



# Full wwPDB X-ray Structure Validation Report ⓘ

May 29, 2024 – 04:00 PM EDT

PDB ID : 1SDL  
Title : CROSS-LINKED, CARBONMONOXY HEMOGLOBIN A  
Authors : Schumacher, M.A.; Dixon, M.M.; Kluger, R.; Jones, R.T.; Brennan, R.G.  
Deposited on : 1996-02-26  
Resolution : 1.80 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.

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)  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36.2

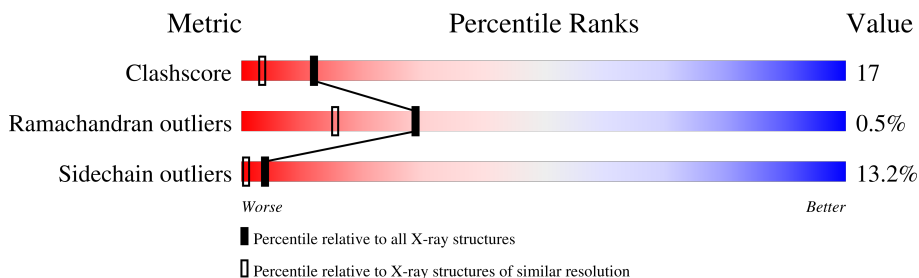
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.80 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	6793 (1.80-1.80)
Ramachandran outliers	138981	6697 (1.80-1.80)
Sidechain outliers	138945	6696 (1.80-1.80)

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  $\leq 5\%$

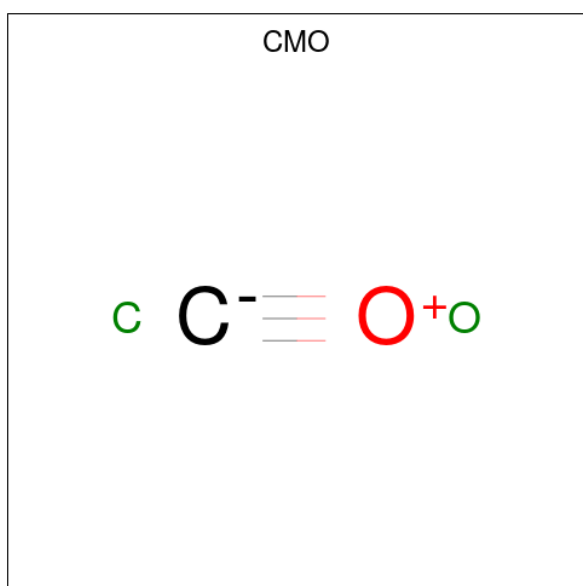
Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	141	
1	C	141	
2	B	146	
2	D	146	



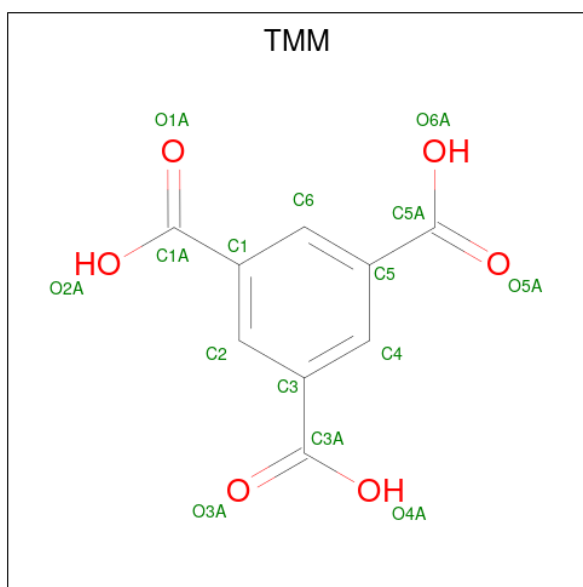
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
3	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
3	B	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
3	C	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
3	D	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		

- Molecule 4 is CARBON MONOXIDE (three-letter code: CMO) (formula: CO).



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	C O	0	0
			2	1 1		
4	B	1	Total	C O	0	0
			2	1 1		
4	C	1	Total	C O	0	0
			2	1 1		
4	D	1	Total	C O	0	0
			2	1 1		

- Molecule 5 is 1,3,5-BENZENETRICARBOXYLIC ACID (three-letter code: TMM) (formula: C<sub>9</sub>H<sub>6</sub>O<sub>6</sub>).



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	D	1	Total	C O	0	0
			13	9 4		

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	83	Total	O	0	0
			83	83		
6	B	103	Total	O	0	0
			103	103		
6	C	97	Total	O	0	0
			97	97		
6	D	116	Total	O	0	0
			116	116		

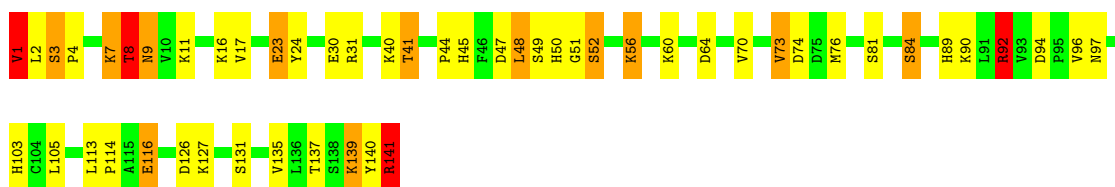
### 3 Residue-property plots [i](#)

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.

Note EDS was not executed.

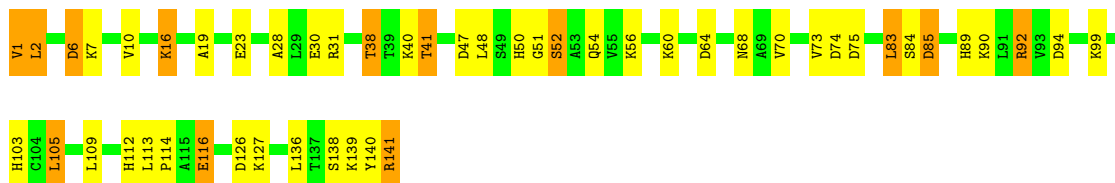
- Molecule 1: HEMOGLOBIN A

Chain A:  63% 26% 9%



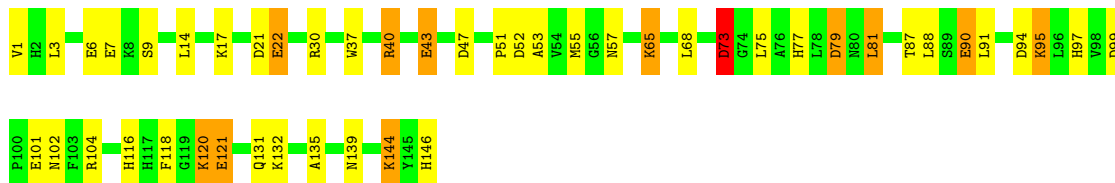
- Molecule 1: HEMOGLOBIN A

Chain C:  65% 26% 9%



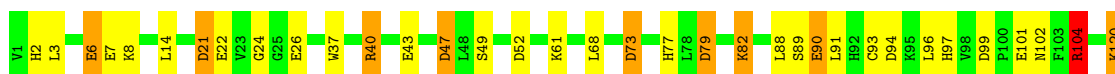
- Molecule 2: HEMOGLOBIN A

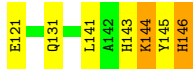
Chain B:  68% 24% 8%



- Molecule 2: HEMOGLOBIN A

Chain D:  71% 21% 8%





## 4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	104.43Å 72.16Å 88.03Å 90.00° 108.25° 90.00°	Depositor
Resolution (Å)	(Not available) – 1.80	Depositor
% Data completeness (in resolution range)	(Not available) ((Not available)-1.80)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	TNT	Depositor
R, $R_{free}$	0.150 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	4976	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	22.0	wwPDB-VP



