



wwPDB X-ray Structure Validation Summary Report ⓘ

Jan 31, 2016 – 07:31 PM GMT

PDB ID : 1FZ5
Title : METHANE MONOOXYGENASE HYDROXYLASE, FORM II CRYSTALLIZED ANAEROBICALLY FROM REDUCED ENZYME
Authors : Whittington, D.A.; Lippard, S.J.
Deposited on : 2000-10-03
Resolution : 2.40 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
A user guide is available at
<http://wwpdb.org/validation/2016/XrayValidationReportHelp>
with specific help available everywhere you see the ⓘ symbol.

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

MolProbity : 4.02b-467
Mogul : 1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20026688
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac : 5.8.0135
CCP4 : 6.5.0
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk26865

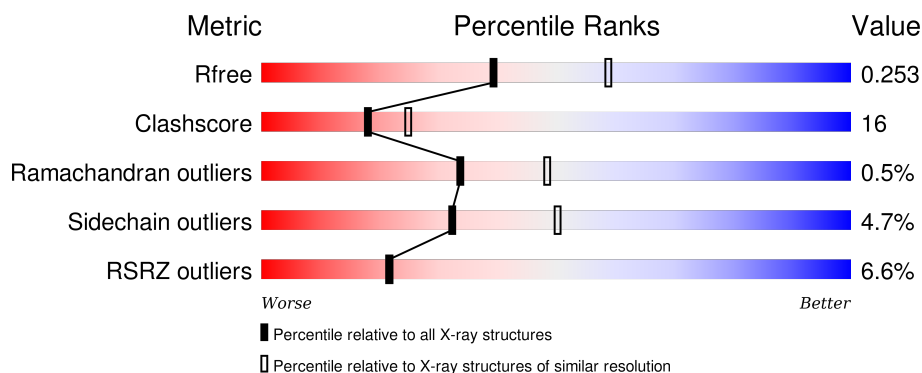
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.40 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}	91344	2919 (2.40-2.40)
Clashscore	102246	3407 (2.40-2.40)
Ramachandran outliers	100387	3351 (2.40-2.40)
Sidechain outliers	100360	3352 (2.40-2.40)
RSRZ outliers	91569	2928 (2.40-2.40)

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 ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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	527	<div> <div>6%</div> <div> <div></div> <div>65%</div> <div>29%</div> <div>• •</div> </div> </div>
1	B	527	<div> <div>7%</div> <div> <div></div> <div>65%</div> <div>29%</div> <div>• •</div> </div> </div>
2	C	389	<div> <div></div> <div> <div></div> <div>74%</div> <div>23%</div> <div>•</div> </div> </div>
2	D	389	<div> <div>10%</div> <div> <div></div> <div>72%</div> <div>25%</div> <div>• •</div> </div> </div>
3	E	170	<div> <div>%</div> <div> <div></div> <div>61%</div> <div>32%</div> <div>• •</div> </div> </div>

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Mol	Chain	Length	Quality of chain
3	F	170	 A horizontal bar chart showing the quality of chain F. The bar is divided into four segments: red (18%), green (62%), yellow (32%), and orange (5%). The segments are labeled with their respective percentages: 18%, 62%, 32%, and 5%.

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 18004 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 METHANE MONOOXYGENASE COMPONENT A, ALPHA CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	511	Total	C	N	O	S	0	0	0
			4181	2675	721	767	18			
1	B	510	Total	C	N	O	S	0	0	0
			4177	2673	719	767	18			

- Molecule 2 is a protein called METHANE MONOOXYGENASE COMPONENT A, BETA CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	388	Total	C	N	O	S	0	0	0
			3193	2054	551	580	8			
2	D	386	Total	C	N	O	S	0	0	0
			3175	2042	548	577	8			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	370	ARG	ALA	CONFLICT	UNP P18798
D	370	ARG	ALA	CONFLICT	UNP P18798

- Molecule 3 is a protein called METHANE MONOOXYGENASE COMPONENT A, GAMMA CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	E	166	Total	C	N	O	S	0	0	0
			1368	867	246	250	5			
3	F	168	Total	C	N	O	S	0	0	0
			1382	875	249	253	5			

- Molecule 4 is FE (II) ION (three-letter code: FE2) (formula: Fe).

