



Full wwPDB X-ray Structure Validation Report

Feb 26, 2014 – 03:09 PM GMT

PDB ID : 1CF3
Title : GLUCOSE OXIDASE FROM APERGILLUS NIGER
Authors : Hecht, H.J.; Kalisz, H.
Deposited on : 1999-03-23
Resolution : 1.90 Å(reported)

This is a full wwPDB validation 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/ValidationPDFNotes.html>

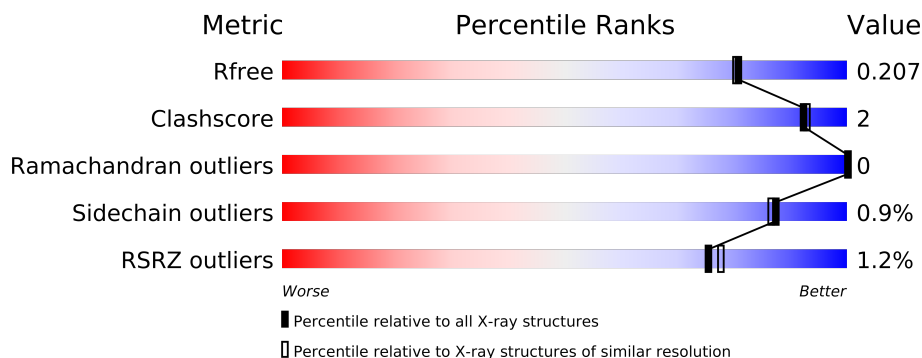
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.15 2013
Xtriage (Phenix) : dev-1323
EDS : stable22639
Percentile statistics : 21963
Refmac : 5.8.0049
CCP4 : 6.3.0 (Settle)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : stable22683

1 Overall quality at a glance


The reported resolution of this entry is 1.90 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}	66092	3684 (1.90-1.90)
Clashscore	79885	4465 (1.90-1.90)
Ramachandran outliers	78287	4413 (1.90-1.90)
Sidechain outliers	78261	4414 (1.90-1.90)
RSRZ outliers	66119	3686 (1.90-1.90)

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. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	583	

The following table lists non-polymeric compounds that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
3	NAG	A	603	-	X

2 Entry composition i

There are 5 unique types of molecules in this entry. The entry contains 4917 atoms, of which 0 are hydrogen and 0 are deuterium.

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 PROTEIN (GLUCOSE OXIDASE).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	581	Total	C	N	O	S	0	0	0
			4452	2801	764	873	14			

- Molecule 2 is a polymer of unknown type called SUGAR (5-MER).

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	5	Total	C	N	O	0	0
			61	34	2	25		

- Molecule 3 is SUGAR (N-ACETYL-D-GLUCOSAMINE) (three-letter code: NAG) (formula: $C_8H_{15}NO_6$).



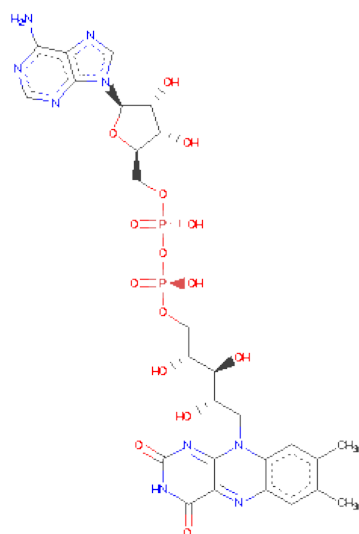
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			14	8	1	5		
3	A	1	Total	C	N	O	0	0
			14	8	1	5		

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 4 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula: $C_{27}H_{33}N_9O_{15}P_2$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	0	0
			53	27	9	15	2		

- Molecule 5 is water.