## 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: CMO, HEM, TMM

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	0.86	5/1097 (0.5%)	1.47	22/1491 (1.5%)
1	C	0.81	3/1097 (0.3%)	1.23	15/1491 (1.0%)
2	B	0.77	7/1153 (0.6%)	1.16	14/1566 (0.9%)
2	D	0.81	6/1153 (0.5%)	1.21	15/1566 (1.0%)
All	All	0.81	21/4500 (0.5%)	1.27	66/6114 (1.1%)

All (21) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	3	SER	N-CA	-7.35	1.31	1.46
1	A	131	SER	CA-CB	-7.02	1.42	1.52
1	C	141	ARG	CB-CG	6.35	1.69	1.52
2	D	6	GLU	CD-OE1	5.84	1.32	1.25
2	B	90	GLU	CD-OE1	5.62	1.31	1.25
2	B	6	GLU	CD-OE1	5.60	1.31	1.25
2	D	90	GLU	CD-OE2	5.58	1.31	1.25
2	B	22	GLU	CD-OE1	5.54	1.31	1.25
1	C	116	GLU	CD-OE1	5.51	1.31	1.25
2	B	7	GLU	CD-OE2	5.47	1.31	1.25
2	D	43	GLU	CD-OE2	5.45	1.31	1.25
2	D	101	GLU	CD-OE2	5.43	1.31	1.25
1	A	116	GLU	CD-OE2	5.42	1.31	1.25
2	B	101	GLU	CD-OE2	5.42	1.31	1.25
2	D	121	GLU	CD-OE2	5.40	1.31	1.25
1	A	23	GLU	CD-OE1	5.39	1.31	1.25
2	B	121	GLU	CD-OE2	5.33	1.31	1.25
2	B	43	GLU	CD-OE2	5.31	1.31	1.25
2	D	22	GLU	CD-OE2	5.30	1.31	1.25
1	C	23	GLU	CD-OE1	5.22	1.31	1.25
1	A	30	GLU	CD-OE2	5.18	1.31	1.25

All (66) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	2	LEU	O-C-N	18.04	151.57	122.70
1	A	2	LEU	CA-C-N	-12.72	89.21	117.20
1	C	141	ARG	NE-CZ-NH2	11.20	125.90	120.30
1	A	131	SER	CB-CA-C	9.64	128.41	110.10
1	C	141	ARG	CB-CA-C	8.81	128.03	110.40
1	A	8	THR	N-CA-CB	8.53	126.51	110.30
2	B	73	ASP	CB-CG-OD1	-8.18	110.94	118.30
1	A	141	ARG	NE-CZ-NH1	8.02	124.31	120.30
1	A	31	ARG	NE-CZ-NH1	7.92	124.26	120.30
2	D	21	ASP	CB-CG-OD1	-7.68	111.39	118.30
1	A	64	ASP	CB-CG-OD1	7.48	125.03	118.30
1	C	74	ASP	CB-CG-OD2	-7.43	111.61	118.30
2	B	99	ASP	CB-CG-OD2	-7.37	111.67	118.30
2	D	99	ASP	CB-CG-OD2	-7.33	111.71	118.30
2	D	104	ARG	NE-CZ-NH1	7.09	123.84	120.30
1	A	2	LEU	C-N-CA	7.00	139.19	121.70
1	A	31	ARG	NE-CZ-NH2	-6.95	116.83	120.30
2	B	21	ASP	CB-CG-OD2	-6.93	112.06	118.30
1	C	94	ASP	CB-CG-OD1	6.93	124.53	118.30
1	A	64	ASP	CB-CG-OD2	-6.88	112.11	118.30
2	D	47	ASP	CB-CG-OD1	-6.74	112.24	118.30
2	B	47	ASP	CB-CG-OD2	-6.72	112.25	118.30
1	C	74	ASP	CB-CG-OD1	6.71	124.34	118.30
1	C	85	ASP	CB-CG-OD1	-6.65	112.31	118.30
1	C	75	ASP	CB-CG-OD2	-6.62	112.34	118.30
1	A	1	VAL	O-C-N	6.55	133.19	122.70
2	D	82	LYS	CB-CA-C	6.50	123.40	110.40
2	D	40	ARG	NE-CZ-NH1	6.44	123.52	120.30
1	A	92	ARG	NE-CZ-NH1	6.36	123.48	120.30
1	C	1	VAL	N-CA-C	-6.28	94.05	111.00
2	B	94	ASP	CB-CG-OD1	6.24	123.91	118.30
1	A	47	ASP	CB-CG-OD1	-6.17	112.75	118.30
2	B	52	ASP	CB-CG-OD1	6.15	123.84	118.30
2	D	73	ASP	CB-CG-OD1	-6.13	112.78	118.30
2	D	52	ASP	CB-CG-OD2	-6.12	112.80	118.30
2	D	79	ASP	CB-CG-OD2	-6.01	112.89	118.30
2	D	52	ASP	CB-CG-OD1	5.94	123.65	118.30
1	C	64	ASP	CB-CG-OD2	-5.79	113.09	118.30
1	C	94	ASP	CB-CG-OD2	-5.75	113.12	118.30
1	C	126	ASP	CB-CG-OD2	-5.75	113.13	118.30
2	B	30	ARG	NE-CZ-NH1	5.73	123.17	120.30
2	B	52	ASP	CB-CG-OD2	-5.66	113.20	118.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	140	TYR	CB-CG-CD2	-5.61	117.64	121.00
1	A	47	ASP	CB-CG-OD2	5.60	123.34	118.30
1	C	140	TYR	CB-CG-CD2	-5.55	117.67	121.00
2	B	47	ASP	CB-CG-OD1	5.54	123.29	118.30
2	D	94	ASP	CB-CG-OD2	-5.54	113.31	118.30
1	A	92	ARG	NE-CZ-NH2	-5.52	117.54	120.30
1	A	126	ASP	CB-CG-OD2	-5.46	113.38	118.30
2	B	79	ASP	CB-CG-OD2	-5.45	113.39	118.30
1	A	94	ASP	CB-CG-OD1	5.45	123.20	118.30
2	B	73	ASP	CB-CG-OD2	5.43	123.19	118.30
1	A	126	ASP	CB-CG-OD1	5.42	123.18	118.30
1	A	1	VAL	CA-C-N	-5.39	105.35	117.20
2	D	21	ASP	CB-CG-OD2	5.37	123.14	118.30
1	A	94	ASP	CB-CG-OD2	-5.37	113.47	118.30
2	B	99	ASP	CB-CG-OD1	5.36	123.12	118.30
2	D	79	ASP	CB-CG-OD1	5.27	123.04	118.30
2	B	94	ASP	CB-CG-OD2	-5.22	113.60	118.30
1	C	6	ASP	CB-CG-OD2	-5.21	113.61	118.30
1	A	76	MET	CG-SD-CE	5.18	108.49	100.20
2	B	21	ASP	CB-CG-OD1	5.13	122.92	118.30
2	D	73	ASP	CB-CG-OD2	5.12	122.91	118.30
1	C	75	ASP	CB-CG-OD1	5.11	122.90	118.30
1	C	31	ARG	NE-CZ-NH1	5.07	122.83	120.30
2	D	99	ASP	CB-CG-OD1	5.03	122.82	118.30

