



# Full wwPDB X-ray Structure Validation Report

Feb 28, 2014 – 02:34 PM GMT

PDB ID : 4JPW  
Title : Crystal structure of broadly and potently neutralizing antibody 12a21 in complex with hiv-1 strain 93th057 gp120 mutant  
Authors : Acharya, P.; Luongo, T.; Zhou, T.; Kwong, P.D.  
Deposited on : 2013-03-19  
Resolution : 2.90 Å(reported)

This is a full wwPDB 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/ValidationPDFNotes.html>

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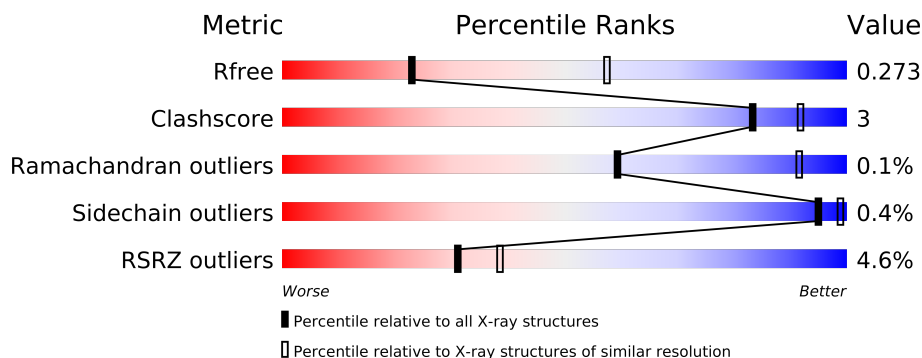
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.15 2013  
Xtriage (Phenix) : dev-1323  
EDS : stable22639  
Percentile statistics : 21963  
Refmac : 5.8.0049  
CCP4 : 6.3.0 (Settle)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)  
Validation Pipeline (wwPDB-VP) : stable22683

# 1 Overall quality at a glance

The reported resolution of this entry is 2.90 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))
$R_{free}$	66092	1053 (2.90-2.90)
Clashscore	79885	1326 (2.90-2.90)
Ramachandran outliers	78287	1290 (2.90-2.90)
Sidechain outliers	78261	1292 (2.90-2.90)
RSRZ outliers	66119	1054 (2.90-2.90)

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. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	G	353	
2	H	225	
3	L	210	

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 6211 atoms, of which 0 are hydrogen and 0 are deuterium.

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 HIV-1 CLADE A/E STRAIN 73TH057 GP120 WITH MUTATION H375S.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	G	345	Total	C	N	O	S	0	0	0
			2692	1688	467	514	23			

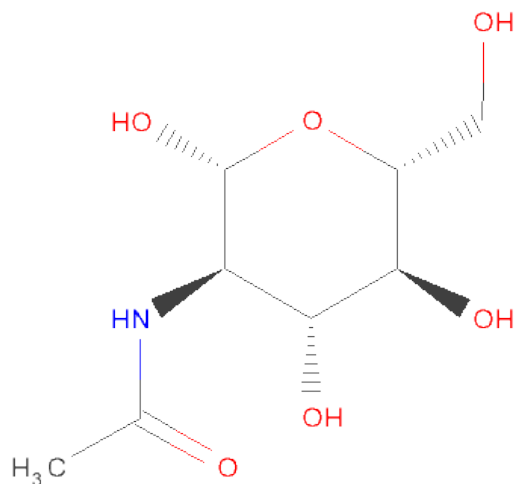
- Molecule 2 is a protein called HEAVY CHAIN OF ANTIBODY 12A21.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	H	223	Total	C	N	O	S	0	0	0
			1708	1085	296	322	5			

- Molecule 3 is a protein called LIGHT CHAIN OF ANTIBODY 12A21.

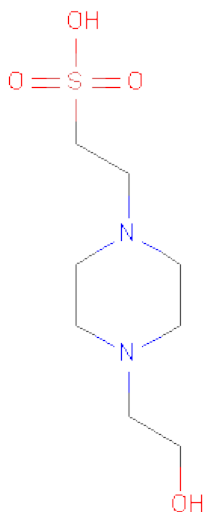
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	L	208	Total	C	N	O	S	0	0	0
			1594	999	278	312	5			

