Acta Crystallographica Section E
**Structure Reports Online**
ISSN 1600-5368

# Hexaaquazinc(II) dichloride bis(hexamethylenetetramine) tetrahydrate

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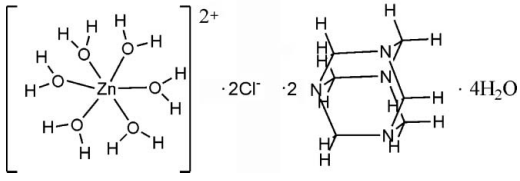
Received 19 July 2008; accepted 1 August 2008

Key indicators: single-crystal X-ray study; $T$ = 291 K; mean $\sigma$(N–C) = 0.004 Å; $R$ factor = 0.038; $wR$ factor = 0.113; data-to-parameter ratio = 17.1.

The title compound, $[Zn(H_2O)_6]Cl_2\cdot 2C_6H_{12}N_4\cdot 4H_2O$, has been prepared under mild hydrothermal conditions. The $Zn^{II}$ atom, located on a centre of symmetry, is coordinated by six water molecules in a distorted octahedral coordination geometry. The hexamethylenetetramine molecule is not coordinated to $Zn^{II}$ but links the Zn complexes *via* three O—H···N hydrogen bonds. The remaining N atom of the hexamethylenetetramine molecule is hydrogen-bonded to a solvent water molecule. In the crystal structure, intermolecular O—H···O, O—H···N and O—H···Cl hydrogen bonds link the components into a three-dimensional network.

## Related literature

For related compounds, see: Zhang *et al.* (2000).



## Experimental

### Crystal data

$[Zn(H_2O)_6]Cl_2\cdot 2C_6H_{12}N_4\cdot 4H_2O$
$M_r$ = 596.84
Triclinic, $P\overline{1}$
$a$ = 9.345 (3) Å
$b$ = 9.4176 (15) Å
$c$ = 9.4535 (15) Å
$\alpha$ = 119.521 (1)°
$\beta$ = 94.218 (2)°
$\gamma$ = 100.969 (2)°
$V$ = 697.0 (3) Å$^3$
$Z$ = 1
Mo $K\alpha$ radiation
$\mu$ = 1.13 mm$^{-1}$
$T$ = 291 (2) K
0.36 × 0.29 × 0.15 mm

### Data collection

Bruker SMART CCD area-detector diffractometer
Absorption correction: multi-scan (*SADABS*; Sheldrick, 1996)
$T_{min}$ = 0.690, $T_{max}$ = 0.849
5184 measured reflections
2576 independent reflections
2466 reflections with $I > 2\sigma(I)$
$R_{int}$ = 0.018

### Refinement

$R[F^2 > 2\sigma(F^2)]$ = 0.038
$wR(F^2)$ = 0.113
$S$ = 1.05
2576 reflections
151 parameters
H-atom parameters constrained
$\Delta\rho_{max}$ = 0.51 e Å$^{-3}$
$\Delta\rho_{min}$ = −0.68 e Å$^{-3}$

**Table 1**
Hydrogen-bond geometry (Å, °).

| $D$—H···$A$ | $D$—H | H···$A$ | $D$···$A$ | $D$—H···$A$ |
|---|---|---|---|---|
| O1—H1$W$···N3 | 0.82 | 2.05 | 2.827 (3) | 158 |
| O1—H2$W$···O5$^{i}$ | 0.83 | 1.94 | 2.743 (3) | 162 |
| O2—H3$W$···N2$^{ii}$ | 0.83 | 1.99 | 2.804 (3) | 167 |
| O2—H4$W$···O4$^{ii}$ | 0.84 | 1.90 | 2.711 (3) | 165 |
| O3—H5$W$···Cl1 | 0.82 | 2.55 | 3.197 (2) | 137 |
| O3—H6$W$···N1$^{iii}$ | 0.83 | 2.01 | 2.813 (3) | 165 |
| O4—H7$W$···Cl1 | 0.83 | 2.36 | 3.175 (2) | 168 |
| O4—H8$W$···N4$^{iv}$ | 0.84 | 2.00 | 2.835 (3) | 174 |
| O5—H9$W$···Cl1 | 0.83 | 2.43 | 3.255 (3) | 168 |
| O5—H10$W$···Cl1$^{v}$ | 0.83 | 2.38 | 3.213 (3) | 175 |

Symmetry codes: (i) $x, y, z-1$; (ii) $-x+1, -y+1, -z+1$; (iii) $x, y-1, z$; (iv) $-x, -y+1, -z+1$; (v) $-x, -y, -z+1$.

