



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 20, 2024 – 02:19 PM EDT

PDB ID : 1EQ9  
Title : CRYSTAL STRUCTURE OF FIRE ANT CHYMOTRYPSIN COMPLEXED TO PMSF  
Authors : Botos, I.; Meyer, E.; Nguyen, M.H.; Swanson, S.M.; Meyer, E.F.  
Deposited on : 2000-04-03  
Resolution : 1.70 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 : 2022.3.0, CSD as543be (2022)  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.39

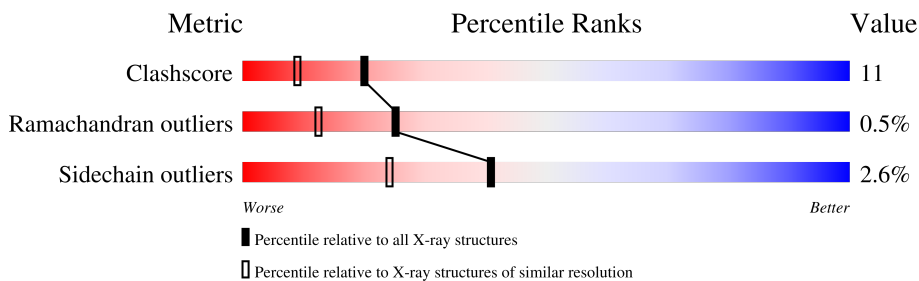
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.70 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	180529	5671 (1.70-1.70)
Ramachandran outliers	177936	5594 (1.70-1.70)
Sidechain outliers	177891	5594 (1.70-1.70)

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	222	
1	B	222	

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	PMS	A	1201	-	X	-	-
2	PMS	B	1202	-	X	-	-

## 2 Entry composition [i](#)

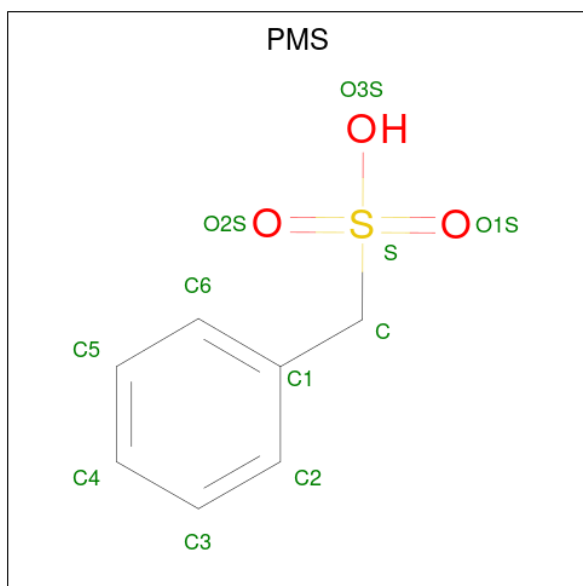
There are 3 unique types of molecules in this entry. The entry contains 3925 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 CHYMOTRYPSIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	222	Total 1688	C 1048	N 301	O 332	S 7	0	0	0
1	B	222	Total 1688	C 1048	N 301	O 332	S 7	0	0	0

- Molecule 2 is phenylmethanesulfonic acid (three-letter code: PMS) (formula: C<sub>7</sub>H<sub>8</sub>O<sub>3</sub>S).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	O	S		
2	A	1	Total 10	C 7	O 2	S 1	0	0
2	B	1	Total 10	C 7	O 2	S 1	0	0

- Molecule 3 is water.


<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
3	A	305	Total 305	O 305	0	0
3	B	224	Total 224	O 224	0	0

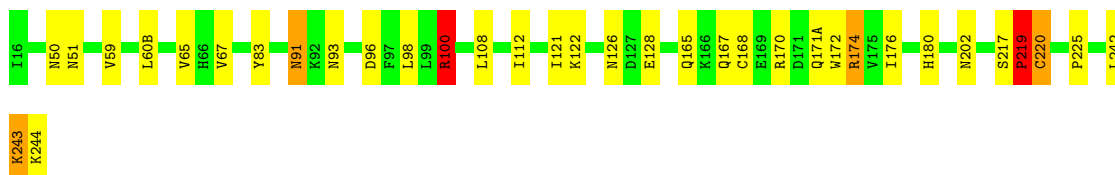
### 3 Residue-property plots [i](#)

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: CHYMOTRYPSIN

Chain A:  84% 13% ..



