



# wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 4, 2024 – 06:36 AM EST

PDB ID : 1POY  
Title : SPERMIDINE/PUTRESCINE-BINDING PROTEIN COMPLEXED WITH SPERMIDINE (DIMER FORM)  
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Deposited on : 1996-02-02  
Resolution : 2.50 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.36  
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) : 2.36

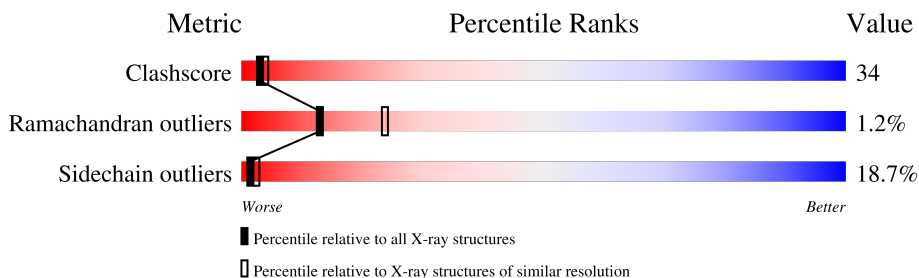
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.50 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))
Clashscore	141614	5346 (2.50-2.50)
Ramachandran outliers	138981	5231 (2.50-2.50)
Sidechain outliers	138945	5233 (2.50-2.50)

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  $\leq 5\%$

Mol	Chain	Length	Quality of chain		
1	1	323	42%	46%	11% .
1	2	323	42%	46%	13%
1	3	323	41%	48%	11% .
1	4	323	43%	47%	9% .

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	SPD	1	400	-	-	X	-
2	SPD	2	400	-	-	X	-

## 2 Entry composition [i](#)

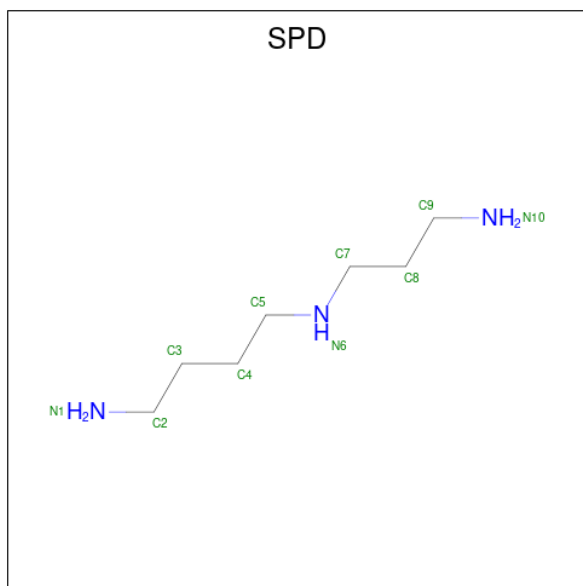
There are 3 unique types of molecules in this entry. The entry contains 10512 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 SPERMIDINE/PUTRESCINE-BINDING PROTEIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	1	323	Total 2557	C 1642	N 412	O 494	S 9	0	0	0
1	2	323	Total 2560	C 1643	N 412	O 496	S 9	0	0	0
1	3	323	Total 2560	C 1643	N 412	O 496	S 9	0	0	0
1	4	323	Total 2560	C 1643	N 412	O 496	S 9	0	0	0

- Molecule 2 is SPERMIDINE (three-letter code: SPD) (formula: C<sub>7</sub>H<sub>19</sub>N<sub>3</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	N		
2	1	1	Total 10	C 7	N 3	0	0
2	2	1	Total 10	C 7	N 3	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	3	1	Total	C	N	0	0
			10	7	3		
2	4	1	Total	C	N	0	0
			10	7	3		