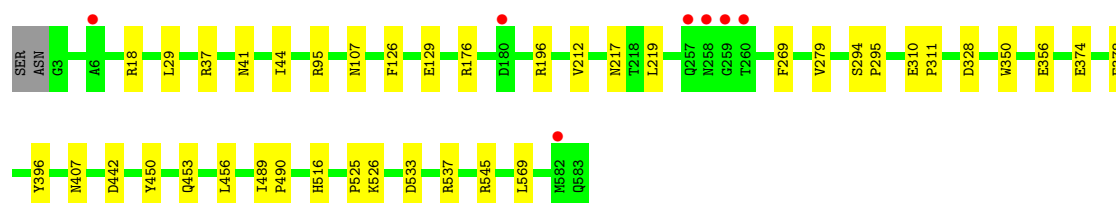
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	309	Total	O	0	0
			309	309		

3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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: PROTEIN (GLUCOSE OXIDASE)

Chain A: 



4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	67.54Å 67.54Å 215.38Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	20.00 – 1.90 19.67 – 1.90	Depositor EDS
% Data completeness (in resolution range)	87.7 (20.00-1.90) 87.9 (19.67-1.90)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	7.17 (at 1.90Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.190 , 0.240 0.162 , 0.207	Depositor DCC
R_{free} test set	2026 reflections (5.28%)	DCC
Wilson B-factor (Å ²)	19.6	Xtriage
Anisotropy	0.476	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 41.1	EDS
Estimated twinning fraction	0.021 for -h,-k,l	Xtriage
L-test for twinning	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtriage
Outliers	0 of 40394 reflections	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	4917	wwPDB-VP
Average B, all atoms (Å ²)	24.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.88% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: BMA, NAG, FAD, MAN

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	0.46	0/4560	1.03	15/6219 (0.2%)

There are no bond length outliers.

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	18	ARG	CD-NE-CZ	8.40	135.36	123.60
1	A	18	ARG	NE-CZ-NH1	6.42	123.51	120.30
1	A	442	ASP	CB-CG-OD1	6.23	123.91	118.30
1	A	450	TYR	CB-CG-CD2	-6.18	117.29	121.00
1	A	396	TYR	CB-CG-CD2	-5.97	117.42	121.00
1	A	176	ARG	NE-CZ-NH2	-5.64	117.48	120.30
1	A	450	TYR	CB-CG-CD1	5.55	124.33	121.00
1	A	196	ARG	NE-CZ-NH2	-5.40	117.60	120.30
1	A	328	ASP	CB-CG-OD1	5.38	123.14	118.30
1	A	95	ARG	NE-CZ-NH1	5.31	122.95	120.30
1	A	396	TYR	CB-CG-CD1	5.29	124.17	121.00
1	A	537	ARG	NE-CZ-NH2	-5.24	117.68	120.30
1	A	356	GLU	OE1-CD-OE2	-5.15	117.12	123.30
1	A	533	ASP	CB-CG-OD1	5.12	122.91	118.30
1	A	545	ARG	NE-CZ-NH1	5.02	122.81	120.30

There are no chirality outliers.

There are no planarity outliers.

5.2 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 hydrogens

added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	4452	0	4240	15	0
2	A	61	0	52	0	0
3	A	42	0	39	0	0
4	A	53	0	31	3	0
5	A	309	0	0	2	0
All	All	4917	0	4362	16	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 2.

All (16) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:269:PHE:HE1	1:A:279:VAL:HG23	1.57	0.69
1:A:310:GLU:HB3	1:A:311:PRO:HD3	1.83	0.60
1:A:107:ASN:HB2	4:A:600:FAD:C5X	2.36	0.56
1:A:41:ASN:HB3	1:A:44:ILE:HD12	1.90	0.53
1:A:107:ASN:HB2	4:A:600:FAD:N5	2.24	0.53
1:A:37:ARG:HH21	1:A:569:LEU:HD22	1.75	0.50
1:A:126:PHE:O	1:A:525:PRO:HD3	2.15	0.46
1:A:453:GLN:HB3	1:A:456:LEU:HD12	1.97	0.45
1:A:526:LYS:HE3	5:A:636:HOH:O	2.17	0.45
1:A:29:LEU:HD23	1:A:29:LEU:C	2.38	0.43
1:A:129:GLU:HG3	5:A:648:HOH:O	2.17	0.43
1:A:294:SER:N	1:A:295:PRO:HD2	2.35	0.42
1:A:374:GLU:O	1:A:378:GLU:HG3	2.19	0.42
4:A:600:FAD:H1'1	4:A:600:FAD:H9	1.84	0.41
1:A:212:VAL:HG22	1:A:350:TRP:HB2	2.03	0.41
1:A:489:ILE:HA	1:A:490:PRO:C	2.41	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone ⓘ

