



# wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 14, 2023 – 05:25 PM EDT

PDB ID : 1RP7  
Title : E. COLI PYRUVATE DEHYDROGENASE INHIBITOR COMPLEX  
Authors : Arjunan, P.; Chandrasekhar, K.; Furey, W.  
Deposited on : 2003-12-03  
Resolution : 2.09 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)  
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) : 2.35

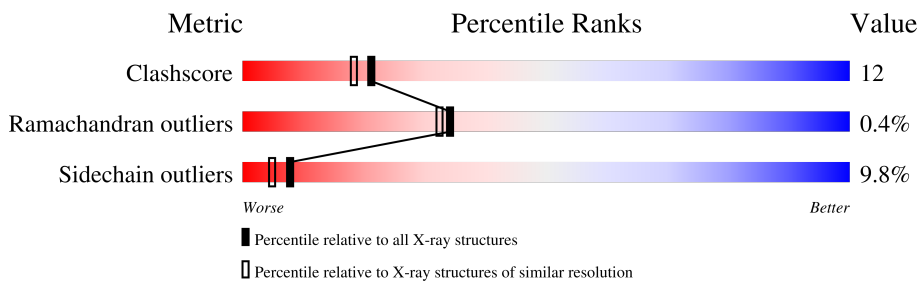
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.09 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	5710 (2.10-2.10)
Ramachandran outliers	138981	5647 (2.10-2.10)
Sidechain outliers	138945	5648 (2.10-2.10)

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	886	
1	B	886	

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 13237 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.

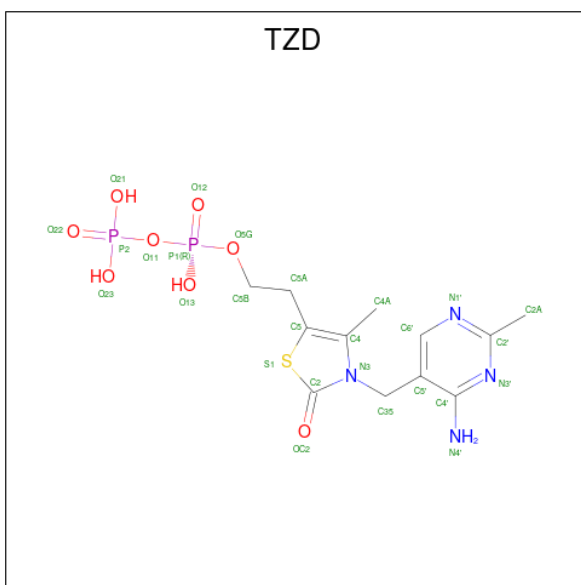
- Molecule 1 is a protein called Pyruvate dehydrogenase E1 component.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	801	6341	4018	1093	1204	26	0	0	0
1	B	801	6341	4018	1093	1204	26	0	0	0

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Mg	0	0
			1	1		
2	B	1	Total	Mg	0	0
			1	1		

- Molecule 3 is 2-{3-[(4-AMINO-2-METHYLPYRIMIDIN-5-YL)METHYL]-4-METHYL-2-OXO-2,3-DIHYDRO-1,3-THIAZOL-5-YL}ETHYL TRIHYDROGEN DIPHOSPHATE (three-letter code: TZD) (formula: C<sub>12</sub>H<sub>18</sub>N<sub>4</sub>O<sub>8</sub>P<sub>2</sub>S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
			Total	C	N	O	P			S
3	A	1	27	12	4	8	2	1	0	0
3	B	1	27	12	4	8	2	1	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	223	Total	O	0	0
			223	223		
4	B	276	Total	O	0	0
			276	276		