Data collection: *SMART* (Bruker, 2002); cell refinement: *SAINT* (Bruker, 2002); data reduction: *SAINT*; program(s) used to solve structure: *SHELXS97* (Sheldrick, 2008); program(s) used to refine structure: *SHELXL97* (Sheldrick, 2008); molecular graphics: *SHELXTL* (Sheldrick, 2008); software used to prepare material for publication: *SHELXTL*.

We thank the Natural Science Foundation of Henan Province and the Key Discipline Foundation of Zhoukou Normal University for financial support of this research.

Supplementary data and figures for this paper are available from the IUCr electronic archives (Reference: KP2186).

## References

Bruker (2002). *SMART* and *SAINT*. Bruker AXS Inc., Madison, Wisconsin, USA.
Sheldrick, G. M. (1996). *SADABS*. University of Göttingen, Germany.
Sheldrick, G. M. (2008). *Acta Cryst.* A**64**, 112–122.
Zhang, Y., Li, J., Nishiura, M. & Imamoto, T. (2000). *J. Mol. Struct.* **523**, 257–260.

# supporting information

*Acta Cryst.* (2008). E**64**, m1132 [doi:10.1107/S1600536808024793]

## Hexaaquazinc(II) dichloride bis(hexamethylenetetramine) tetrahydrate

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### S1. Comment

The asymmetric unit (Fig.1) consists of one half of hexaaua $Zn^{II}$ octahedron, one chloride ion, one uncoordinated neutral hexamethylenetetramine and two molecules of water of crystallization. The hexamethylenetetramine molecule is linked to the $[Zn(H_2O)_6]^{2+}$ *via* three O—H···N hydrogen bonds, while atom N3 of hexamethylenetetramine is hydrogen-bonded to O5 of the solvent water molecule. The $Cl^-$ anions link to the $[Zn(H_2O)_6]^{2+}$ and water of crystallization *via* O—H···Cl hydrogen bonding, Hydrogen bonding of these anionic and cationic frameworks results in the formation of a three-dimensional network (Table 1, Fig. 2).

### S2. Experimental

All the reagents were of AR grade and used without further purification. $C_6H_{12}N_4$ (1.401 g, 10 mmol) were dissolved in 50 mL $H_2O$ solution, then the resultant solution was added in 10 mL double-distilled water containing $ZnCl_2$ (0.273 g, 2 mmol). The resulting solution was heated at 423 K for 96 h. After cooling to room temperature, block crystals were obtained in a yield up to 21.1%.

### S3. Refinement

H atoms bonded to O atoms were located in a difference map and included in their 'as found′ positions with $U_{iso}$(H) = 1.5$U_{eq}$(O). Other H atoms were positioned geometrically with C—H = 0.97 Å and with $U_{iso}$(H)=1.2$U_{eq}$(C). All H atoms were treated as riding.