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	579/583 (99%)	560 (97%)	19 (3%)	0	100	100

There are no Ramachandran outliers to report.

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	466/468 (100%)	462 (99%)	4 (1%)	87	86

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	217	ASN
1	A	219	LEU
1	A	407	ASN
1	A	516	HIS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	142	GLN
1	A	407	ASN
1	A	493	ASN

5.3.3 RNA ⓘ

There are no RNA chains 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 ⓘ

5 carbohydrates 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	NAG	A	601	1,2	12,14,15	1.47	2 (16%)	15,19,21	0.70	0
2	NAG	A	602	2	12,14,15	1.34	2 (16%)	15,19,21	0.75	0
2	BMA	A	613	2	10,11,12	0.60	0	11,15,17	1.01	1 (9%)
2	MAN	A	615	2	10,11,12	0.78	0	11,15,17	1.40	1 (9%)
2	MAN	A	616	2	10,11,12	0.64	0	11,15,17	1.13	1 (9%)

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	NAG	A	601	1,2	-	0/6/23/26	0/1/1/1
2	NAG	A	602	2	-	0/6/23/26	0/1/1/1
2	BMA	A	613	2	-	0/2/19/22	0/1/1/1
2	MAN	A	615	2	-	0/2/19/22	0/1/1/1
2	MAN	A	616	2	-	0/2/19/22	0/1/1/1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	601	NAG	O7-C7	-3.70	1.15	1.23
2	A	602	NAG	O7-C7	-3.49	1.15	1.23
2	A	601	NAG	O5-C5	-2.16	1.41	1.45
2	A	602	NAG	O5-C5	-2.14	1.41	1.45

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	616	MAN	C4-C3-C2	2.84	114.32	110.50

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	613	BMA	C4-C3-C2	2.39	113.72	110.50
2	A	615	MAN	O3-C3-C4	2.17	115.22	110.35

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

5.6 Ligand geometry

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$
4	FAD	A	600	-	58,58,58	1.64	11 (18%)	85,89,89	1.83	17 (20%)
3	NAG	A	603	1	12,14,15	1.33	1 (8%)	15,19,21	0.76	0
3	NAG	A	604	1	12,14,15	1.33	2 (16%)	15,19,21	1.49	3 (20%)
3	NAG	A	605	1	12,14,15	1.53	2 (16%)	15,19,21	1.19	2 (13%)

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
4	FAD	A	600	-	-	0/34/50/50	0/1/6/6
3	NAG	A	603	1	-	0/6/23/26	0/1/1/1
3	NAG	A	604	1	-	0/6/23/26	0/1/1/1
3	NAG	A	605	1	-	0/6/23/26	0/1/1/1