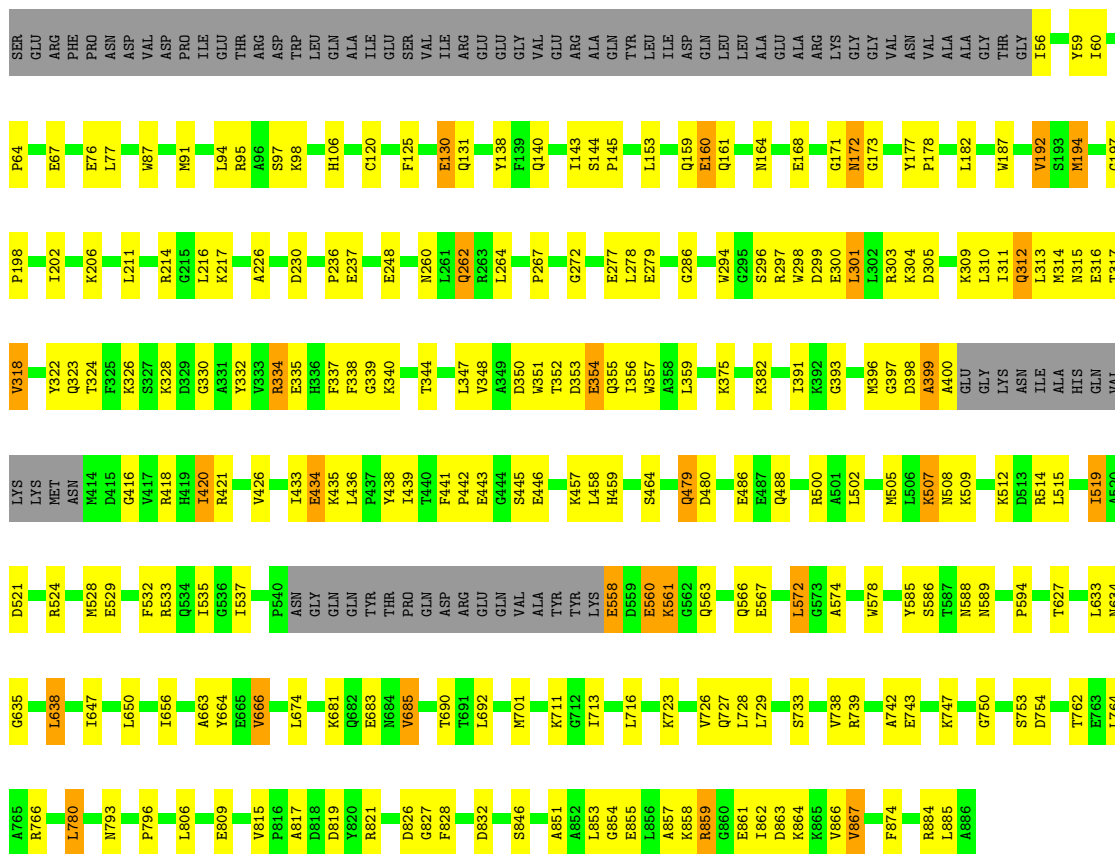
### 3 Residue-property plots

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.

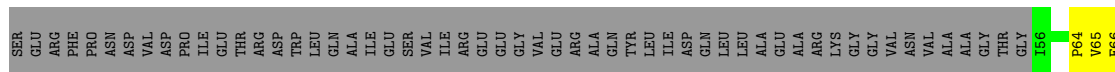
- Molecule 1: Pyruvate dehydrogenase E1 component

Chain A: 



- Molecule 1: Pyruvate dehydrogenase E1 component

Chain B: 



E67	G197	K304	LYS	N508	P591	Y803
Q68	P198	K309	ASN	K509	Y599	L806
P69	Y203	T317	ILE	K512	L610	F807
E70	K206	Y322	ALA	L515	G626	A808
E76	F207	Q323	HIS	D521	T627	E809
L77	L208	K326	GLN	E522	L633	Q810
E78	K209	G330	VAL	G527	L638	V811
R79	Y210	K340	LYS	M528	I666	V815
R82	Y211	Y341	LYS	E529	Y664	D818
W87	L211	F342	ASN	G530	V668	F828
I90	E212	E343	MET	L531	E680	V843
M91	K221	T344	ASN	F532	K681	S846
R95	Q222	T344	M414	R533	E685	E855
A96	L228	V348	D415	I537	V685	L856
S97	D230	A349	R418	Y538	E694	R859
L103	G231	D350	H419	S539	M698	G860
H106	E232	D351	I420	P540	M701	E861
M107	M233	T352	R421	ASN	I713	K664
S112	D234	G353	D422	GLY	L716	F874
F125	K239	E354	V426	GLN	E717	D877
G134	I242	Q355	P427	GLN	T718	R880
Q140	T243	I356	V428	THR	I719	V881
I143	E248	L359	S429	PRO	E720	A886
S144	N260	K360	D432	GLN	G721	
P145	L261	R361	I433	GLN	S722	
M164	Q262	D365	E434	THR	G724	
V169	R263	K368	K435	ASP	K725	
N172	L264	K374	I439	ARG	R736	
G173	D265	K375	P442	ARG	H737	
L174	G266	A376	E443	GLU	V738	
S175	V268	Q377	S444	GLN	R739	
Y176	F282	K380	E446	ALA	K747	
P178	W287	G381	Y450	TYR	G752	
W187	W294	K382	Q454	LYS	L764	
Q188	R297	V385	L458	E558	P779	
F189	W298	T390	E471	D559	L780	
P190	D299	I391	L475	G560	R784	
T191	E300	K392	L484	E564	S800	
W192	A399	G393	Q488	L564		
S193	A400	Y394	S489	L565		
M194	L302	V395	K490	Q566		
G195	R303	T399	I496	E567		
L196		L494	R500	N570		
		Q488	L506	A574		
		S489	K507	G575		
		K490		C576		
		I496		Y585		
		R500		T587		
		L506		N588		
		K507		L590		

## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	81.55Å 141.84Å 82.17Å 90.00° 102.61° 90.00°	Depositor
Resolution (Å)	8.00 – 2.09	Depositor
% Data completeness (in resolution range)	84.5 (8.00-2.09)	Depositor
$R_{merge}$	0.07	Depositor
$R_{sym}$	0.07	Depositor
Refinement program	X-PLOR 3.851	Depositor
R, $R_{free}$	0.192 , 0.252	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	13237	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	18.0	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: MG, TZD

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	0.36	0/6484	0.60	1/8766 (0.0%)
1	B	0.37	0/6484	0.61	1/8766 (0.0%)
All	All	0.36	0/12968	0.61	2/17532 (0.0%)

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

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
1	A	171	GLY	N-CA-C	5.40	126.61	113.10
1	B	638	LEU	CA-CB-CG	5.35	127.61	115.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	803	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	A	6341	0	6179	162	0
1	B	6341	0	6179	154	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	27	0	15	0	0
3	B	27	0	15	1	0
4	A	223	0	0	2	0
4	B	276	0	0	10	0
All	All	13237	0	12388	304	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 12.

The worst 5 of 304 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:309:LYS:HG3	1:B:343:GLU:HG3	1.34	1.09
1:B:90:ILE:HG12	1:B:107:MET:HE3	1.37	1.01
1:A:64:PRO:HG2	1:A:67:GLU:HG3	1.47	0.96
1:B:509:LYS:H	1:B:509:LYS:HD2	1.30	0.95
1:B:198:PRO:HG3	1:B:228:LEU:HD22	1.52	0.91

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	795/886 (90%)	752 (95%)	40 (5%)	3 (0%)	34 32
1	B	795/886 (90%)	755 (95%)	37 (5%)	3 (0%)	34 32

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	1590/1772 (90%)	1507 (95%)	77 (5%)	6 (0%)	34	32

5 of 6 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	397	GLY
1	A	305	ASP
1	B	627	THR
1	B	398	ASP
1	A	399	ALA

### 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	665/735 (90%)	605 (91%)	60 (9%)	9	6
1	B	665/735 (90%)	595 (90%)	70 (10%)	7	4
All	All	1330/1470 (90%)	1200 (90%)	130 (10%)	8	5

5 of 130 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	610	LEU
1	B	718	THR
1	A	690	THR
1	A	685	VAL
1	B	725	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 6 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	106	HIS
1	B	466	GLN
1	B	737	HIS

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Mol	Chain	Res	Type
1	A	466	GLN
1	A	106	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](#)

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 for Mogul analysis.

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
3	TZD	A	889	2	23,28,28	1.56	6 (26%)	28,42,42	1.09	2 (7%)
3	TZD	B	887	2	23,28,28	1.65	5 (21%)	28,42,42	1.10	2 (7%)

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	TZD	A	889	2	-	3/16/17/17	0/2/2/2

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	TZD	B	887	2	-	5/16/17/17	0/2/2/2

The worst 5 of 11 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	887	TZD	C4'-N3'	3.86	1.40	1.35
3	A	889	TZD	C4'-N3'	3.69	1.40	1.35
3	B	887	TZD	C5'-C4'	3.61	1.49	1.42
3	A	889	TZD	C5'-C4'	3.31	1.48	1.42
3	B	887	TZD	C2'-N1'	2.65	1.38	1.34

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	887	TZD	C6'-N1'-C2'	2.59	120.37	115.96
3	A	889	TZD	C6'-N1'-C2'	2.54	120.28	115.96
3	B	887	TZD	C5-C4-N3	2.17	112.20	107.66
3	A	889	TZD	C5-C4-N3	2.01	111.87	107.66

There are no chirality outliers.