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	1069	0	1072	51	0
1	C	1069	0	1073	47	1
2	B	1123	0	1115	35	0
2	D	1123	0	1116	42	0
3	A	43	0	30	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	43	0	30	3	0
3	C	43	0	30	0	0
3	D	43	0	30	2	0
4	A	2	0	0	0	0
4	B	2	0	0	0	0
4	C	2	0	0	0	0
4	D	2	0	0	0	0
5	D	13	0	3	1	0
6	A	83	0	0	6	0
6	B	103	0	0	11	2
6	C	97	0	0	11	1
6	D	116	0	0	5	4
All	All	4976	0	4499	156	4

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 17.

All (156) 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)
2:D:6:GLU:HB2	6:D:337:HOH:O	1.53	1.08
1:C:68:ASN:HB2	6:C:209:HOH:O	1.64	0.96
2:B:135:ALA:HB3	2:D:146:HIS:CE1	2.03	0.94
2:D:104:ARG:HG3	2:D:104:ARG:HH11	1.34	0.92
6:B:202:HOH:O	1:C:38:THR:CG2	2.19	0.90
1:A:113:LEU:HD13	1:A:116:GLU:HB2	1.54	0.87
2:B:132:LYS:HA	2:D:146:HIS:CE1	2.11	0.85
2:B:120:LYS:HD2	2:B:120:LYS:H	1.43	0.84
1:A:92:ARG:HG3	1:A:92:ARG:NH1	1.91	0.84
1:A:7:LYS:O	1:A:8:THR:HB	1.77	0.82
1:A:92:ARG:HG3	1:A:92:ARG:HH11	1.42	0.81
2:B:146:HIS:O	2:D:2:HIS:ND1	2.16	0.79
1:C:112:HIS:O	1:C:113:LEU:HD23	1.80	0.79
1:A:41:THR:HB	2:D:40:ARG:HH22	1.46	0.79
2:D:89:SER:OG	2:D:144:LYS:HG2	1.83	0.79
1:C:70:VAL:O	1:C:73:VAL:HG23	1.83	0.78
2:B:120:LYS:H	2:B:120:LYS:CD	1.97	0.75
1:A:141:ARG:HG3	1:A:141:ARG:HH11	1.51	0.75
2:B:91:LEU:HD12	2:B:95:LYS:HE3	1.69	0.74
2:D:6:GLU:CB	6:D:337:HOH:O	2.18	0.74
2:D:144:LYS:HZ2	2:D:144:LYS:HA	1.52	0.74