- Molecule 1: CHYMOTRYPSIN

Chain B:  85% 12% .



## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	61.12Å 85.84Å 97.61Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 1.70	Depositor
% Data completeness (in resolution range)	82.3 (20.00-1.70)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	CNS 0.5	Depositor
R, $R_{free}$	0.209 , 0.242	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	3925	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: PMS

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	0.28	0/1720	0.68	4/2340 (0.2%)
1	B	0.28	0/1720	0.68	5/2340 (0.2%)
All	All	0.28	0/3440	0.68	9/4680 (0.2%)

There are no bond length outliers.

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	400	ARG	NE-CZ-NH1	-7.24	116.68	120.30
1	A	220	CYS	N-CA-C	6.93	129.71	111.00
1	B	520	CYS	N-CA-C	6.91	129.64	111.00
1	A	100	ARG	NE-CZ-NH2	-6.17	117.22	120.30
1	B	400	ARG	NE-CZ-NH2	6.10	123.35	120.30
1	A	100	ARG	NE-CZ-NH1	5.89	123.25	120.30
1	A	174	ARG	NE-CZ-NH1	-5.60	117.50	120.30
1	B	474	ARG	NE-CZ-NH2	-5.22	117.69	120.30
1	B	474	ARG	NE-CZ-NH1	5.20	122.90	120.30

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	1688	0	1643	42	0
1	B	1688	0	1643	37	0
2	A	10	0	7	0	0
2	B	10	0	7	0	0
3	A	305	0	0	14	0
3	B	224	0	0	8	0
All	All	3925	0	3300	75	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 11.