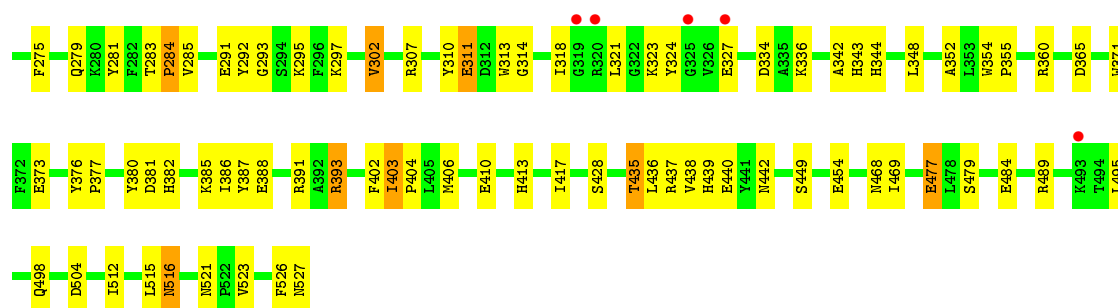
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	1	Total 1	Fe 1	0	0
4	A	1	Total 1	Fe 1	0	0

- Molecule 5 is CALCIUM ION (three-letter code: CA) (formula: Ca).

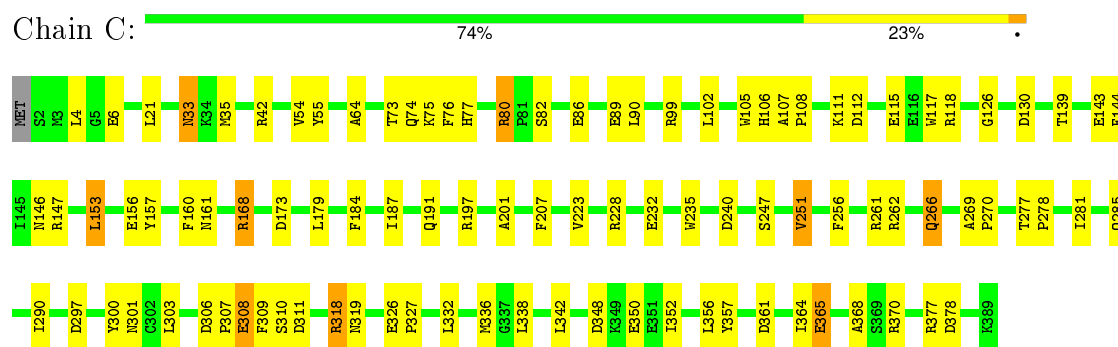
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total 1	Ca 1	0	0
5	C	1	Total 1	Ca 1	0	0

- Molecule 6 is water.

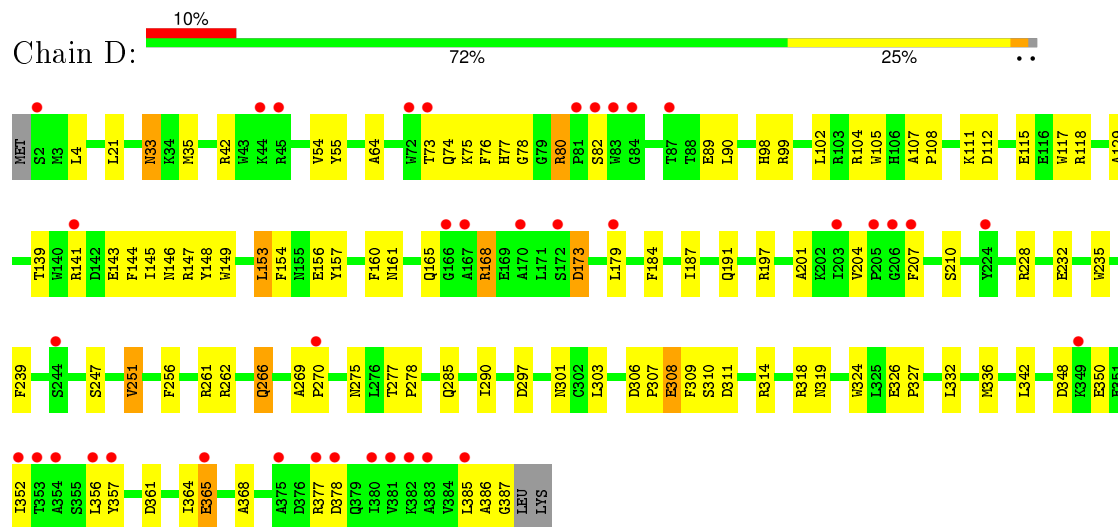
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	133	Total 133	O 133	0	0
6	B	89	Total 89	O 89	0	0
6	C	178	Total 178	O 178	0	0
6	D	42	Total 42	O 42	0	0
6	E	70	Total 70	O 70	0	0
6	F	12	Total 12	O 12	0	0