- Molecule 4 is SUGAR (N-ACETYL-D-GLUCOSAMINE) (three-letter code: NAG) (formula: C<sub>8</sub>H<sub>15</sub>NO<sub>6</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	G	1	Total	C	N	O	0	0
			14	8	1	5		
4	G	1	Total	C	N	O	0	0
			14	8	1	5		
4	G	1	Total	C	N	O	0	0
			14	8	1	5		
4	G	1	Total	C	N	O	0	0
			14	8	1	5		
4	G	1	Total	C	N	O	0	0
			14	8	1	5		
4	G	1	Total	C	N	O	0	0
			14	8	1	5		
4	G	1	Total	C	N	O	0	0
			14	8	1	5		
4	G	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 5 is 4-(2-HYDROXYETHYL)-1-PIPERAZINEETHANESULFONIC ACID (three-letter code: EPE) (formula: C<sub>8</sub>H<sub>18</sub>N<sub>2</sub>O<sub>4</sub>S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	G	1	Total	C	N	O	S	0	0
			15	8	2	4	1		

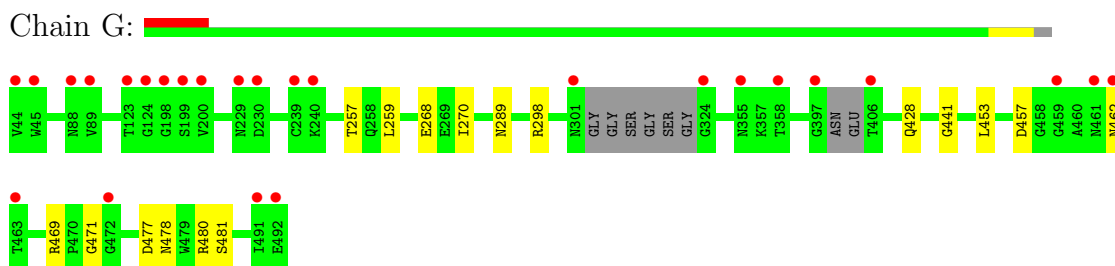
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	G	35	Total	O	0	0
			35	35		
6	H	16	Total	O	0	0
			16	16		
6	L	11	Total	O	0	0
			11	11		

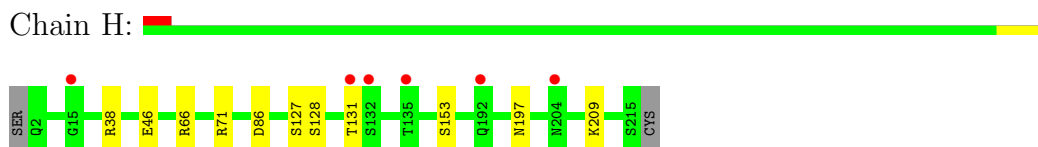
### 3 Residue-property plots

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.

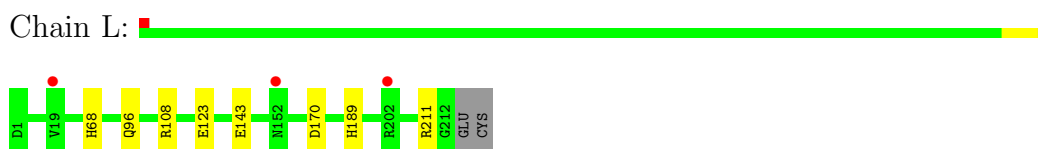
- Molecule 1: HIV-1 CLADE A/E STRAIN 73TH057 GP120 WITH MUTATION H375S



- Molecule 2: HEAVY CHAIN OF ANTIBODY 12A21



- Molecule 3: LIGHT CHAIN OF ANTIBODY 12A21



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	61.98Å 65.99Å 213.02Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	41.44 – 2.90 41.44 – 2.90	Depositor EDS
% Data completeness (in resolution range)	97.1 (41.44-2.90) 97.2 (41.44-2.90)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	0.10	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.81 (at 2.90Å)	Xtriage
Refinement program	PHENIX (phenix.refine: dev_998)	Depositor
R, $R_{free}$	0.206 , 0.265 0.209 , 0.273	Depositor DCC
$R_{free}$ test set	986 reflections (5.06%)	DCC
Wilson B-factor (Å <sup>2</sup> )	58.7	Xtriage
Anisotropy	0.579	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 34.0	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	0 of 19492 reflections	Xtriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	6211	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	65.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.59% of the height of the origin peak. No significant pseudotranslation is detected.*

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

## 5 Model quality

### 5.1 Standard geometry

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

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	G	0.21	0/2747	0.39	0/3727
2	H	0.22	0/1755	0.40	0/2393
3	L	0.23	0/1630	0.39	0/2212
All	All	0.22	0/6132	0.39	0/8332

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	G	2692	0	0	10	0
2	H	1708	0	0	5	0
3	L	1594	0	0	4	0
4	G	140	0	130	1	0
5	G	15	0	17	1	0
6	G	35	0	0	0	0
6	H	16	0	0	0	0
6	L	11	0	0	0	0
All	All	6211	0	147	19	0



Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 3.