All (75) 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:219:PRO:HD2	1:B:519:PRO:HD2	1.42	1.00
1:B:351:ASN:HD21	1:B:543:LYS:H	1.20	0.89
1:A:51:ASN:HD21	1:A:243:LYS:H	1.25	0.84
1:B:391:ASN:HD22	1:B:393:ASN:H	1.29	0.78
1:A:91:ASN:HD22	1:A:93:ASN:H	1.30	0.77
1:A:243:LYS:O	1:A:243:LYS:HD3	1.88	0.73
1:A:91:ASN:ND2	1:A:93:ASN:H	1.87	0.73
1:B:543:LYS:O	1:B:543:LYS:HD3	1.90	0.72
1:B:391:ASN:ND2	1:B:393:ASN:H	1.87	0.71
1:B:476:ILE:H	1:B:480:HIS:HD2	1.39	0.71
1:B:360(D):ASN:HD21	1:B:362:ASN:HB2	1.60	0.67
1:A:59:VAL:HA	1:A:60(B):LEU:HD13	1.77	0.66
1:A:65:VAL:HG12	3:A:1096:HOH:O	1.96	0.66
1:A:165:GLN:HA	3:A:899:HOH:O	1.95	0.66
1:A:174:ARG:HD2	3:A:792:HOH:O	1.95	0.66
1:A:176:ILE:H	1:A:180:HIS:HD2	1.44	0.66
1:B:363:ARG:HA	1:B:363:ARG:HE	1.65	0.60
1:A:98:LEU:HB3	3:A:792:HOH:O	2.01	0.59
1:A:167:GLN:O	1:A:170:ARG:HG2	2.03	0.58
1:B:361:LEU:HD22	1:B:361:LEU:N	2.20	0.56
1:A:171(A):GLN:HG2	1:A:225:PRO:HG2	1.87	0.56
1:B:391:ASN:HD22	1:B:393:ASN:N	2.03	0.56
1:A:202:ASN:HB2	3:A:798:HOH:O	2.06	0.55
1:A:217:SER:OG	1:B:519:PRO:HB2	2.07	0.55
1:A:121:ILE:HD12	3:A:909:HOH:O	2.07	0.55
1:B:362:ASN:HB3	3:B:1057:HOH:O	2.06	0.55
1:A:50:ASN:HB2	1:A:243:LYS:CD	2.38	0.54
1:B:350:ASN:HB2	1:B:543:LYS:HD2	1.89	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:100:ARG:HD3	3:A:908:HOH:O	2.06	0.54
1:A:219:PRO:HB2	1:B:517:SER:OG	2.08	0.54
1:A:91:ASN:HD22	1:A:93:ASN:N	2.04	0.54
1:A:50:ASN:HB2	1:A:243:LYS:HD2	1.89	0.53
1:A:51:ASN:OD1	1:A:243:LYS:HD2	2.08	0.53
1:B:360(D):ASN:ND2	1:B:362:ASN:H	2.07	0.53
1:B:351:ASN:OD1	1:B:543:LYS:HD2	2.09	0.52
1:B:350:ASN:HB2	1:B:543:LYS:CD	2.39	0.52
1:B:351:ASN:ND2	1:B:543:LYS:H	2.00	0.52
1:A:168:CYS:HB2	3:A:899:HOH:O	2.09	0.52
1:A:122:LYS:HE3	3:A:850:HOH:O	2.11	0.50
1:B:365:VAL:HG21	1:B:408:LEU:HD21	1.95	0.49
1:B:426:ASN:ND2	1:B:428:GLU:H	2.11	0.49
1:A:83:TYR:HD1	3:A:1096:HOH:O	1.96	0.48
1:B:471(A):GLN:HG2	1:B:525:PRO:HG2	1.94	0.48
1:B:480:HIS:HE1	3:B:911:HOH:O	1.96	0.48
1:B:544:LYS:N	1:B:544:LYS:HD2	2.29	0.47
1:A:60(B):LEU:N	1:A:60(B):LEU:HD12	2.29	0.47
1:A:126:ASN:ND2	1:A:128:GLU:H	2.11	0.47
1:A:244:LYS:N	1:A:244:LYS:HD2	2.30	0.47
1:A:65:VAL:HG21	1:A:108:LEU:HD21	1.97	0.47
1:A:243:LYS:HE3	3:A:758:HOH:O	2.15	0.47
1:B:399:LEU:HD22	3:B:902:HOH:O	2.15	0.46
1:A:171(A):GLN:HE21	1:A:172:TRP:H	1.64	0.46
1:A:167:GLN:HE21	1:A:170:ARG:NH2	2.14	0.44
1:B:435:PRO:HD3	3:B:1005:HOH:O	2.17	0.44
1:A:50:ASN:CB	1:A:243:LYS:HG3	2.48	0.44
1:B:363:ARG:HA	1:B:363:ARG:NE	2.31	0.44
1:B:350:ASN:CB	1:B:543:LYS:HG3	2.48	0.44
1:B:383:TYR:CE2	1:B:412:ILE:HA	2.53	0.44
1:A:51:ASN:HD21	1:A:243:LYS:N	2.05	0.43
1:B:361:LEU:HD22	1:B:361:LEU:H	1.82	0.43
1:B:515:PHE:HB3	3:B:902:HOH:O	2.18	0.43
1:A:51:ASN:ND2	1:A:243:LYS:H	2.04	0.43
1:A:176:ILE:H	1:A:180:HIS:CD2	2.31	0.43
1:B:351:ASN:HD21	1:B:543:LYS:N	2.01	0.43
1:B:422:LYS:HD3	3:B:891:HOH:O	2.18	0.43
1:A:100:ARG:HD2	1:A:176:ILE:HD13	2.00	0.42
1:A:180:HIS:HE1	3:A:751:HOH:O	2.03	0.42
1:A:220:CYS:HA	3:A:580:HOH:O	2.19	0.42
1:B:520:CYS:HA	3:B:620:HOH:O	2.19	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:386:GLU:HB2	1:B:409:THR:HG22	2.01	0.42
1:B:400:ARG:HG2	3:B:712:HOH:O	2.20	0.42
1:A:67:VAL:HG13	3:A:1096:HOH:O	2.19	0.41
1:A:83:TYR:CE2	1:A:112:ILE:HA	2.55	0.41
1:A:96:ASP:OD1	1:B:396:ASP:CG	2.59	0.41
1:B:476:ILE:H	1:B:480:HIS:CD2	2.29	0.41

