



# Full wwPDB X-ray Structure Validation Report ⓘ

May 25, 2020 – 09:58 pm BST

PDB ID : 5IWD  
Title : HCMV DNA polymerase subunit UL44 complex with a small molecule  
Authors : Chen, H.; Coen, D.M.; Hogle, J.M.; Filman, D.J.  
Deposited on : 2016-03-22  
Resolution : 2.56 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.

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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 : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.11  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.11

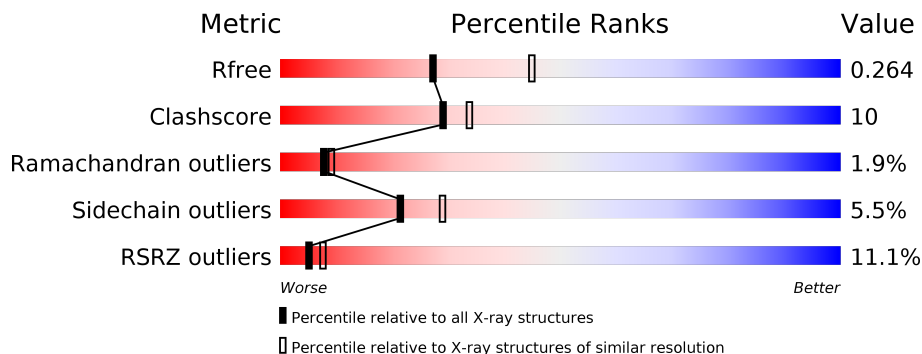
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.56 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))
$R_{free}$	130704	1279 (2.58-2.54)
Clashscore	141614	1327 (2.58-2.54)
Ramachandran outliers	138981	1312 (2.58-2.54)
Sidechain outliers	138945	1312 (2.58-2.54)
RSRZ outliers	127900	1269 (2.58-2.54)

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 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	290	 10% 62% 26% • 10%

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 2102 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.

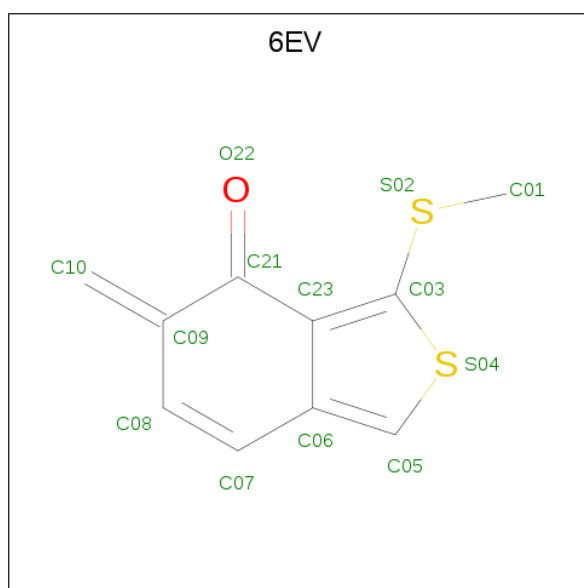
- Molecule 1 is a protein called DNA polymerase processivity factor.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	261	2062	1315	353	384	10	0	1	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	5	ASP	THR	conflict	UNP P16790
A	205	SER	ALA	see remark 999	UNP P16790

- Molecule 2 is 5-methylidene-3-(methylsulfanyl)-2-benzothiophen-4(5H)-one (three-letter code: 6EV) (formula: C<sub>10</sub>H<sub>8</sub>OS<sub>2</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	O	S		
2	A	1	13	10	1	2	0	0
2	A	1	13	10	1	2	0	0

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	O	S		
2	A	1	13	10	1	2	0	0

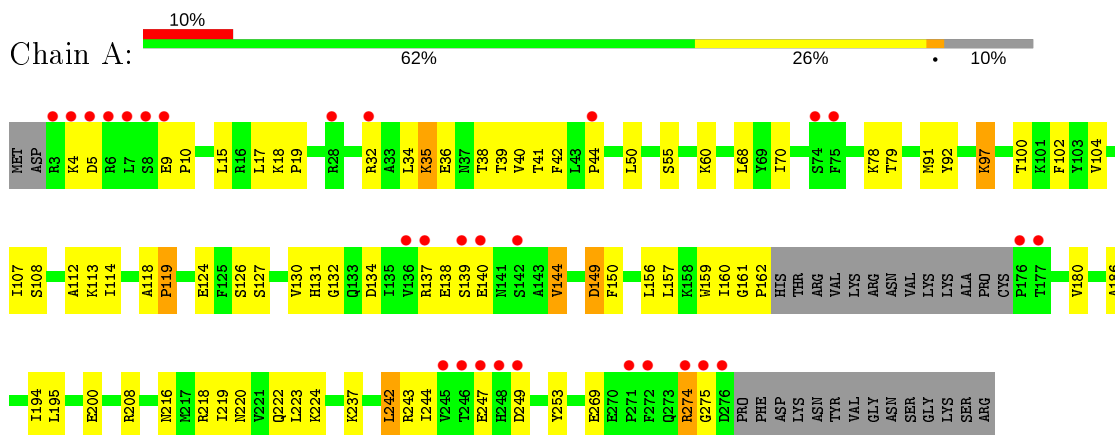
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	O	0	0
			1	1		