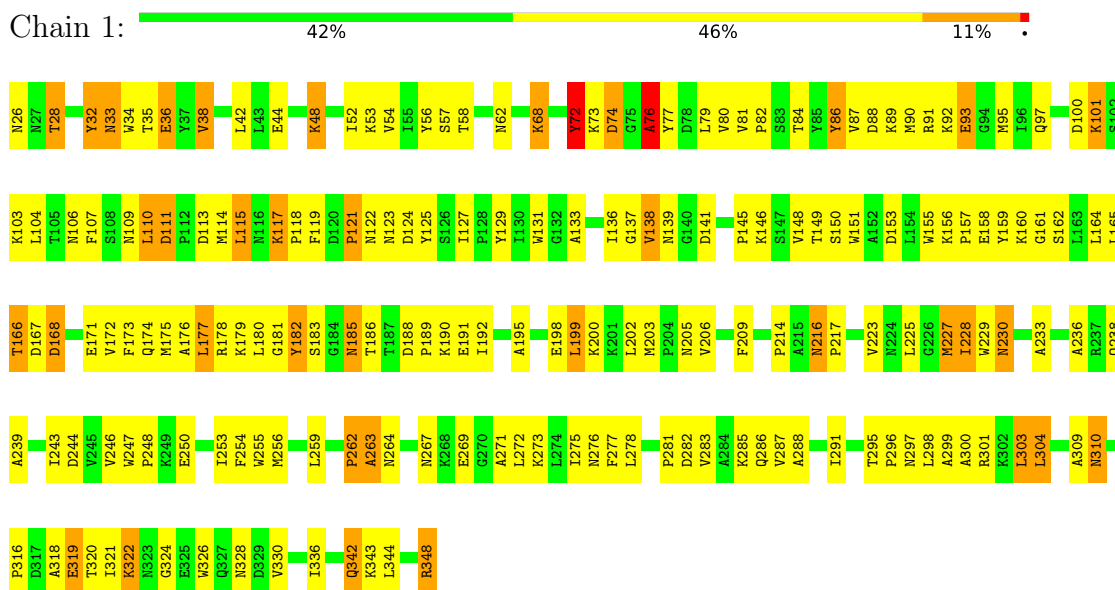
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	1	59	Total	O	0	0
			59	59		
3	2	53	Total	O	0	0
			53	53		
3	3	71	Total	O	0	0
			71	71		
3	4	52	Total	O	0	0
			52	52		

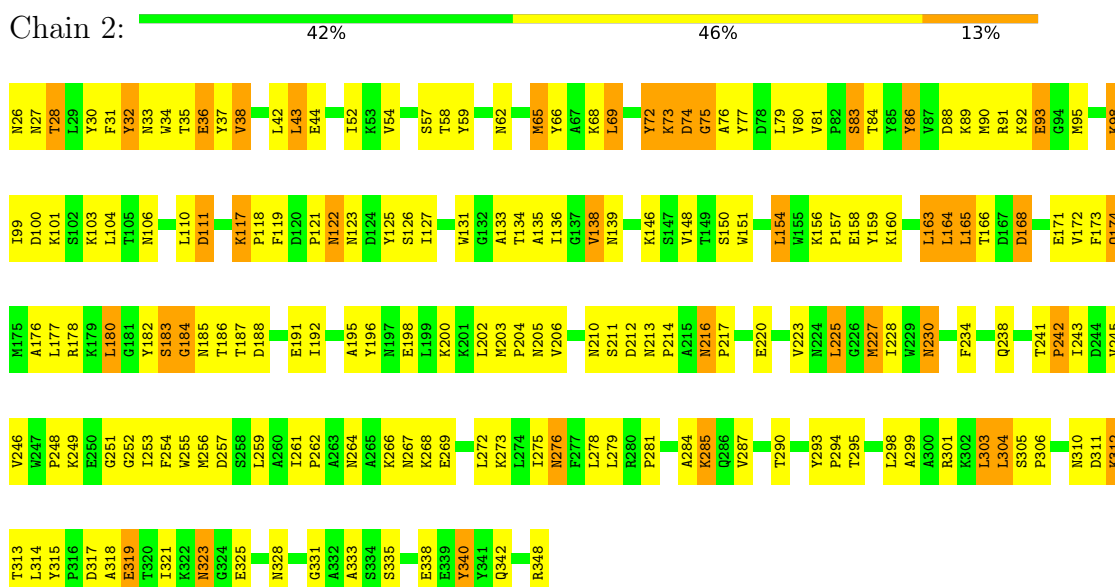
### 3 Residue-property plots [i](#)

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. 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. 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: SPERMIDINE/PUTRESCINE-BINDING PROTEIN