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	220/222 (99%)	212 (96%)	7 (3%)	1 (0%)	25	12
1	B	220/222 (99%)	211 (96%)	8 (4%)	1 (0%)	25	12
All	All	440/444 (99%)	423 (96%)	15 (3%)	2 (0%)	25	12

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	219	PRO
1	B	519	PRO

### 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	189/189 (100%)	184 (97%)	5 (3%)	41	24
1	B	189/189 (100%)	184 (97%)	5 (3%)	41	24
All	All	378/378 (100%)	368 (97%)	10 (3%)	41	24

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	91	ASN
1	A	100	ARG
1	A	219	PRO
1	A	242	LEU
1	A	243	LYS
1	B	360(D)	ASN
1	B	391	ASN
1	B	519	PRO
1	B	542	LEU
1	B	543	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (27) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	51	ASN
1	A	57	HIS
1	A	91	ASN
1	A	107	HIS
1	A	119	GLN
1	A	126	ASN
1	A	134	ASN
1	A	167	GLN
1	A	171(A)	GLN
1	A	180	HIS
1	A	192	HIS
1	A	209	GLN
1	A	241	ASN
1	B	351	ASN
1	B	357	HIS
1	B	360(D)	ASN
1	B	391	ASN
1	B	407	HIS
1	B	419	GLN
1	B	426	ASN

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Mol	Chain	Res	Type
1	B	434	ASN
1	B	450	ASN
1	B	480	HIS
1	B	492	HIS
1	B	502	ASN
1	B	509	GLN
1	B	541	ASN

### 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 oligosaccharides in this entry.

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

2 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	PMS	A	1201	1	7,10,11	2.26	4 (57%)	11,12,15	4.17	9 (81%)
2	PMS	B	1202	1	7,10,11	2.26	4 (57%)	11,12,15	4.20	9 (81%)

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	PMS	A	1201	1	-	1/4/4/5	0/1/1/1
2	PMS	B	1202	1	-	1/4/4/5	0/1/1/1

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1202	PMS	C6-C1	3.67	1.46	1.38
2	A	1201	PMS	C6-C1	3.57	1.46	1.38
2	A	1201	PMS	C5-C4	3.06	1.45	1.38
2	B	1202	PMS	C5-C4	2.93	1.44	1.38
2	A	1201	PMS	C5-C6	2.76	1.43	1.38
2	B	1202	PMS	C5-C6	2.73	1.43	1.38
2	A	1201	PMS	C4-C3	2.31	1.43	1.38
2	B	1202	PMS	C4-C3	2.27	1.43	1.38

All (18) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1201	PMS	C3-C2-C1	7.77	131.53	120.61
2	B	1202	PMS	C3-C2-C1	7.76	131.52	120.61
2	A	1201	PMS	O1S-S-C	4.90	114.02	105.55
2	B	1202	PMS	C6-C1-C2	-4.88	110.98	118.23
2	A	1201	PMS	C6-C1-C2	-4.85	111.03	118.23
2	B	1202	PMS	O1S-S-C	4.83	113.89	105.55
2	B	1202	PMS	C-C1-C6	4.40	125.36	120.56
2	A	1201	PMS	C-C1-C6	4.28	125.23	120.56
2	B	1202	PMS	C5-C4-C3	-4.16	114.18	119.87
2	A	1201	PMS	C5-C4-C3	-4.06	114.31	119.87
2	B	1202	PMS	C1-C-S	4.01	120.84	110.71
2	B	1202	PMS	O2S-S-C	3.97	112.41	105.55
2	A	1201	PMS	O2S-S-C	3.92	112.33	105.55
2	A	1201	PMS	C1-C-S	3.83	120.39	110.71
2	B	1202	PMS	C4-C5-C6	2.93	123.86	120.24
2	A	1201	PMS	C-C1-C2	2.92	123.74	120.56
2	A	1201	PMS	C4-C5-C6	2.86	123.76	120.24
2	B	1202	PMS	C-C1-C2	2.83	123.65	120.56

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	1201	PMS	C1-C-S-O2S
2	B	1202	PMS	C1-C-S-O2S

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

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.