5 of 8 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	889	TZD	P1-O11-P2-O21
3	B	887	TZD	C4-C5-C5A-C5B
3	B	887	TZD	P1-O11-P2-O21
3	B	887	TZD	P1-O11-P2-O23
3	A	889	TZD	C4-C5-C5A-C5B

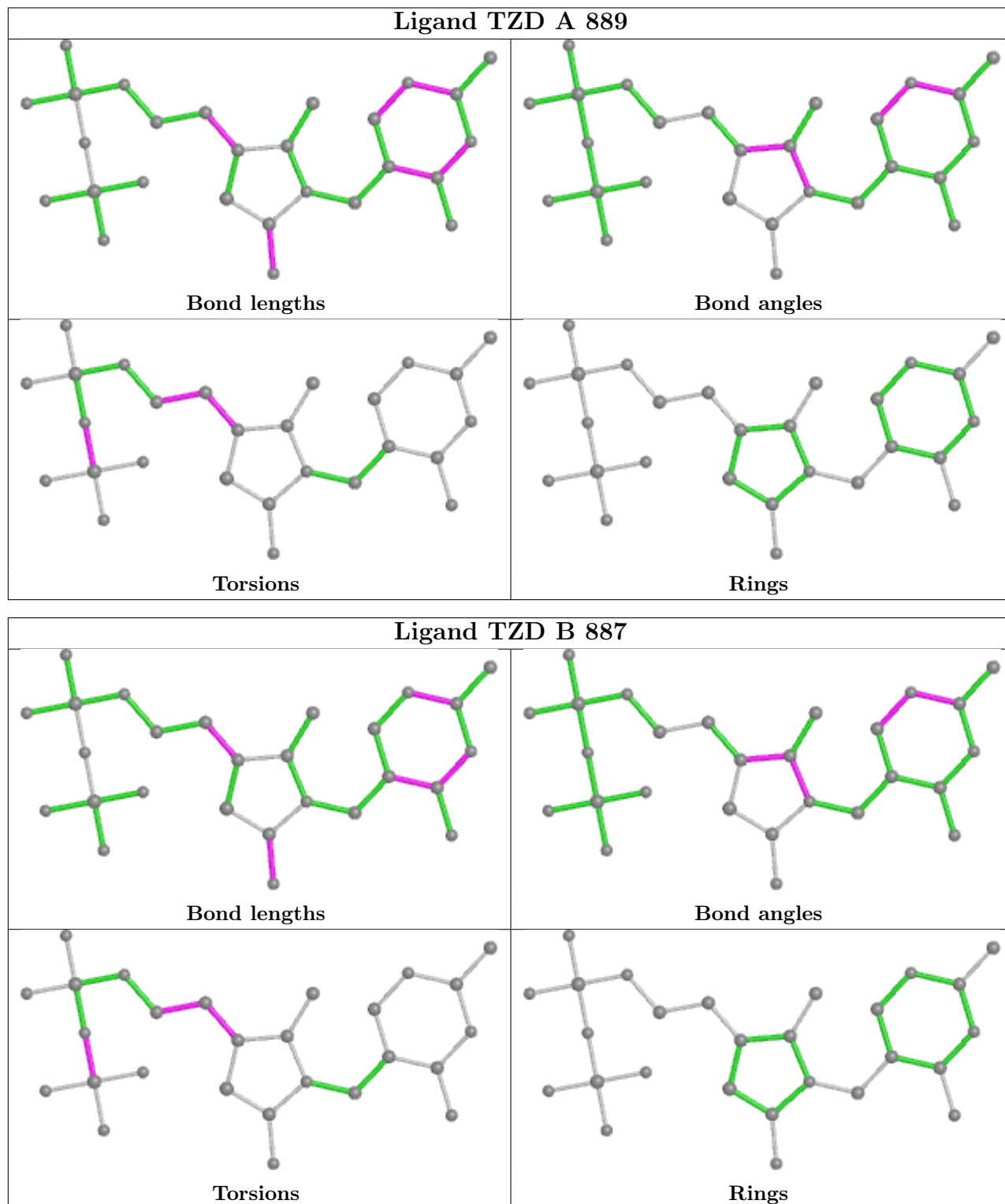
There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	887	TZD	1	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

### 6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

### 6.4 Ligands

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers

EDS was not executed - this section is therefore empty.