU:HG	2.18	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:279:ASN:O	1:A:283:GLU:HB3	2.20	0.42
1:B:126:PRO:HA	1:B:155:PHE:HE1	1.85	0.42
1:B:79:MSE:SE	1:B:158:MSE:HE1	2.71	0.41
1:B:24:GLU:O	1:B:28:ASP:HB2	2.20	0.41
1:B:264:LEU:HD12	1:B:264:LEU:HA	1.93	0.41
1:B:270:PHE:O	1:B:273:TRP:HD1	2.03	0.41
1:A:282:LEU:HD23	1:A:312:ILE:HD11	2.03	0.41
1:B:251:LYS:HA	1:B:332:LEU:HD13	2.03	0.40
1:B:4:SER:OG	1:B:191:ASP:HB3	2.21	0.40
1:B:109:TYR:CE1	1:B:426:ARG:HD2	2.57	0.40
1:B:274:TRP:CH2	1:B:301:LYS:HE3	2.57	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	385/468 (82%)	367 (95%)	15 (4%)	3 (1%)	24	27
1	B	387/468 (83%)	369 (95%)	13 (3%)	5 (1%)	15	15
All	All	772/936 (82%)	736 (95%)	28 (4%)	8 (1%)	19	21

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	252	THR
1	B	60	LEU
1	B	70	LEU
1	B	124	SER
1	A	62	ASP
1	A	333	ASP
1	A	355	ARG

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Mol	Chain	Res	Type
1	B	354	SER

### 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	307/382 (80%)	298 (97%)	9 (3%)	50	66
1	B	308/382 (81%)	298 (97%)	10 (3%)	46	62
All	All	615/764 (80%)	596 (97%)	19 (3%)	47	64

All (19) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	MSE
1	A	60	LEU
1	A	97	LYS
1	A	125	ARG
1	A	217	THR
1	A	245	ARG
1	A	334	LEU
1	A	353	SER
1	A	378	SER
1	B	60	LEU
1	B	100	ARG
1	B	132	ILE
1	B	157	GLU
1	B	218	THR
1	B	303	ASN
1	B	317	VAL
1	B	353	SER
1	B	425	ILE
1	B	434	ASP

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	5	GLN
1	A	168	GLN
1	A	208	ASN
1	A	253	ASN
1	B	34	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 carbohydrates in this entry.

### 5.6 Ligand geometry [i](#)

Of 3 ligands modelled in this entry, 3 are monoatomic - leaving 0 for Mogul analysis.

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 [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	389/468 (83%)	0.38	25 (6%) 23 31	38, 57, 96, 119	0
1	B	391/468 (83%)	0.40	27 (6%) 20 27	38, 57, 97, 116	0
All	All	780/936 (83%)	0.39	52 (6%) 21 29	38, 57, 96, 119	0

All (52) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	61	ALA	9.0
1	A	435	TYR	6.3
1	B	332	LEU	5.9
1	B	63	SER	5.9
1	A	252	THR	5.7
1	B	185	THR	5.3
1	B	390	ASP	4.7
1	B	435	TYR	4.7
1	B	129	ILE	4.5
1	A	310	GLU	4.2
1	A	311	ALA	3.9
1	A	333	ASP	3.8
1	A	413	VAL	3.7
1	A	389	ALA	3.7
1	A	314	CYS	3.7
1	A	390	ASP	3.6
1	B	65	LEU	3.5
1	B	319	ALA	3.5
1	B	320	ASP	3.3
1	B	183	ILE	3.3
1	B	124	SER	3.2
1	B	339	VAL	3.1
1	A	331	SER	3.0
1	B	64	LEU	3.0

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Mol	Chain	Res	Type	RSRZ
1	B	104	ASP	3.0
1	A	63	SER	2.9
1	A	299	PHE	2.9
1	A	258	CYS	2.8
1	A	303	ASN	2.8
1	B	259	ASN	2.7
1	A	62	ASP	2.7
1	A	302	LEU	2.7
1	A	434	ASP	2.7
1	A	306	GLY	2.7
1	A	124	SER	2.7
1	B	331	SER	2.5
1	B	62	ASP	2.5
1	A	250	ALA	2.4
1	A	64	LEU	2.4
1	B	391	GLY	2.3
1	B	59	GLY	2.3
1	B	333	ASP	2.3
1	B	252	THR	2.2
1	B	317	VAL	2.2
1	A	317	VAL	2.2
1	A	0	HIS	2.2
1	B	58	THR	2.2
1	B	78	VAL	2.2
1	B	314	CYS	2.2
1	B	416	ASP	2.1
1	A	334	LEU	2.1
1	A	332	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 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. LLDF column lists the quality of electron

density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(Å <sup>2</sup> )	Q<0.9
2	CL	A	458	1/1	0.81	0.11	-	90,90,90,90	0
2	CL	A	459	1/1	0.84	0.10	-	87,87,87,87	0
2	CL	A	457	1/1	0.85	0.07	-	89,89,89,89	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.