All (19) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
3:L:189:HIS:O	3:L:211:ARG:NH1	2.29	0.65
2:H:127:SER:OG	2:H:128:SER:N	2.42	0.52
3:L:108:ARG:NH1	3:L:170:ASP:O	2.45	0.49
1:G:257:THR:O	1:G:259:LEU:N	2.46	0.49
1:G:298:ARG:NH2	1:G:441:GLY:O	2.46	0.48
1:G:477:ASP:OD1	1:G:480:ARG:NH1	2.46	0.48
2:H:153:SER:O	2:H:197:ASN:N	2.48	0.47
1:G:428:GLN:N	1:G:428:GLN:OE1	2.49	0.45
1:G:457:ASP:OD2	1:G:469:ARG:NH1	2.50	0.45
1:G:478:ASN:O	1:G:481:SER:OG	2.35	0.45
1:G:268:GLU:O	1:G:289:ASN:ND2	2.50	0.45
2:H:209:LYS:NZ	3:L:123:GLU:OE1	2.50	0.44
3:L:143:GLU:OE2	3:L:143:GLU:N	2.49	0.44
2:H:66:ARG:NH2	2:H:86:ASP:OD2	2.50	0.44
1:G:462:ASN:OD1	1:G:462:ASN:N	2.53	0.42
1:G:270:ILE:N	4:G:505:NAG:HO6	2.18	0.42
5:G:511:EPE:H61	5:G:511:EPE:H101	1.89	0.41
1:G:453:LEU:O	1:G:471:GLY:N	2.54	0.41
2:H:38:ARG:NE	2:H:46:GLU:OE1	2.54	0.41

There are no symmetry-related clashes.

## 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	G	339/353 (96%)	324 (96%)	15 (4%)	0	100	100
2	H	221/225 (98%)	211 (96%)	10 (4%)	0	100	100
3	L	206/210 (98%)	197 (96%)	8 (4%)	1 (0%)	38	79
All	All	766/788 (97%)	732 (96%)	33 (4%)	1 (0%)	59	91

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	L	68	HIS

### 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	G	307/311 (99%)	307 (100%)	0	100	100
2	H	189/191 (99%)	187 (99%)	2 (1%)	84	97
3	L	180/182 (99%)	179 (99%)	1 (1%)	92	98
All	All	676/684 (99%)	673 (100%)	3 (0%)	95	99

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

Mol	Chain	Res	Type
2	H	71	ARG
2	H	131	THR
3	L	96	GLN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 5.3.3 RNA ⓘ

There are no RNA chains 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 ⓘ

11 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$
4	NAG	G	501	1	12,14,15	0.73	1 (8%)	15,19,21	1.07	1 (6%)
4	NAG	G	502	1	12,14,15	0.68	1 (8%)	15,19,21	1.02	1 (6%)
4	NAG	G	503	1	12,14,15	0.69	1 (8%)	15,19,21	0.88	1 (6%)
4	NAG	G	504	1	12,14,15	0.70	1 (8%)	15,19,21	0.98	2 (13%)
4	NAG	G	505	1	12,14,15	0.63	0	15,19,21	0.92	1 (6%)
4	NAG	G	506	1	12,14,15	0.65	0	15,19,21	0.78	1 (6%)
4	NAG	G	507	1	12,14,15	0.66	1 (8%)	15,19,21	0.81	1 (6%)
4	NAG	G	508	1	12,14,15	0.68	0	15,19,21	0.83	0
4	NAG	G	509	1	12,14,15	0.71	1 (8%)	15,19,21	0.95	1 (6%)
4	NAG	G	510	1	12,14,15	0.66	1 (8%)	15,19,21	0.81	1 (6%)
5	EPE	G	511	-	15,15,15	0.81	1 (6%)	20,20,20	2.02	7 (35%)

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
4	NAG	G	501	1	-	0/6/23/26	0/1/1/1
4	NAG	G	502	1	-	0/6/23/26	0/1/1/1
4	NAG	G	503	1	-	0/6/23/26	0/1/1/1
4	NAG	G	504	1	-	0/6/23/26	0/1/1/1
4	NAG	G	505	1	-	0/6/23/26	0/1/1/1
4	NAG	G	506	1	-	0/6/23/26	0/1/1/1
4	NAG	G	507	1	-	0/6/23/26	0/1/1/1
4	NAG	G	508	1	-	0/6/23/26	0/1/1/1
4	NAG	G	509	1	-	0/6/23/26	0/1/1/1
4	NAG	G	510	1	-	0/6/23/26	0/1/1/1
5	EPE	G	511	-	-	0/9/19/19	0/1/1/1