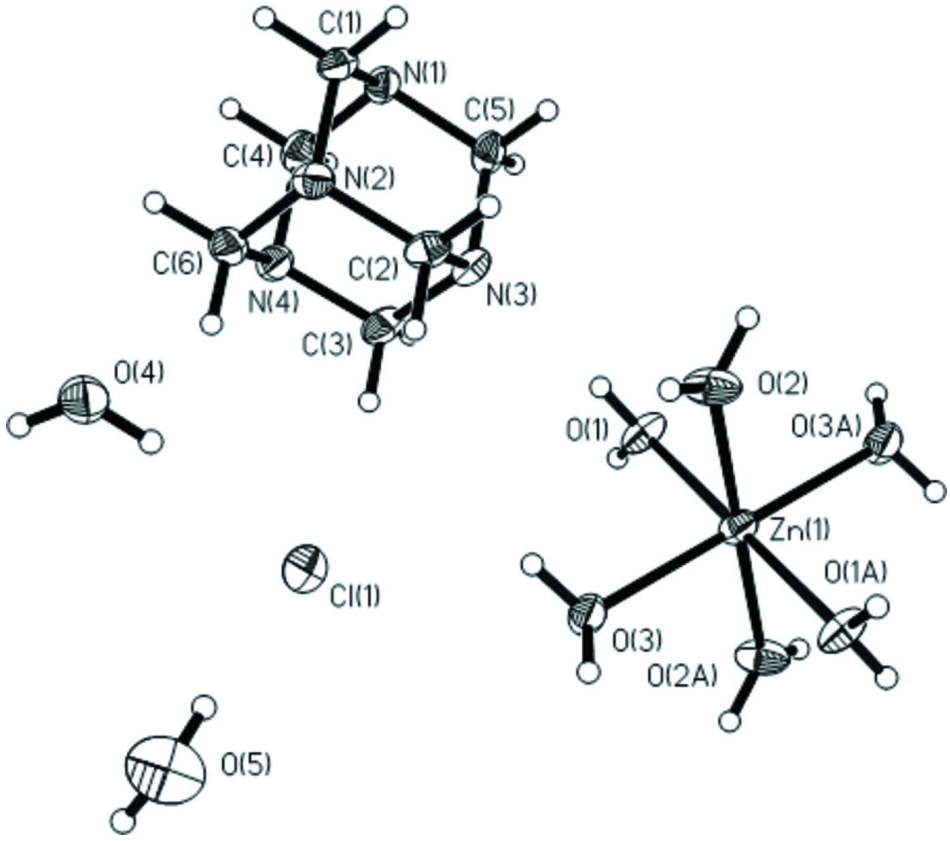


**Figure 1**

Plot of an asymmetric unit with the 30% probability ellipsoids.

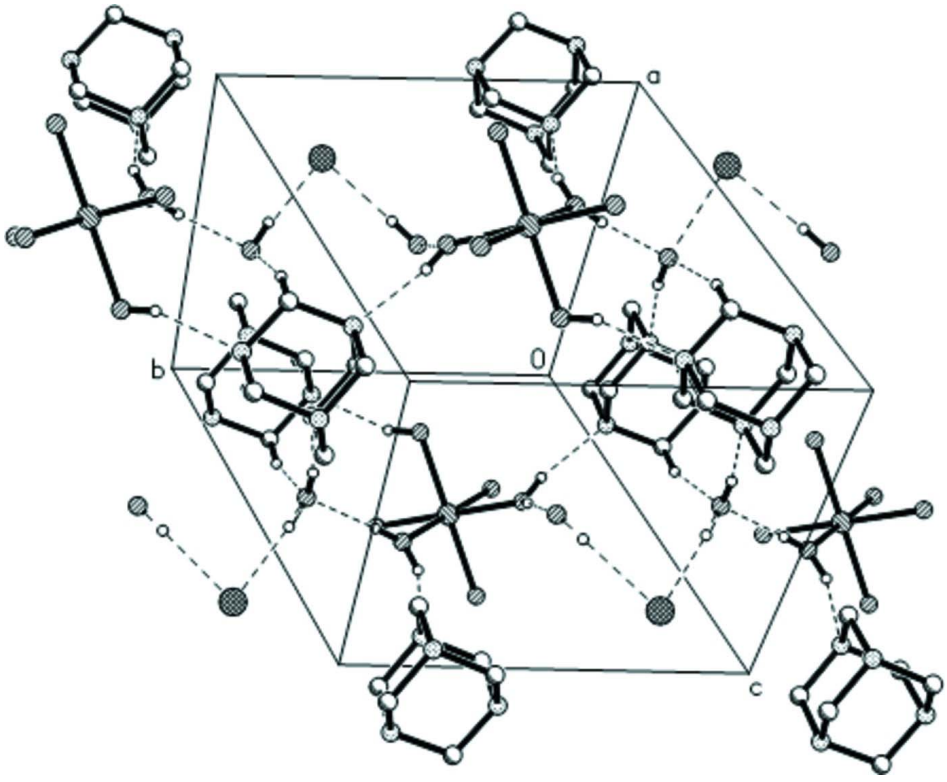


**Figure 2**

Three-dimensional network of hydrogen-bonding pattern with the motif $R_4^4(16)$ linking the cationic moieties with hexamine which are in turn interwoven with anionic moieties via water molecules.