### 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 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: DNA polymerase processivity factor



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	91.80Å 127.04Å 66.00Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	27.12 – 2.56 30.17 – 2.56	Depositor EDS
% Data completeness (in resolution range)	97.5 (27.12-2.56) 97.3 (30.17-2.56)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.04	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.56 (at 2.57Å)	Xtrriage
Refinement program	PHENIX (1.10_2155: ???)	Depositor
R, $R_{free}$	0.212 , 0.267 0.214 , 0.264	Depositor DCC
$R_{free}$ test set	601 reflections (4.82%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	78.8	Xtrriage
Anisotropy	0.459	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.27 , 66.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	2102	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	98.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.28% 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 [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: 6EV

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	0.44	0/2107	0.65	1/2860 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
1	A	242	LEU	CA-CB-CG	5.18	127.22	115.30

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	2062	0	2088	40	0
2	A	39	0	0	0	0
3	A	1	0	0	0	0
All	All	2102	0	2088	40	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 10.

All (40) 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:9:GLU:HG3	1:A:10:PRO:HD2	1.71	0.71
1:A:17:LEU:HD11	1:A:100:THR:O	1.96	0.65
1:A:34:LEU:HD22	1:A:38:THR:HG21	1.82	0.62
1:A:144:VAL:HG13	1:A:244:ILE:HB	1.81	0.61
1:A:222:GLN:HE21	1:A:224:LYS:HB3	1.67	0.59
1:A:42:PHE:CE1	1:A:104:VAL:HG21	2.40	0.57
1:A:132:GLY:N	1:A:134:ASP:OD1	2.37	0.56
1:A:97:LYS:HD3	1:A:97:LYS:H	1.71	0.55
1:A:44:PRO:HA	1:A:70:ILE:HD13	1.92	0.52
1:A:180:VAL:HB	1:A:223:LEU:HD13	1.92	0.51
1:A:118:ALA:HB1	1:A:119:PRO:HD2	1.93	0.51
1:A:150:PHE:CE1	1:A:237:LYS:HA	2.45	0.51
1:A:32:ARG:HH11	1:A:92:TYR:HE1	1.60	0.49
1:A:112:ALA:O	1:A:126:SER:HA	2.13	0.49
1:A:186:ALA:N	1:A:216:ASN:OD1	2.46	0.48
1:A:41:THR:HG23	1:A:79:THR:HG22	1.95	0.48
1:A:78:LYS:NZ	1:A:108:SER:O	2.47	0.47
1:A:159:TRP:CH2	1:A:195:LEU:HG	2.50	0.47
1:A:149:ASP:HB2	1:A:208:ARG:O	2.14	0.46
1:A:18:LYS:HB2	1:A:19:PRO:HD3	1.96	0.46
1:A:243:ARG:HB2	1:A:253:TYR:HB3	1.97	0.45
1:A:107:ILE:HD12	1:A:113:LYS:HD3	1.99	0.44
1:A:137:ARG:NH1	1:A:139:SER:HB3	2.33	0.44
1:A:150:PHE:CD1	1:A:237:LYS:HA	2.53	0.44
1:A:40:VAL:O	1:A:79:THR:HA	2.18	0.44
1:A:194:ILE:HG23	1:A:200:GLU:HG3	1.99	0.43
1:A:131:HIS:HA	1:A:132:GLY:HA3	1.52	0.43
1:A:274:ARG:HA	1:A:275:GLY:HA3	1.55	0.43
1:A:35:LYS:NZ	1:A:36:GLU:HG2	2.34	0.42
1:A:50:LEU:HD11	1:A:91:MET:HE2	2.01	0.42
1:A:220:ASN:H	1:A:269:GLU:HG3	1.83	0.42
1:A:114:ILE:O	1:A:124:GLU:HA	2.20	0.42
1:A:15:LEU:HG	1:A:102:PHE:CD2	2.55	0.42
1:A:138:GLU:C	1:A:140:GLU:H	2.22	0.42
1:A:161:GLY:HA3	1:A:162:PRO:HA	1.71	0.41
1:A:130:VAL:HG22	1:A:131:HIS:H	1.85	0.41
1:A:32:ARG:HD3	1:A:92:TYR:CE1	2.55	0.41
1:A:157:LEU:HA	1:A:157:LEU:HD23	1.93	0.41
1:A:222:GLN:NE2	1:A:224:LYS:HB3	2.34	0.41
1:A:156:LEU:O	1:A:160:ILE:HG13	2.21	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	258/290 (89%)	235 (91%)	18 (7%)	5 (2%)	8 9

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	247	GLU
1	A	55	SER
1	A	119	PRO
1	A	5	ASP
1	A	274	ARG

### 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	239/264 (90%)	226 (95%)	13 (5%)	22 29

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	4	LYS
1	A	35	LYS
1	A	39	THR
1	A	60	LYS
1	A	68	LEU
1	A	97	LYS