All (16) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	600	FAD	PA-O2A	-4.26	1.36	1.55
3	A	605	NAG	O7-C7	-4.11	1.14	1.23
4	A	600	FAD	P-O3P	-3.97	1.52	1.59
4	A	600	FAD	O4B-C1B	3.94	1.47	1.41
3	A	603	NAG	O7-C7	-3.66	1.15	1.23
4	A	600	FAD	C1'-C2'	3.57	1.55	1.51
3	A	604	NAG	O7-C7	-3.57	1.15	1.23
4	A	600	FAD	O5'-C5'	3.32	1.58	1.44
4	A	600	FAD	P-O2P	-3.15	1.41	1.55
4	A	600	FAD	C4X-C10	2.80	1.45	1.40
4	A	600	FAD	C2-N3	2.72	1.42	1.37
4	A	600	FAD	C9A-N10	2.44	1.42	1.38
4	A	600	FAD	C10-N10	-2.38	1.33	1.38
4	A	600	FAD	C4-C4X	2.32	1.45	1.41
3	A	605	NAG	O5-C5	-2.13	1.41	1.45
3	A	604	NAG	O5-C5	-2.08	1.41	1.45

All (22) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	600	FAD	C2-N1-C10	7.19	122.22	114.98
4	A	600	FAD	O4B-C1B-N9A	-6.32	102.56	108.44
4	A	600	FAD	C4X-C10-N1	-4.09	118.65	122.73
4	A	600	FAD	N3A-C2A-N1A	-3.99	125.37	128.71
4	A	600	FAD	C5'-C4'-C3'	-3.86	104.78	112.06
4	A	600	FAD	C2A-N1A-C6A	3.40	124.90	118.77
4	A	600	FAD	O4B-C1B-C2B	-3.35	101.64	106.77
4	A	600	FAD	C1'-N10-C9A	-3.17	115.79	118.87
3	A	605	NAG	O5-C5-C4	-3.05	106.78	110.65
4	A	600	FAD	C6-C5X-N5	-3.01	115.46	118.97
4	A	600	FAD	C1'-N10-C10	3.00	123.43	119.17
3	A	604	NAG	C3-C2-N2	2.96	116.26	111.76
3	A	604	NAG	C2-N2-C7	2.87	127.91	123.09
4	A	600	FAD	C4-N3-C2	-2.87	119.50	125.39
3	A	604	NAG	C4-C3-C2	-2.74	104.61	111.32
4	A	600	FAD	C5A-C6A-N6A	2.59	126.58	120.72
4	A	600	FAD	C4X-C10-N10	-2.53	119.25	120.51
3	A	605	NAG	C3-C2-N2	-2.22	108.38	111.76
4	A	600	FAD	N1-C10-N10	2.21	121.77	115.97
4	A	600	FAD	C4B-O4B-C1B	-2.11	107.45	109.75
4	A	600	FAD	C2'-C1'-N10	2.11	115.25	112.45
4	A	600	FAD	C5A-C4A-N9A	-2.02	104.25	107.16

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues

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	581/583 (99%)	-0.30	7 (1%) 75 78	9, 22, 40, 64	0

All (7) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	258	ASN	3.9
1	A	260	THR	3.8
1	A	582	MET	2.9
1	A	257	GLN	2.7
1	A	180	ASP	2.1
1	A	6	ALA	2.1
1	A	259	GLY	2.0

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 ⓘ

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	RSR	LLDF	B-factors(Å ²)	Q<0.9
2	BMA	A	613	11/12	0.17	1.28	37,40,41,43	0
2	NAG	A	601	14/15	0.10	1.11	26,28,30,31	0
2	MAN	A	615	11/12	0.16	1.11	43,44,47,49	0

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Mol	Type	Chain	Res	Atoms	RSR	LLDF	B-factors(\AA^2)	Q<0.9
2	NAG	A	602	14/15	0.13	0.35	31,34,37,38	0
2	MAN	A	616	11/12	0.31	-	51,54,55,55	0

6.4 Ligands

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	RSR	LLDF	B-factors(\AA^2)	Q<0.9
3	NAG	A	603	14/15	0.33	2.30	49,53,55,55	0
3	NAG	A	605	14/15	0.10	0.75	25,27,33,34	0
3	NAG	A	604	14/15	0.13	0.60	28,31,34,37	0
4	FAD	A	600	53/53	0.06	-0.72	11,14,18,19	0

6.5 Other polymers

There are no such residues in this entry.