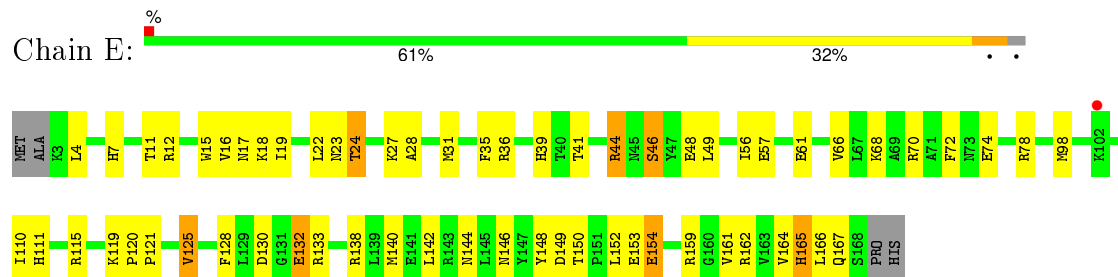
• Molecule 2: METHANE MONOOXYGENASE COMPONENT A, BETA CHAIN



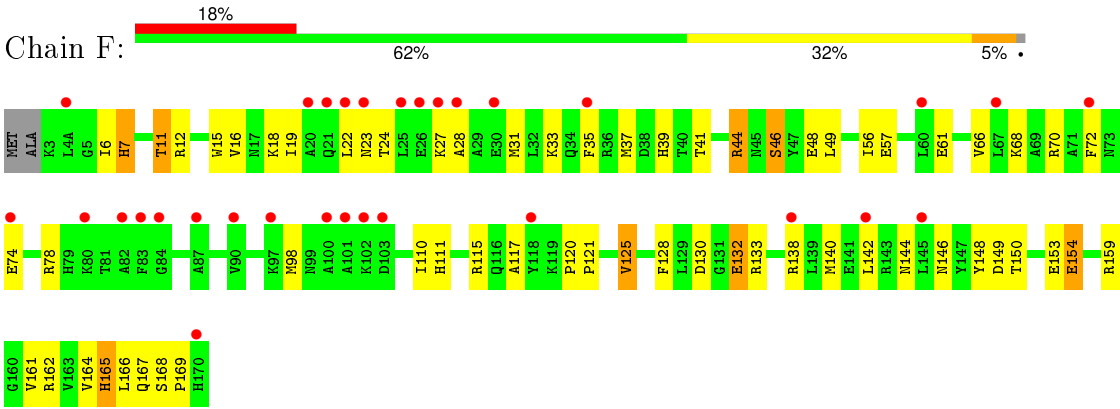
• Molecule 2: METHANE MONOOXYGENASE COMPONENT A, BETA CHAIN



• Molecule 3: METHANE MONOOXYGENASE COMPONENT A, GAMMA CHAIN



• Molecule 3: METHANE MONOOXYGENASE COMPONENT A, GAMMA CHAIN



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	71.24Å 171.57Å 220.52Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.40 – 2.40 49.08 – 2.40	Depositor EDS
% Data completeness (in resolution range)	89.2 (46.40-2.40) 89.3 (49.08-2.40)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.72 (at 2.39Å)	Xtriage
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.218 , 0.253 0.219 , 0.253	Depositor DCC
R_{free} test set	3359 reflections (3.53%)	DCC
Wilson B-factor (Å ²)	33.5	Xtriage
Anisotropy	0.169	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 45.0	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	0 of 104302 reflections	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	18004	wwPDB-VP
Average B, all atoms (Å ²)	44.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.61% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: CA, FE2

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	0.38	0/4306	0.70	9/5848 (0.2%)
1	B	0.39	0/4302	0.71	9/5842 (0.2%)
2	C	0.40	0/3289	0.65	3/4464 (0.1%)
2	D	0.36	0/3271	0.65	4/4442 (0.1%)
3	E	0.42	0/1396	0.61	0/1880
3	F	0.35	0/1412	0.58	0/1903
All	All	0.38	0/17976	0.67	25/24379 (0.1%)

There are no bond length outliers.