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:79:ASP:HA	6:B:249:HOH:O	1.87	0.74
1:C:84:SER:HB3	6:C:258:HOH:O	1.88	0.72
1:C:139:LYS:HG2	6:C:258:HOH:O	1.89	0.72
2:D:104:ARG:HG3	2:D:104:ARG:NH1	1.98	0.71
2:D:24:GLY:HA2	2:D:68:LEU:HD13	1.72	0.70
1:C:89:HIS:CE1	1:C:139:LYS:HD2	2.28	0.69
1:C:56:LYS:HG2	6:C:246:HOH:O	1.90	0.69
1:C:103:HIS:HD2	6:C:249:HOH:O	1.76	0.68
1:C:51:GLY:O	1:C:56:LYS:HE2	1.92	0.68
1:A:4:PRO:O	6:A:259:HOH:O	2.12	0.67
2:B:146:HIS:ND1	6:B:276:HOH:O	2.28	0.66
1:A:1:VAL:O	1:A:1:VAL:HG23	1.96	0.66
2:D:104:ARG:HH11	2:D:104:ARG:CG	2.08	0.66
6:B:202:HOH:O	1:C:38:THR:HG21	1.90	0.66
2:D:93:CYS:HB2	2:D:145:TYR:CE1	2.31	0.65
1:C:103:HIS:HE1	2:D:131:GLN:OE1	1.79	0.65
1:C:47:ASP:HB3	1:C:54:GLN:NE2	2.13	0.64
1:A:103:HIS:HE1	2:B:131:GLN:OE1	1.81	0.64
1:A:70:VAL:O	1:A:73:VAL:HG22	1.97	0.63
1:C:7:LYS:HG2	1:C:73:VAL:HG11	1.81	0.62
1:A:113:LEU:CD1	1:A:116:GLU:HB2	2.26	0.62
2:B:120:LYS:HD2	2:B:120:LYS:N	2.13	0.62
1:A:127:LYS:HZ2	1:C:141:ARG:HB2	1.65	0.61
2:B:65:LYS:NZ	2:B:65:LYS:HB2	2.16	0.61
1:A:56:LYS:HE2	6:A:252:HOH:O	2.00	0.61
1:A:84:SER:OG	1:A:139:LYS:HD3	2.01	0.60
1:A:7:LYS:O	1:A:8:THR:CB	2.47	0.60
1:A:92:ARG:HH11	1:A:92:ARG:CG	2.14	0.60
1:A:7:LYS:O	6:A:259:HOH:O	2.17	0.58
1:A:113:LEU:HD13	1:A:116:GLU:CB	2.29	0.58
2:D:144:LYS:HZ2	2:D:144:LYS:CA	2.15	0.58
2:D:143:HIS:C	2:D:144:LYS:HZ3	2.08	0.58
1:A:141:ARG:HG3	1:A:141:ARG:NH1	2.17	0.57
1:C:16:LYS:O	1:C:16:LYS:HD3	2.04	0.57
1:A:103:HIS:HD2	6:A:229:HOH:O	1.87	0.57
1:C:89:HIS:HE1	1:C:139:LYS:HD2	1.70	0.56
1:A:127:LYS:HG2	1:C:141:ARG:CB	2.37	0.55
1:C:52:SER:O	1:C:56:LYS:HG3	2.07	0.55
2:D:3:LEU:HA	2:D:7:GLU:OE1	2.07	0.54
2:D:79:ASP:HB3	6:D:356:HOH:O	2.06	0.54
1:A:1:VAL:O	1:A:1:VAL:CG2	2.55	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:89:HIS:NE2	1:C:139:LYS:HB3	2.23	0.54
2:D:144:LYS:HA	2:D:144:LYS:NZ	2.20	0.53
1:C:47:ASP:CB	1:C:54:GLN:NE2	2.71	0.53
1:C:7:LYS:HD3	1:C:73:VAL:HG11	1.90	0.53
1:A:8:THR:H	1:A:11:LYS:H	1.57	0.53
2:B:73:ASP:O	2:B:77:HIS:HD2	1.91	0.53
2:B:51:PRO:O	2:B:55:MET:HG2	2.09	0.52
1:A:45:HIS:ND1	1:A:45:HIS:N	2.58	0.52
1:A:1:VAL:HG12	1:C:138:SER:O	2.10	0.52
2:B:40:ARG:HG2	6:B:220:HOH:O	2.10	0.52
1:C:47:ASP:H	1:C:54:GLN:NE2	2.08	0.52
1:A:127:LYS:HG2	1:C:141:ARG:HB3	1.93	0.51
2:B:132:LYS:O	2:D:146:HIS:HE1	1.93	0.51
2:D:144:LYS:CA	2:D:144:LYS:NZ	2.74	0.51
2:D:144:LYS:NZ	2:D:144:LYS:N	2.58	0.51
2:D:37:TRP:HE1	2:D:102:ASN:HD21	1.59	0.51
2:B:132:LYS:CA	2:D:146:HIS:CE1	2.91	0.50
1:C:127:LYS:NZ	6:C:211:HOH:O	2.43	0.50
2:D:143:HIS:CD2	2:D:144:LYS:NZ	2.79	0.50
3:B:200:HEM:HMB1	3:B:200:HEM:HBB2	1.93	0.50
1:C:83:LEU:HB3	1:C:136:LEU:HD21	1.92	0.50
1:A:49:SER:O	1:A:52:SER:HB3	2.12	0.50
2:D:144:LYS:HZ3	2:D:144:LYS:N	2.09	0.49
2:D:104:ARG:NH1	2:D:104:ARG:CG	2.72	0.49
1:A:41:THR:HB	2:D:40:ARG:NH2	2.21	0.49
1:A:135:VAL:HG23	6:A:280:HOH:O	2.13	0.48
2:B:132:LYS:O	2:D:146:HIS:CE1	2.67	0.48
2:B:97:HIS:CD2	1:C:41:THR:HG23	2.48	0.48
1:A:137:THR:OG1	1:A:141:ARG:NH2	2.47	0.48
1:A:3:SER:HA	1:A:4:PRO:HD3	1.67	0.47
1:A:7:LYS:HE3	1:A:74:ASP:OD2	2.14	0.47
2:B:40:ARG:NH2	6:B:219:HOH:O	2.31	0.47
1:C:116:GLU:HB2	6:C:216:HOH:O	2.15	0.47
1:A:41:THR:CB	2:D:40:ARG:HH22	2.22	0.47
1:C:2:LEU:HD22	1:C:2:LEU:HA	1.72	0.47
1:C:83:LEU:HB3	1:C:136:LEU:CD2	2.45	0.47
2:D:73:ASP:O	2:D:77:HIS:HD2	1.98	0.47
1:C:112:HIS:C	1:C:113:LEU:HD23	2.35	0.46
1:A:45:HIS:NE2	3:A:200:HEM:O1D	2.28	0.46
2:B:118:PHE:O	2:B:121:GLU:HB2	2.16	0.46
1:C:6:ASP:O	1:C:10:VAL:HG23	2.16	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:56:LYS:HE3	1:A:56:LYS:HB2	1.47	0.45
2:B:95:LYS:HE3	2:B:95:LYS:HB2	1.74	0.45
1:C:40:LYS:NZ	6:C:247:HOH:O	2.49	0.45
1:C:116:GLU:OE1	1:C:116:GLU:N	2.49	0.45
1:C:28:ALA:CB	1:C:105:LEU:HD13	2.46	0.45
2:B:40:ARG:NE	6:B:219:HOH:O	2.40	0.45
1:A:40:LYS:HB3	1:A:48:LEU:HD23	1.98	0.44
2:B:135:ALA:HB3	2:D:146:HIS:HE1	1.75	0.44
1:C:114:PRO:HG3	6:D:314:HOH:O	2.17	0.44
2:B:132:LYS:HA	2:D:146:HIS:HE1	1.73	0.44
1:A:50:HIS:C	1:A:52:SER:H	2.20	0.44
2:B:53:ALA:O	2:B:57:ASN:HB2	2.18	0.44
2:D:141:LEU:HD13	3:D:200:HEM:HBB2	1.98	0.44
2:B:1:VAL:HG12	2:D:146:HIS:ND1	2.33	0.44
1:C:89:HIS:CE1	1:C:139:LYS:CD	3.00	0.43
2:D:82:LYS:HB3	5:D:300:TMM:O5A	2.18	0.43
1:A:127:LYS:HG2	1:C:141:ARG:HB2	1.99	0.43
2:B:75:LEU:HD23	2:B:75:LEU:HA	1.83	0.43
2:B:87:THR:HG23	6:B:284:HOH:O	2.17	0.43
2:B:43:GLU:CG	1:C:92:ARG:NH2	2.82	0.43
1:A:44:PRO:HG2	1:A:45:HIS:H	1.83	0.43
1:C:99:LYS:HG2	6:C:280:HOH:O	2.18	0.43
1:A:9:ASN:HD22	1:A:9:ASN:HA	1.71	0.42
1:C:19:ALA:HB3	6:C:238:HOH:O	2.19	0.42
1:C:83:LEU:HD12	1:C:83:LEU:HA	1.76	0.42
2:D:143:HIS:HD2	2:D:144:LYS:NZ	2.17	0.42
1:A:92:ARG:NH1	6:A:271:HOH:O	2.30	0.42
1:A:114:PRO:HA	2:B:116:HIS:CD2	2.54	0.42
1:A:96:VAL:CG1	1:A:97:ASN:N	2.82	0.42
1:C:30:GLU:OE2	1:C:50:HIS:ND1	2.43	0.42
1:C:47:ASP:CB	1:C:54:GLN:HE22	2.32	0.42
3:B:200:HEM:HAD1	6:B:290:HOH:O	2.18	0.42
1:C:113:LEU:HD12	6:C:216:HOH:O	2.20	0.42
2:B:90:GLU:HG3	6:B:264:HOH:O	2.19	0.42
2:B:81:LEU:HD12	2:B:81:LEU:HA	1.86	0.42
1:A:17:VAL:HG13	1:A:24:TYR:CD2	2.54	0.42
2:D:26:GLU:HG3	6:D:322:HOH:O	2.19	0.42
3:B:200:HEM:HBB2	3:B:200:HEM:CMB	2.50	0.41
1:A:141:ARG:NH1	1:A:141:ARG:CG	2.83	0.41
2:D:96:LEU:O	2:D:97:HIS:HB2	2.21	0.41
1:A:3:SER:OG	1:A:4:PRO:HD2	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:89:HIS:NE2	1:A:139:LYS:HG2	2.35	0.41
2:D:143:HIS:CD2	2:D:144:LYS:HZ3	2.38	0.41
1:A:48:LEU:HD12	1:A:48:LEU:HA	1.78	0.41
1:A:113:LEU:HA	1:A:114:PRO:HD2	1.68	0.41
1:A:139:LYS:HD2	1:A:139:LYS:N	2.35	0.41
2:B:37:TRP:HE1	2:B:102:ASN:HD21	1.68	0.41
2:D:143:HIS:HD2	2:D:144:LYS:HZ1	1.69	0.41
1:A:49:SER:O	1:A:52:SER:CB	2.69	0.41
2:D:120:LYS:HD3	2:D:120:LYS:HA	1.70	0.41
2:B:144:LYS:NZ	6:B:217:HOH:O	2.53	0.40
3:D:200:HEM:HMC1	3:D:200:HEM:HBC2	2.03	0.40
2:B:43:GLU:HG3	1:C:92:ARG:NH2	2.36	0.40