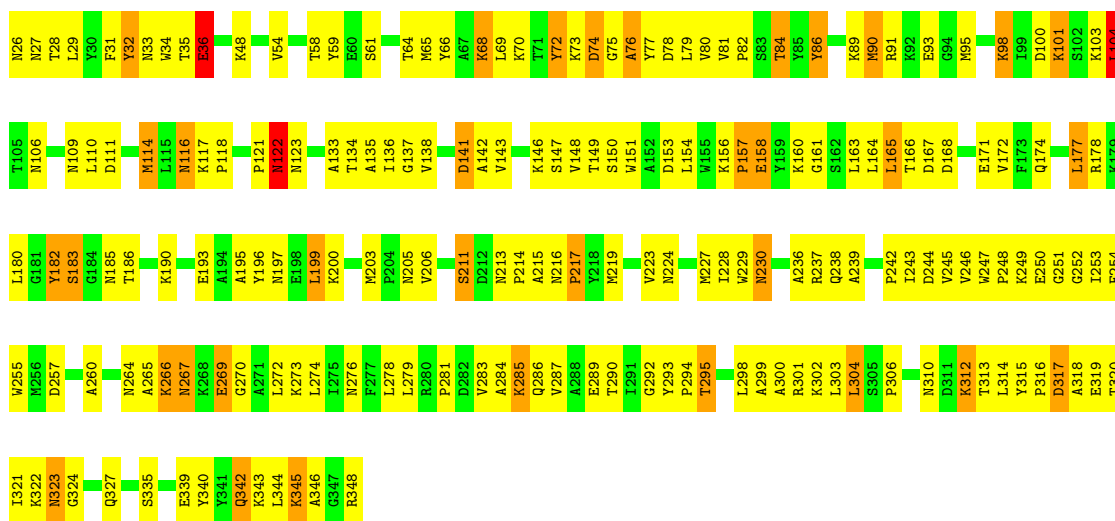


- Molecule 1: SPERMIDINE/PUTRESCINE-BINDING PROTEIN



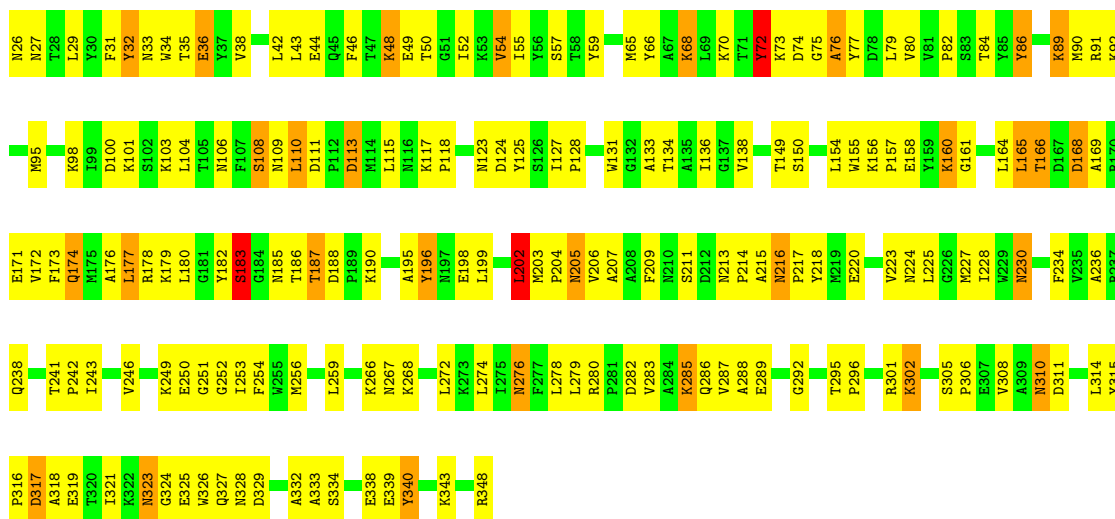
• Molecule 1: SPERMIDINE/PUTRESCINE-BINDING PROTEIN

Chain 3:  41% 48% 11%



• Molecule 1: SPERMIDINE/PUTRESCINE-BINDING PROTEIN

Chain 4:  43% 47% 9%



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	145.30Å 69.10Å 72.50Å 90.00° 107.60° 90.00°	Depositor
Resolution (Å)	6.00 – 2.50 71.01 – 2.00	Depositor EDS
% Data completeness (in resolution range)	(Not available) (6.00-2.50) 59.5 (71.01-2.00)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$	-	Xtrriage
Refinement program	X-PLOR	Depositor
R, $R_{free}$	0.199 , 0.280 0.203 , (Not available)	Depositor DCC
$R_{free}$ test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	10.2	Xtrriage
Anisotropy	1.082	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.29 , 59.8	EDS
L-test for twinning <sup>1</sup>	$\langle  L  \rangle = 0.33$ , $\langle L^2 \rangle = 0.17$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.87	EDS
Total number of atoms	10512	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	19.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 38.14 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 3.8549e-04.*

<sup>1</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: SPD

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	1	0.71	1/2623 (0.0%)	0.90	4/3568 (0.1%)
1	2	0.74	0/2626	0.92	5/3572 (0.1%)
1	3	0.76	1/2626 (0.0%)	0.90	3/3572 (0.1%)
1	4	0.76	0/2626	0.88	5/3572 (0.1%)
All	All	0.74	2/10501 (0.0%)	0.90	17/14284 (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	2	0	1
1	3	0	1
All	All	0	2

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	1	76	ALA	CA-CB	-6.12	1.39	1.52
1	3	122	ASN	CA-CB	5.93	1.68	1.53

The worst 5 of 17 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	1	72	TYR	N-CA-C	8.16	133.04	111.00
1	4	202	LEU	CA-CB-CG	6.88	131.12	115.30
1	2	183	SER	N-CA-C	6.64	128.94	111.00
1	2	75	GLY	N-CA-C	-6.36	97.19	113.10
1	2	252	GLY	N-CA-C	-6.17	97.68	113.10