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	G	511	EPE	C10-S	2.78	1.81	1.77
4	G	501	NAG	O5-C5	-2.19	1.41	1.45
4	G	509	NAG	O5-C5	-2.13	1.41	1.45
4	G	502	NAG	O5-C5	-2.08	1.41	1.45
4	G	504	NAG	O5-C5	-2.08	1.41	1.45
4	G	503	NAG	O5-C5	-2.05	1.41	1.45
4	G	507	NAG	O5-C5	-2.02	1.41	1.45
4	G	510	NAG	O5-C5	-2.01	1.41	1.45

All (17) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	G	511	EPE	O2S-S-C10	4.29	110.49	106.81
5	G	511	EPE	C5-N4-C3	3.72	118.11	108.86
5	G	511	EPE	O1S-S-C10	3.49	109.80	106.81
5	G	511	EPE	C7-N4-C3	3.37	120.01	111.32
5	G	511	EPE	C7-N4-C5	2.87	118.74	111.32
4	G	509	NAG	O5-C5-C6	2.81	109.93	106.98
4	G	501	NAG	O5-C5-C6	2.76	109.88	106.98
4	G	502	NAG	O5-C5-C6	2.59	109.70	106.98
4	G	503	NAG	O5-C5-C6	2.45	109.55	106.98
4	G	506	NAG	O5-C5-C6	2.36	109.46	106.98
5	G	511	EPE	O3S-S-C10	2.35	108.91	105.93
4	G	507	NAG	O5-C5-C6	2.33	109.43	106.98
4	G	504	NAG	O5-C5-C6	2.24	109.33	106.98
5	G	511	EPE	C6-N1-C2	2.22	114.39	108.86
4	G	505	NAG	O5-C5-C6	2.16	109.25	106.98
4	G	510	NAG	O5-C5-C6	2.12	109.21	106.98
4	G	504	NAG	C3-C2-N2	-2.12	108.53	111.76

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

## 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<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	G	345/353 (97%)	0.28	26 (7%)	14 17	35, 63, 117, 147	0
2	H	223/225 (99%)	0.16	6 (2%)	52 61	36, 60, 104, 143	0
3	L	208/210 (99%)	-0.07	3 (1%)	72 80	39, 61, 85, 112	0
All	All	776/788 (98%)	0.15	35 (4%)	31 39	35, 61, 110, 147	0

All (35) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	G	44	VAL	6.4
2	H	132	SER	5.4
1	G	492	GLU	4.7
1	G	123	THR	4.5
2	H	131	THR	4.3
1	G	199	SER	4.1
2	H	204	ASN	3.9
1	G	324	GLY	3.7
1	G	463	THR	3.6
1	G	406	THR	3.5
1	G	200	VAL	3.5
1	G	198	GLY	3.4
1	G	45	TRP	3.1
1	G	240	LYS	3.1
1	G	355	ASN	2.9
1	G	461	ASN	2.8
1	G	459	GLY	2.8
1	G	230	ASP	2.7
1	G	462	ASN	2.5
1	G	124	GLY	2.4
1	G	89	VAL	2.4
3	L	202	ARG	2.4
1	G	239	CYS	2.4

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Mol	Chain	Res	Type	RSRZ
3	L	19	VAL	2.3
1	G	88	ASN	2.2
1	G	301	ASN	2.2
2	H	15	GLY	2.2
1	G	358	THR	2.2
2	H	192	GLN	2.2
3	L	152	ASN	2.2
1	G	491	ILE	2.1
1	G	229	ASN	2.1
1	G	397	GLY	2.1
2	H	135	THR	2.0
1	G	472	GLY	2.0

## 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 ⓘ

There are no carbohydrates in this entry.

## 6.4 Ligands ⓘ

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	RSR	LLDF	B-factors(Å <sup>2</sup> )	Q<0.9
4	NAG	G	507	14/15	0.26	-	63,73,79,81	0
4	NAG	G	505	14/15	0.30	-	56,66,71,73	0
4	NAG	G	508	14/15	0.21	-	49,57,61,63	0
4	NAG	G	501	14/15	0.16	-	64,68,71,71	0
4	NAG	G	506	14/15	0.32	-	55,65,69,70	0
4	NAG	G	510	14/15	0.49	-	87,99,101,102	0
4	NAG	G	502	14/15	0.35	-	76,85,89,90	0
4	NAG	G	509	14/15	0.27	-	73,82,86,87	0
4	NAG	G	503	14/15	0.15	-	47,51,55,56	0

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Mol	Type	Chain	Res	Atoms	RSR	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
5	EPE	G	511	15/15	0.20	-	53,57,62,65	0
4	NAG	G	504	14/15	0.20	-	61,67,70,71	0

## 6.5 Other polymers ⓘ

There are no such residues in this entry.