All (4) 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)
6:B:216:HOH:O	6:D:313:HOH:O[4_554]	0.06	2.14
6:C:232:HOH:O	6:D:412:HOH:O[4_554]	0.12	2.08
6:B:256:HOH:O	6:D:337:HOH:O[4_554]	2.17	0.03
1:C:41:THR:O	6:D:381:HOH:O[4_554]	2.17	0.03

## 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	139/141 (99%)	127 (91%)	9 (6%)	3 (2%)	<b>6</b> <b>1</b>
1	C	139/141 (99%)	138 (99%)	1 (1%)	0	<b>100</b> <b>100</b>
2	B	144/146 (99%)	140 (97%)	4 (3%)	0	<b>100</b> <b>100</b>
2	D	144/146 (99%)	141 (98%)	3 (2%)	0	<b>100</b> <b>100</b>

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	566/574 (99%)	546 (96%)	17 (3%)	3 (0%)	29 15

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	8	THR
1	A	52	SER
1	A	51	GLY

### 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	113/113 (100%)	95 (84%)	18 (16%)	2 0
1	C	113/113 (100%)	99 (88%)	14 (12%)	4 1
2	B	118/118 (100%)	102 (86%)	16 (14%)	3 1
2	D	118/118 (100%)	105 (89%)	13 (11%)	6 1
All	All	462/462 (100%)	401 (87%)	61 (13%)	4 1

All (61) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	VAL
1	A	7	LYS
1	A	8	THR
1	A	9	ASN
1	A	16	LYS
1	A	23	GLU
1	A	41	THR
1	A	48	LEU
1	A	56	LYS
1	A	60	LYS
1	A	73	VAL
1	A	81	SER

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>
1	A	84	SER
1	A	90	LYS
1	A	92	ARG
1	A	105	LEU
1	A	139	LYS
1	A	141	ARG
2	B	3	LEU
2	B	9	SER
2	B	14	LEU
2	B	17	LYS
2	B	22	GLU
2	B	40	ARG
2	B	65	LYS
2	B	68	LEU
2	B	73	ASP
2	B	81	LEU
2	B	88	LEU
2	B	95	LYS
2	B	104	ARG
2	B	120	LYS
2	B	139	ASN
2	B	144	LYS
1	C	1	VAL
1	C	2	LEU
1	C	16	LYS
1	C	38	THR
1	C	41	THR
1	C	48	LEU
1	C	52	SER
1	C	60	LYS
1	C	83	LEU
1	C	85	ASP
1	C	90	LYS
1	C	92	ARG
1	C	105	LEU
1	C	109	LEU
2	D	8	LYS
2	D	14	LEU
2	D	21	ASP
2	D	47	ASP
2	D	49	SER
2	D	61	LYS

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Mol	Chain	Res	Type
2	D	88	LEU
2	D	90	GLU
2	D	91	LEU
2	D	104	ARG
2	D	120	LYS
2	D	144	LYS
2	D	146	HIS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (19) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	9	ASN
1	A	50	HIS
1	A	97	ASN
1	A	103	HIS
2	B	77	HIS
2	B	102	ASN
2	B	108	ASN
1	C	9	ASN
1	C	54	GLN
1	C	68	ASN
1	C	89	HIS
1	C	103	HIS
2	D	77	HIS
2	D	80	ASN
2	D	102	ASN
2	D	108	ASN
2	D	117	HIS
2	D	143	HIS
2	D	146	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 monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

9 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	CMO	B	201	3	0,1,1	-	-	-		
4	CMO	D	201	3	0,1,1	-	-	-		
3	HEM	B	200	2,4	41,50,50	1.73	8 (19%)	45,82,82	1.45	8 (17%)
3	HEM	A	200	4,1	41,50,50	1.52	9 (21%)	45,82,82	1.52	7 (15%)
4	CMO	A	201	3	0,1,1	-	-	-		
3	HEM	C	200	4,1	41,50,50	1.56	7 (17%)	45,82,82	1.55	10 (22%)
4	CMO	C	201	3	0,1,1	-	-	-		
5	TMM	D	300	2	13,13,15	1.31	2 (15%)	17,17,21	2.00	5 (29%)
3	HEM	D	200	2,4	41,50,50	1.55	6 (14%)	45,82,82	1.65	10 (22%)

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
3	HEM	B	200	2,4	-	6/12/54/54	-
3	HEM	A	200	4,1	-	2/12/54/54	-
3	HEM	C	200	4,1	-	2/12/54/54	-
5	TMM	D	300	2	-	4/8/8/12	0/1/1/1
3	HEM	D	200	2,4	-	4/12/54/54	-

All (32) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	200	HEM	C3C-C2C	-5.32	1.33	1.40
3	C	200	HEM	C3C-C2C	-4.43	1.34	1.40
3	D	200	HEM	C3C-C2C	-4.14	1.34	1.40
3	B	200	HEM	CAB-C3B	4.02	1.58	1.47
3	A	200	HEM	C3C-CAC	3.68	1.55	1.47
3	A	200	HEM	C3C-C2C	-3.65	1.35	1.40
3	D	200	HEM	C3C-CAC	3.62	1.55	1.47
3	D	200	HEM	CAB-C3B	3.36	1.56	1.47
3	A	200	HEM	CAB-C3B	3.32	1.56	1.47
5	D	300	TMM	C3-C3A	3.30	1.57	1.47
3	B	200	HEM	CMC-C2C	3.25	1.59	1.51
3	C	200	HEM	C3C-CAC	3.21	1.54	1.47
3	C	200	HEM	CHA-C4D	3.00	1.42	1.35
3	D	200	HEM	CMD-C2D	2.67	1.56	1.50
3	B	200	HEM	C4A-NA	2.60	1.41	1.36
3	A	200	HEM	C1A-NA	2.59	1.41	1.36
3	A	200	HEM	CHB-C1B	2.46	1.41	1.35
3	A	200	HEM	O2D-CGD	-2.45	1.22	1.30
3	D	200	HEM	C3D-C2D	-2.44	1.31	1.36
3	C	200	HEM	O1D-CGD	2.40	1.30	1.22
3	B	200	HEM	O2A-CGA	-2.32	1.22	1.30
3	B	200	HEM	C2A-C3A	-2.32	1.30	1.37
5	D	300	TMM	O6A-C5A	-2.23	1.23	1.30
3	A	200	HEM	C2C-C1C	2.22	1.47	1.42
3	C	200	HEM	CMC-C2C	2.22	1.56	1.51
3	B	200	HEM	FE-NB	2.17	2.07	1.96
3	C	200	HEM	CMA-C3A	2.13	1.56	1.51
3	D	200	HEM	C3B-C4B	2.13	1.49	1.44
3	B	200	HEM	CAA-C2A	-2.09	1.49	1.52
3	A	200	HEM	CMB-C2B	2.08	1.55	1.50
3	C	200	HEM	C4A-NA	2.07	1.40	1.36
3	A	200	HEM	C1D-C2D	2.04	1.48	1.44