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Mol	Chain	Res	Type
1	A	127	SER
1	A	144	VAL
1	A	149	ASP
1	A	218	ARG
1	A	219	ILE
1	A	242	LEU
1	A	249	ASP

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

### 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](#)

3 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	6EV	A	303	1,2	12,14,14	4.64	6 (50%)	8,20,20	11.16	6 (75%)
2	6EV	A	301	1,2	12,14,14	4.97	6 (50%)	8,20,20	8.32	5 (62%)
2	6EV	A	302	1	12,14,14	4.72	6 (50%)	8,20,20	10.05	4 (50%)

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	6EV	A	303	1,2	-	0/2/15/15	0/2/2/2
2	6EV	A	301	1,2	-	2/2/15/15	0/2/2/2
2	6EV	A	302	1	-	2/2/15/15	0/2/2/2

All (18) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	301	6EV	C08-C07	12.79	1.56	1.34
2	A	302	6EV	C08-C07	12.27	1.55	1.34
2	A	303	6EV	C08-C07	12.08	1.55	1.34
2	A	301	6EV	C05-C06	8.88	1.42	1.37
2	A	302	6EV	C05-C06	8.37	1.42	1.37
2	A	303	6EV	C05-C06	8.26	1.41	1.37
2	A	301	6EV	C06-C07	5.41	1.56	1.44
2	A	302	6EV	C06-C07	4.88	1.55	1.44
2	A	303	6EV	C06-C07	4.69	1.54	1.44
2	A	301	6EV	C08-C09	2.88	1.49	1.43
2	A	302	6EV	C08-C09	2.70	1.49	1.43
2	A	303	6EV	C08-C09	2.59	1.49	1.43
2	A	301	6EV	C10-C09	2.50	1.40	1.33
2	A	302	6EV	C09-C21	2.45	1.48	1.43
2	A	303	6EV	C10-C09	2.32	1.39	1.33
2	A	301	6EV	C09-C21	2.25	1.48	1.43
2	A	303	6EV	C09-C21	2.23	1.48	1.43
2	A	302	6EV	C10-C09	2.23	1.39	1.33

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	303	6EV	C06-C05-S04	-25.45	105.42	112.53
2	A	302	6EV	C06-C05-S04	-24.33	105.74	112.53
2	A	301	6EV	C06-C05-S04	-20.91	106.69	112.53
2	A	303	6EV	C05-C06-C23	15.10	115.85	111.69
2	A	302	6EV	C05-C06-C23	12.80	115.22	111.69
2	A	301	6EV	C05-C06-C23	9.16	114.21	111.69
2	A	303	6EV	C07-C08-C09	-7.34	109.39	121.79
2	A	303	6EV	C06-C07-C08	-6.37	112.80	121.54
2	A	302	6EV	C06-C07-C08	-5.39	114.15	121.54

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	302	6EV	C07-C08-C09	-4.26	114.59	121.79
2	A	301	6EV	C07-C08-C09	-3.97	115.08	121.79
2	A	303	6EV	O22-C21-C09	-3.51	117.99	122.19
2	A	303	6EV	C08-C09-C21	-3.39	116.05	120.12
2	A	301	6EV	C06-C07-C08	-2.98	117.45	121.54
2	A	301	6EV	O22-C21-C09	-2.25	119.50	122.19

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	301	6EV	S04-C03-S02-C01
2	A	301	6EV	C23-C03-S02-C01
2	A	302	6EV	S04-C03-S02-C01
2	A	302	6EV	C23-C03-S02-C01

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	261/290 (90%)	0.97	29 (11%) <b>5</b> <b>7</b>	56, 87, 155, 223	11 (4%)

All (29) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	6	ARG	45.0
1	A	5	ASP	23.0
1	A	7	LEU	21.0
1	A	139	SER	8.4
1	A	3	ARG	8.3
1	A	272	PHE	8.3
1	A	8	SER	7.2
1	A	276	ASP	5.7
1	A	248	HIS	5.6
1	A	176	PRO	5.6
1	A	271	PRO	5.1
1	A	177	THR	4.9
1	A	137	ARG	4.8
1	A	245	VAL	4.3
1	A	274	ARG	4.1
1	A	247	GLU	3.9
1	A	44	PRO	3.8
1	A	275	GLY	3.3
1	A	4	LYS	2.8
1	A	246	THR	2.8
1	A	32	ARG	2.8
1	A	140	GLU	2.8
1	A	75	PHE	2.7
1	A	136	VAL	2.6
1	A	249	ASP	2.5
1	A	142	SER	2.4
1	A	74	SER	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	28	ARG	2.1
1	A	9	GLU	2.1

## 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. 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(Å <sup>2</sup> )	Q<0.9
2	6EV	A	301	13/13	0.77	0.29	113,116,118,120	13
2	6EV	A	303	13/13	0.78	0.34	105,121,128,138	13
2	6EV	A	302	13/13	0.88	0.25	116,123,131,133	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.