The worst 5 of 25 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	318	ARG	NE-CZ-NH1	13.78	127.19	120.30
2	C	318	ARG	NE-CZ-NH1	-13.70	113.45	120.30
2	D	318	ARG	NE-CZ-NH2	-13.58	113.51	120.30
1	B	77	ARG	NE-CZ-NH2	-13.18	113.71	120.30
1	A	77	ARG	NE-CZ-NH1	-12.11	114.25	120.30

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-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 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	4181	0	3977	153	0
1	B	4177	0	3975	156	0
2	C	3193	0	3042	87	0
2	D	3175	0	3018	92	0
3	E	1368	0	1363	59	0
3	F	1382	0	1366	62	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
5	A	1	0	0	0	0
5	C	1	0	0	0	0
6	A	133	0	0	3	0
6	B	89	0	0	2	0
6	C	178	0	0	8	0
6	D	42	0	0	0	0
6	E	70	0	0	1	0
6	F	12	0	0	0	0
All	All	18004	0	16741	538	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 16.

The worst 5 of 538 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:352:ALA:HA	1:A:404:PRO:HB2	1.36	1.06
1:B:352:ALA:HA	1:B:404:PRO:HB2	1.38	1.02
1:A:355:PRO:HG2	1:A:403:ILE:HD11	1.43	0.99
1:B:355:PRO:HG2	1:B:403:ILE:HD11	1.42	0.99
2:C:270:PRO:HB3	2:D:270:PRO:HB3	1.45	0.98

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	509/527 (97%)	481 (94%)	25 (5%)	3 (1%)	30	43
1	B	508/527 (96%)	479 (94%)	27 (5%)	2 (0%)	39	56
2	C	386/389 (99%)	368 (95%)	16 (4%)	2 (0%)	34	48
2	D	384/389 (99%)	363 (94%)	18 (5%)	3 (1%)	24	35
3	E	164/170 (96%)	161 (98%)	3 (2%)	0	100	100
3	F	166/170 (98%)	162 (98%)	4 (2%)	0	100	100
All	All	2117/2172 (98%)	2014 (95%)	93 (4%)	10 (0%)	34	48

5 of 10 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	D	386	ALA
2	C	64	ALA
2	D	64	ALA
1	A	40	LYS
1	B	40	LYS

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	A	432/442 (98%)	411 (95%)	21 (5%)	31	48
1	B	432/442 (98%)	411 (95%)	21 (5%)	31	48
2	C	322/323 (100%)	310 (96%)	12 (4%)	41	62
2	D	320/323 (99%)	308 (96%)	12 (4%)	40	60
3	E	144/147 (98%)	134 (93%)	10 (7%)	19	30
3	F	145/147 (99%)	136 (94%)	9 (6%)	23	35
All	All	1795/1824 (98%)	1710 (95%)	85 (5%)	32	50

5 of 85 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	442	ASN

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Mol	Chain	Res	Type
2	C	173	ASP
3	F	23	ASN
1	B	477	GLU
2	C	35	MET

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 72 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	227	ASN
1	B	344	HIS
3	E	167	GLN
1	B	249	ASN
1	B	273	ASN

5.3.3 RNA ⓘ

There are no RNA molecules 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 ⓘ

Of 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

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, 95th 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 ²)	Q<0.9
1	A	511/527 (96%)	0.28	33 (6%) 22 22	22, 42, 71, 88	0
1	B	510/527 (96%)	0.24	37 (7%) 18 18	25, 41, 74, 87	0
2	C	388/389 (99%)	-0.29	0 100 100	19, 28, 47, 65	0
2	D	386/389 (99%)	0.62	38 (9%) 10 9	27, 53, 84, 89	0
3	E	166/170 (97%)	-0.30	1 (0%) 90 90	18, 32, 51, 68	0
3	F	168/170 (98%)	1.05	31 (18%) 2 2	42, 62, 83, 92	0
All	All	2129/2172 (98%)	0.24	140 (6%) 22 22	18, 41, 77, 92	0

The worst 5 of 140 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	D	380	ILE	6.4
1	B	264	ALA	6.2
1	A	310	TYR	5.7
2	D	353	THR	5.1
2	D	205	PRO	4.9

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 [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. 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, 95th 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	LLDF	B-factors(Å ²)	Q<0.9
4	FE2	B	5003	1/1	0.87	0.18	0.88	58,58,58,58	0
5	CA	A	5005	1/1	0.98	0.10	-1.89	53,53,53,53	0
4	FE2	A	5001	1/1	0.96	0.12	-2.48	56,56,56,56	0
5	CA	C	5006	1/1	0.93	0.08	-	64,64,64,64	0

6.5 Other polymers [i](#)

There are no such residues in this entry.