All (40) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	200	HEM	C4B-CHC-C1C	4.71	128.77	122.56
3	C	200	HEM	CMA-C3A-C4A	-4.65	121.32	128.46
5	D	300	TMM	O3A-C3A-C3	-4.57	109.80	124.59
3	A	200	HEM	CMA-C3A-C4A	-4.46	121.62	128.46
5	D	300	TMM	C2-C3-C3A	3.80	128.08	119.98
3	D	200	HEM	CMA-C3A-C4A	-3.79	122.64	128.46
3	C	200	HEM	CMA-C3A-C2A	3.23	131.03	124.94

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	200	HEM	C4C-CHD-C1D	3.08	126.62	122.56
3	D	200	HEM	CMC-C2C-C3C	3.07	130.42	124.68
3	D	200	HEM	CMA-C3A-C2A	3.01	130.62	124.94
3	A	200	HEM	C4B-CHC-C1C	2.99	126.51	122.56
3	B	200	HEM	O1D-CGD-CBD	-2.99	113.47	123.08
3	A	200	HEM	CMA-C3A-C2A	2.99	130.58	124.94
3	B	200	HEM	CMC-C2C-C3C	2.98	130.25	124.68
5	D	300	TMM	C4-C5-C5A	2.97	125.37	119.98
3	D	200	HEM	CHC-C4B-C3B	2.96	129.10	124.57
3	B	200	HEM	C4B-CHC-C1C	2.76	126.19	122.56
3	D	200	HEM	C3B-C2B-C1B	2.73	108.51	106.49
3	C	200	HEM	C4B-CHC-C1C	2.73	126.16	122.56
5	D	300	TMM	C4-C3-C3A	-2.72	114.17	119.98
3	A	200	HEM	CMB-C2B-C1B	-2.48	121.26	125.04
3	C	200	HEM	CAD-C3D-C4D	-2.48	120.33	124.66
3	C	200	HEM	CBB-CAB-C3B	-2.45	115.42	127.62
5	D	300	TMM	C6-C5-C5A	-2.39	115.65	119.98
3	A	200	HEM	CMC-C2C-C3C	2.39	129.14	124.68
3	B	200	HEM	CMD-C2D-C1D	-2.37	121.44	125.04
3	B	200	HEM	CMA-C3A-C4A	-2.32	124.90	128.46
3	A	200	HEM	O1D-CGD-CBD	-2.30	115.68	123.08
3	D	200	HEM	C3D-C4D-ND	-2.27	107.64	110.17
3	D	200	HEM	CHC-C4B-NB	-2.25	121.99	124.43
3	C	200	HEM	C3D-C4D-ND	-2.21	107.71	110.17
3	C	200	HEM	O1A-CGA-CBA	-2.17	116.11	123.08
3	B	200	HEM	C3B-C2B-C1B	2.17	108.09	106.49
3	C	200	HEM	C2C-C3C-C4C	2.14	108.39	106.90
3	C	200	HEM	C4B-C3B-C2B	2.12	108.80	107.11
3	D	200	HEM	C4D-ND-C1D	2.12	107.26	105.07
3	B	200	HEM	CAD-C3D-C4D	-2.10	120.98	124.66
3	D	200	HEM	O1D-CGD-CBD	-2.09	116.37	123.08
3	B	200	HEM	C4C-CHD-C1D	2.04	125.25	122.56
3	C	200	HEM	O2D-CGD-O1D	2.03	128.35	123.30

There are no chirality outliers.

All (18) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	D	200	HEM	C4B-C3B-CAB-CBB
3	B	200	HEM	C2D-C3D-CAD-CBD
3	D	200	HEM	C2B-C3B-CAB-CBB
5	D	300	TMM	C4-C5-C5A-O6A

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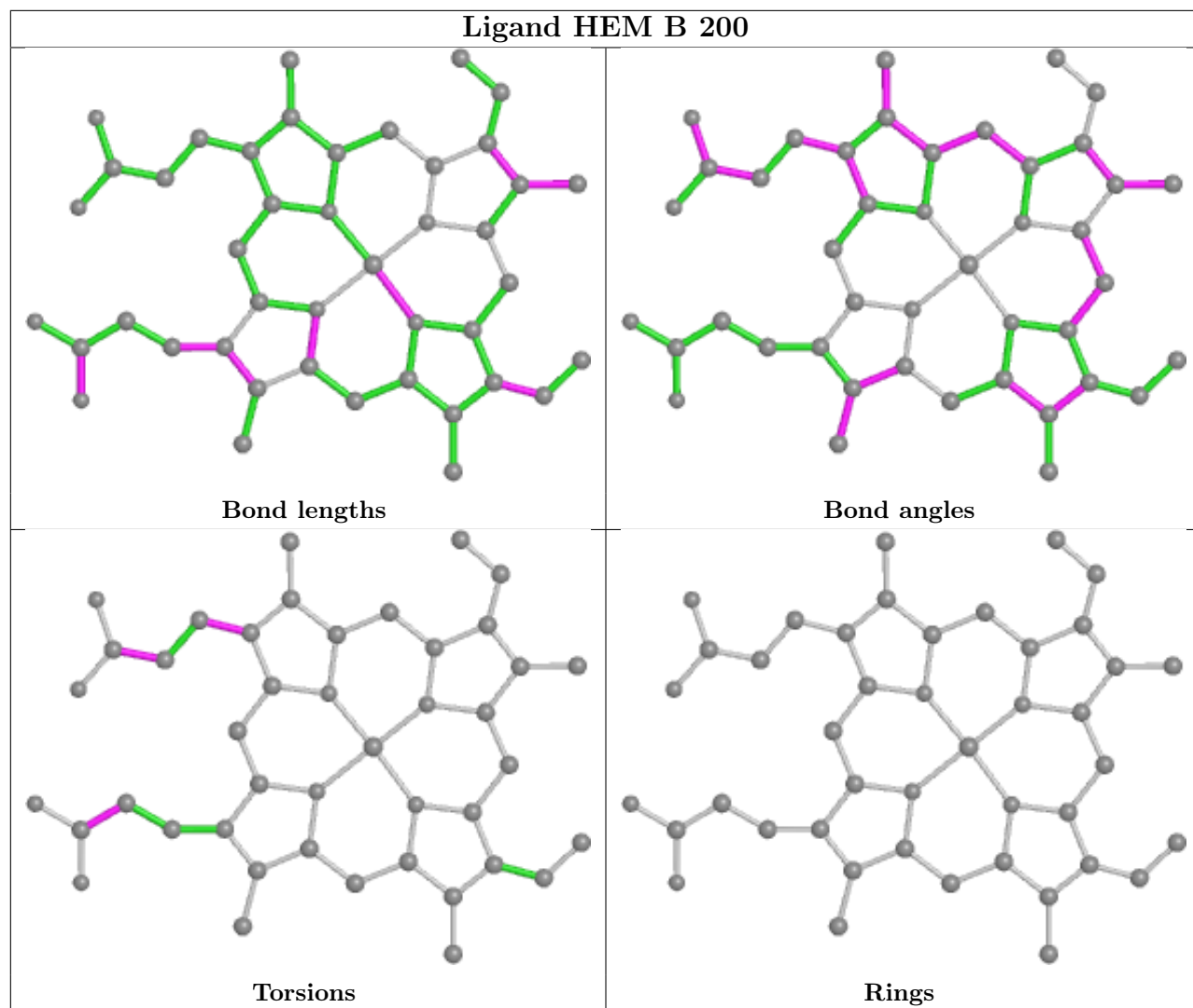
Mol	Chain	Res	Type	Atoms
5	D	300	TMM	C4-C5-C5A-O5A
5	D	300	TMM	C6-C5-C5A-O6A
5	D	300	TMM	C6-C5-C5A-O5A
3	B	200	HEM	C4D-C3D-CAD-CBD
3	A	200	HEM	CAD-CBD-CGD-O2D
3	B	200	HEM	CAD-CBD-CGD-O1D
3	D	200	HEM	CAD-CBD-CGD-O1D
3	A	200	HEM	CAD-CBD-CGD-O1D
3	D	200	HEM	CAD-CBD-CGD-O2D
3	B	200	HEM	CAD-CBD-CGD-O2D
3	B	200	HEM	CAA-CBA-CGA-O2A
3	C	200	HEM	CAD-CBD-CGD-O2D
3	B	200	HEM	CAA-CBA-CGA-O1A
3	C	200	HEM	CAD-CBD-CGD-O1D