There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	2	30	TYR	Sidechain
1	3	182	TYR	Sidechain

## 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	1	2557	0	2502	185	0
1	2	2560	0	2504	177	0
1	3	2560	0	2504	189	0
1	4	2560	0	2504	147	0
2	1	10	0	19	8	0
2	2	10	0	19	10	0
2	3	10	0	19	5	0
2	4	10	0	19	5	0
3	1	59	0	0	3	0
3	2	53	0	0	11	0
3	3	71	0	0	12	0
3	4	52	0	0	5	0
All	All	10512	0	10090	694	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 34.

The worst 5 of 694 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)
1:3:32:TYR:HB2	1:3:76:ALA:HB3	1.30	1.07
1:1:73:LYS:HA	1:1:77:TYR:HE1	1.24	1.00
1:3:342:GLN:HA	1:3:342:GLN:HE21	1.27	0.95
1:2:160:LYS:HA	1:2:205:ASN:ND2	1.82	0.94
1:1:93:GLU:HB3	1:1:95:MET:HG3	1.49	0.93

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	1	321/323 (99%)	276 (86%)	42 (13%)	3 (1%)	17	31
1	2	321/323 (99%)	283 (88%)	35 (11%)	3 (1%)	17	31
1	3	321/323 (99%)	287 (89%)	29 (9%)	5 (2%)	9	17
1	4	321/323 (99%)	277 (86%)	39 (12%)	5 (2%)	9	17
All	All	1284/1292 (99%)	1123 (88%)	145 (11%)	16 (1%)	13	24

5 of 16 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	2	184	GLY
1	3	35	THR
1	3	123	ASN
1	4	35	THR
1	3	36	GLU

### 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	1	272/273 (100%)	221 (81%)	51 (19%)	1	2
1	2	273/273 (100%)	219 (80%)	54 (20%)	1	2
1	3	273/273 (100%)	224 (82%)	49 (18%)	2	3
1	4	273/273 (100%)	223 (82%)	50 (18%)	1	3
All	All	1091/1092 (100%)	887 (81%)	204 (19%)	1	2

5 of 204 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	3	89	LYS
1	3	272	LEU
1	4	323	ASN
1	3	104	LEU
1	3	165	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 47 such sidechains are listed below:

Mol	Chain	Res	Type
1	3	213	ASN
1	3	342	GLN
1	3	216	ASN
1	3	276	ASN
1	4	45	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 monosaccharides in this entry.

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

4 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	SPD	3	400	-	9,9,9	0.62	0	8,8,8	1.07	1 (12%)
2	SPD	4	400	-	9,9,9	0.94	1 (11%)	8,8,8	1.64	2 (25%)
2	SPD	2	400	-	9,9,9	0.56	0	8,8,8	2.59	3 (37%)
2	SPD	1	400	-	9,9,9	0.61	0	8,8,8	1.19	1 (12%)

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	SPD	3	400	-	-	3/7/7/7	-
2	SPD	4	400	-	-	5/7/7/7	-
2	SPD	2	400	-	-	4/7/7/7	-
2	SPD	1	400	-	-	3/7/7/7	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	4	400	SPD	C7-N6	-2.46	1.38	1.46

The worst 5 of 7 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	2	400	SPD	C8-C7-N6	5.85	127.93	112.14
2	4	400	SPD	C4-C5-N6	-3.69	102.17	112.14
2	2	400	SPD	C4-C5-N6	-2.90	104.32	112.14
2	1	400	SPD	C7-N6-C5	-2.84	100.05	113.45
2	2	400	SPD	C7-N6-C5	-2.72	100.61	113.45

There are no chirality outliers.

5 of 15 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	4	400	SPD	N6-C7-C8-C9
2	2	400	SPD	C8-C7-N6-C5
2	3	400	SPD	C4-C5-N6-C7
2	1	400	SPD	C4-C5-N6-C7
2	2	400	SPD	C2-C3-C4-C5

There are no ring outliers.

4 monomers are involved in 28 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	3	400	SPD	5	0
2	4	400	SPD	5	0
2	2	400	SPD	10	0
2	1	400	SPD	8	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 [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

Unable to reproduce the depositors R factor - this section is therefore empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

Unable to reproduce the depositors R factor - this section is therefore empty.

### 6.3 Carbohydrates [i](#)

Unable to reproduce the depositors R factor - this section is therefore empty.

### 6.4 Ligands [i](#)

Unable to reproduce the depositors R factor - this section is therefore empty.

### 6.5 Other polymers [i](#)

Unable to reproduce the depositors R factor - this section is therefore empty.