There are no ring outliers.

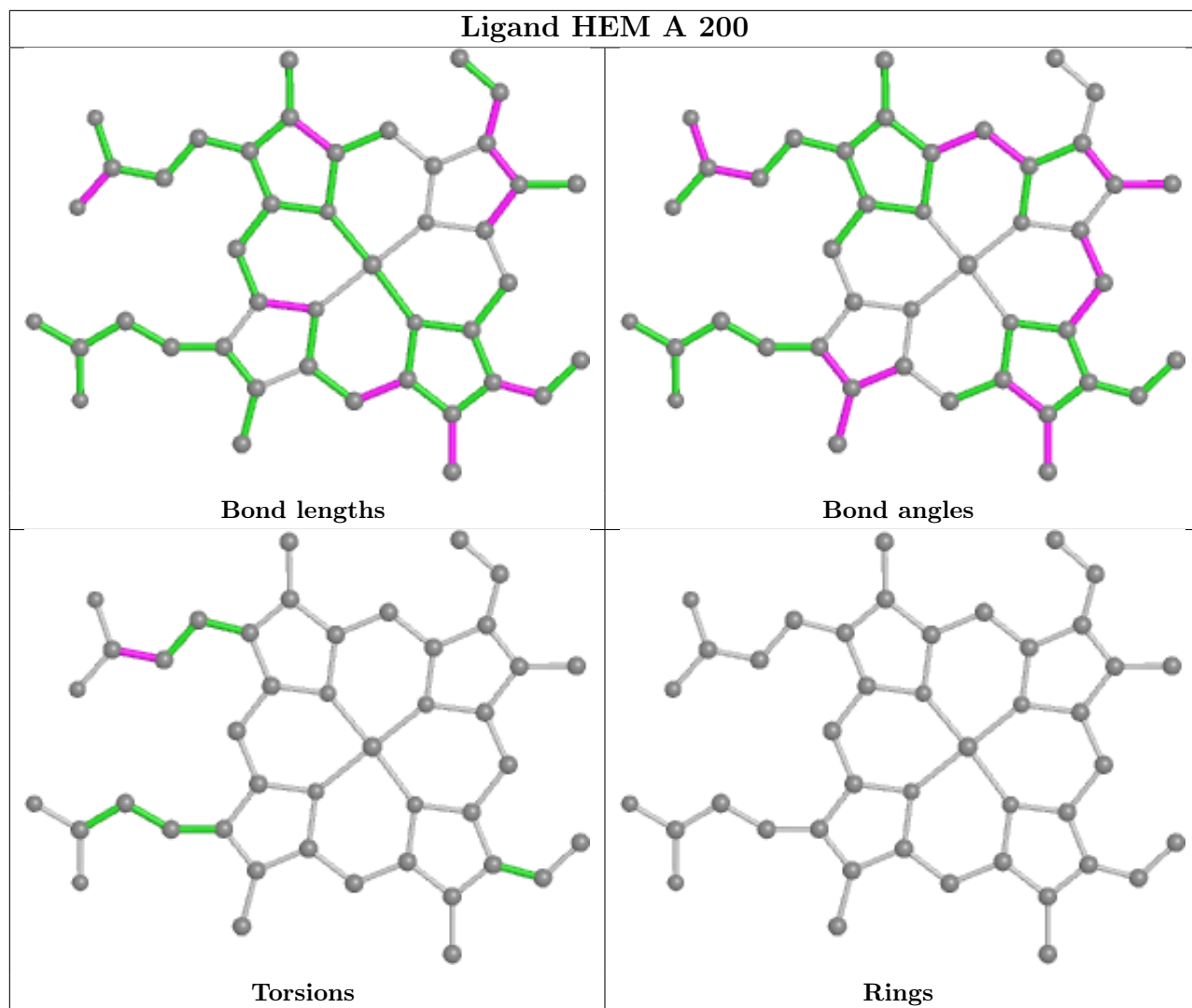
4 monomers are involved in 7 short contacts:

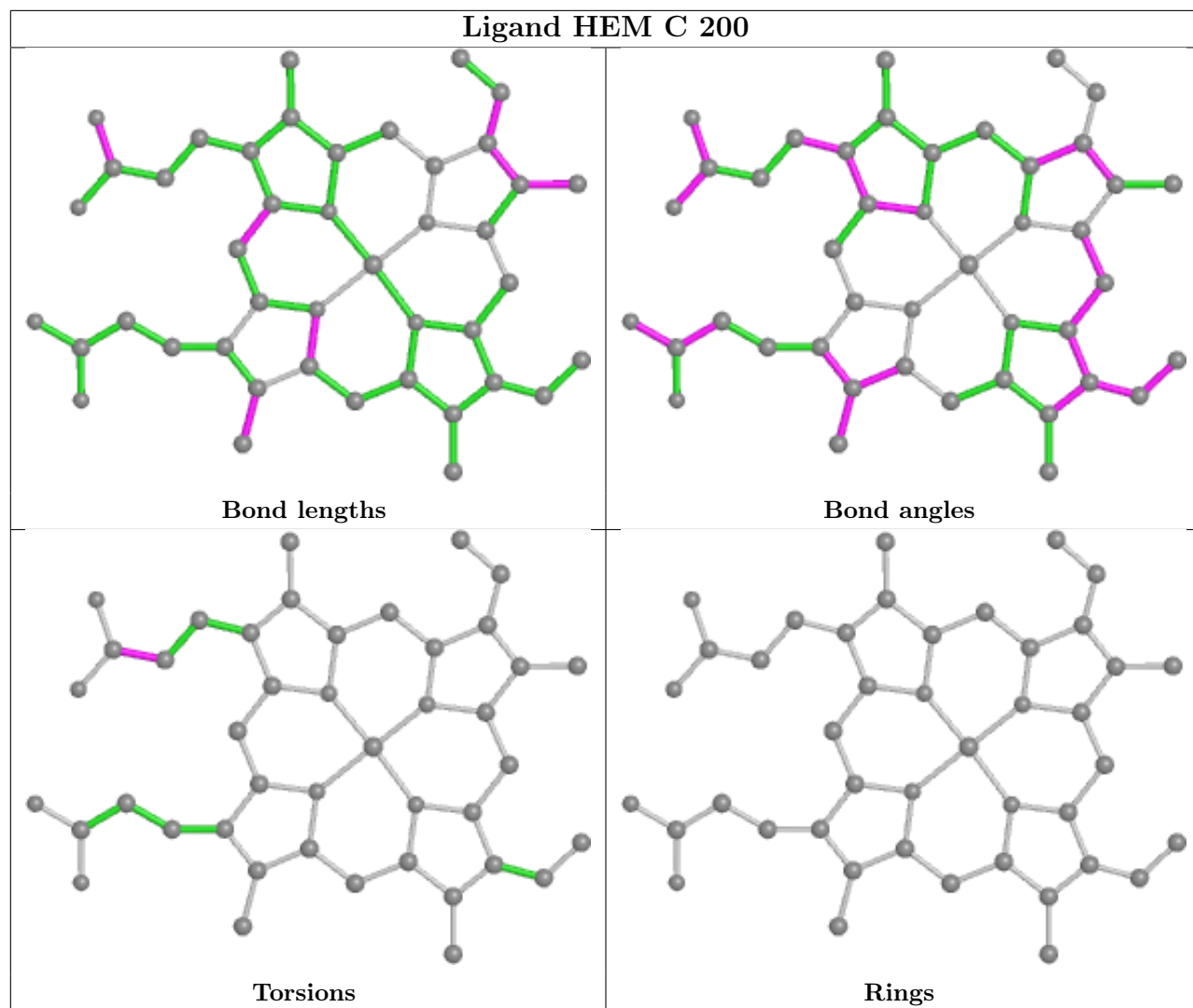
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	200	HEM	3	0
3	A	200	HEM	1	0
5	D	300	TMM	1	0
3	D	200	HEM	2	0

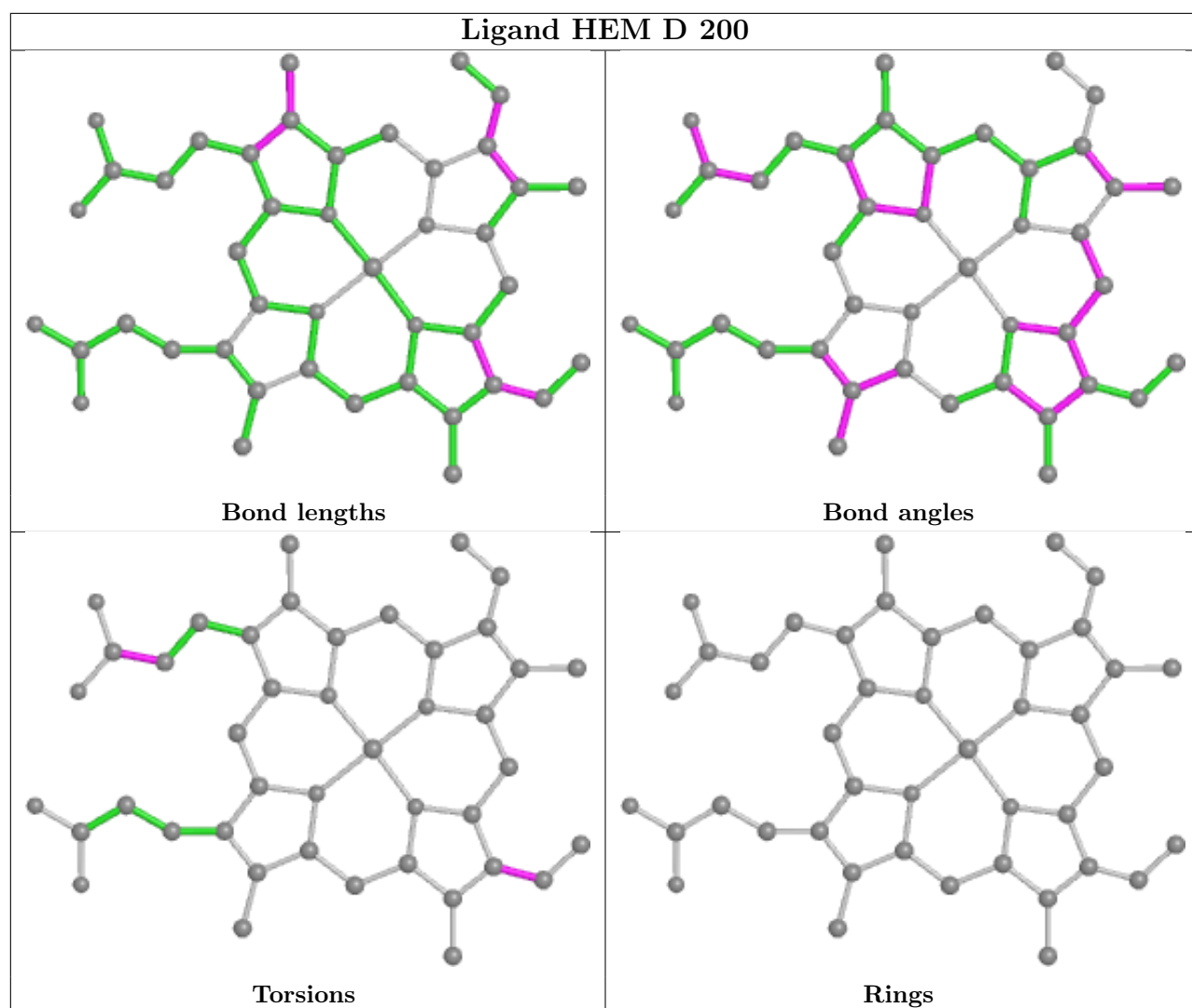
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.











## 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](#)

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates [i](#)

EDS was not executed - this section is therefore empty.

### 6.4 Ligands [i](#)

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.