**Hexaaquazinc(II) dichloride bis(hexamethylenetetramine) tetrahydrate**

*Crystal data*

$[Zn(H_2O)_6]Cl_2·2C_6H_{12}N_4·4H_2O$
$M_r$ = 596.84
Triclinic, $P\overline{1}$
Hall symbol: -P 1
$a$ = 9.345 (3) Å
$b$ = 9.4176 (15) Å
$c$ = 9.4535 (15) Å
$\alpha$ = 119.521 (1)°
$\beta$ = 94.218 (2)°
$\gamma$ = 100.969 (2)°
$V$ = 697.0 (3) Å$^3$
$Z$ = 1
$F(000)$ = 316
$D_x$ = 1.422 Mg m$^{-3}$
Mo $K\alpha$ radiation, $\lambda$ = 0.71073 Å
Cell parameters from 2143 reflections
$\theta$ = 2.5–25.5°
$\mu$ = 1.13 mm$^{-1}$
$T$ = 291 K
Block, colorless
0.36 × 0.29 × 0.15 mm

*Data collection*

Bruker SMART CCD area-detector diffractometer
Radiation source: fine-focus sealed tube
Graphite monochromator
Detector resolution: 0 pixels mm$^{-1}$
$\varphi$ and $\omega$ scans
Absorption correction: multi-scan (*SADABS*; Sheldrick, 1996)
$T_{min}$ = 0.690, $T_{max}$ = 0.849
5184 measured reflections
2576 independent reflections
2466 reflections with $I > 2\sigma(I)$
$R_{int}$ = 0.018
$\theta_{max}$ = 25.5°, $\theta_{min}$ = 2.5°
$h$ = −11→11
$k$ = −11→11
$l$ = −11→11

*Refinement*

Refinement on $F^2$
Least-squares matrix: full
$R[F^2 > 2\sigma(F^2)] = 0.038$
$wR(F^2) = 0.113$
$S = 1.05$
2576 reflections
151 parameters
0 restraints
Primary atom site location: structure-invariant direct methods
Secondary atom site location: difference Fourier map
Hydrogen site location: inferred from neighbouring sites
H-atom parameters constrained
$w = 1/[\sigma^2(F_o^2) + (0.0645P)^2 + 0.6988P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max} < 0.001$
$\Delta\rho_{max} = 0.51$ e Å$^{-3}$
$\Delta\rho_{min} = -0.68$ e Å$^{-3}$

*Special details*

**Geometry**. All e.s.d.'s (except the e.s.d. in the dihedral angle between two l.s. planes) are estimated using the full covariance matrix. The cell e.s.d.'s are taken into account individually in the estimation of e.s.d.'s in distances, angles and torsion angles; correlations between e.s.d.'s in cell parameters are only used when they are defined by crystal symmetry. An approximate (isotropic) treatment of cell e.s.d.'s is used for estimating e.s.d.'s involving l.s. planes.

**Refinement**. Refinement of $F^2$ against ALL reflections. The weighted *R*-factor *wR* and goodness of fit *S* are based on $F^2$, conventional *R*-factors *R* are based on *F*, with *F* set to zero for negative $F^2$. The threshold expression of $F^2 > \sigma(F^2)$ is used only for calculating *R*-factors(gt) *etc*. and is not relevant to the choice of reflections for refinement. *R*-factors based on $F^2$ are statistically about twice as large as those based on *F*, and *R*- factors based on ALL data will be even larger.

*Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters (Å²)*

| | *x* | *y* | *z* | $U_{iso}$*/$U_{eq}$ |
|---|---|---|---|---|
| Zn1 | 0.5000 | 0.0000 | 0.0000 | 0.02942 (16) |
| Cl1 | 0.18939 (10) | 0.17479 (10) | 0.43496 (10) | 0.0530 (2) |
| O1 | 0.3835 (2) | 0.1347 (2) | −0.0573 (2) | 0.0385 (5) |
| H1W | 0.3888 | 0.2257 | 0.0269 | 0.058* |
| H2W | 0.3035 | 0.0961 | −0.1235 | 0.058* |
| O2 | 0.6192 (2) | 0.2238 (2) | 0.1987 (2) | 0.0445 (5) |
| H3W | 0.6176 | 0.2521 | 0.2964 | 0.067* |
| H4W | 0.6833 | 0.2949 | 0.1930 | 0.067* |
| O3 | 0.3580 (2) | −0.0281 (3) | 0.1463 (3) | 0.0449 (5) |
| H5W | 0.3405 | 0.0629 | 0.2078 | 0.067* |
| H6W | 0.3658 | −0.0839 | 0.1907 | 0.067* |
| O4 | 0.1961 (2) | 0.5028 (3) | 0.7778 (3) | 0.0453 (5) |
| H7W | 0.2082 | 0.4201 | 0.6931 | 0.068* |
| H8W | 0.1053 | 0.4939 | 0.7784 | 0.068* |
| O5 | 0.1487 (3) | 0.0521 (4) | 0.7002 (4) | 0.0734 (8) |
| H9W | 0.1699 | 0.0950 | 0.6431 | 0.110* |
| H10W | 0.0600 | −0.0024 | 0.6715 | 0.110* |
| N1 | 0.3345 (3) | 0.7407 (3) | 0.2554 (3) | 0.0330 (5) |
| N2 | 0.3362 (3) | 0.6543 (3) | 0.4602 (3) | 0.0333 (5) |
| N3 | 0.3418 (3) | 0.4524 (3) | 0.1728 (3) | 0.0321 (5) |
| N4 | 0.1152 (2) | 0.5427 (3) | 0.2441 (3) | 0.0340 (5) |
| C1 | 0.3865 (3) | 0.7935 (3) | 0.4289 (3) | 0.0356 (6) |
| H1A | 0.3492 | 0.8886 | 0.5010 | 0.043* |
| H1B | 0.4942 | 0.8302 | 0.4552 | 0.043* |
| C2 | 0.3944 (3) | 0.5116 (3) | 0.3488 (3) | 0.0342 (6) |

| | | | | |
|---|---|---|---|---|
| H2A | 0.3628 | 0.4191 | 0.3677 | 0.041* |
| H2B | 0.5022 | 0.5466 | 0.3743 | 0.041* |
| C3 | 0.1782 (3) | 0.4021 (3) | 0.1376 (3) | 0.0381 (6) |
| H3A | 0.1440 | 0.3088 | 0.1546 | 0.046* |
| H3B | 0.1422 | 0.3632 | 0.0223 | 0.046* |
| C4 | 0.1706 (3) | 0.6838 (4) | 0.2176 (4) | 0.0375 (6) |
| H4A | 0.1348 | 0.6480 | 0.1032 | 0.045* |
| H4B | 0.1311 | 0.7778 | 0.2876 | 0.045* |
| C5 | 0.3925 (3) | 0.5955 (4) | 0.1482 (3) | 0.0353 (6) |
| H5A | 0.3595 | 0.5592 | 0.0331 | 0.042* |
| H5B | 0.5003 | 0.6306 | 0.1729 | 0.042* |
| C6 | 0.1728 (3) | 0.5995 (4) | 0.4186 (3) | 0.0369 (6) |
| H6A | 0.1333 | 0.6925 | 0.4910 | 0.044* |
| H6B | 0.1386 | 0.5076 | 0.4377 | 0.044* |

*Atomic displacement parameters (Å²)*

| | $U^{11}$ | $U^{22}$ | $U^{33}$ | $U^{12}$ | $U^{13}$ | $U^{23}$ |
|---|---|---|---|---|---|---|
| Zn1 | 0.0395 (3) | 0.0233 (2) | 0.0250 (2) | 0.00991 (17) | 0.00711 (17) | 0.01148 (18) |
| Cl1 | 0.0591 (5) | 0.0399 (4) | 0.0534 (5) | 0.0135 (3) | 0.0246 (4) | 0.0173 (4) |
| O1 | 0.0604 (11) | 0.0278 (9) | 0.0329 (10) | 0.0192 (8) | −0.0009 (8) | 0.0105 (8) |
| O2 | 0.0710 (13) | 0.0280 (10) | 0.0220 (9) | −0.0076 (9) | 0.0009 (9) | 0.0081 (8) |
| O3 | 0.0675 (14) | 0.0422 (11) | 0.0548 (12) | 0.0327 (10) | 0.0401 (11) | 0.0367 (10) |
| O4 | 0.0398 (11) | 0.0386 (11) | 0.0417 (11) | 0.0003 (9) | 0.0055 (9) | 0.0130 (9) |
| O5 | 0.0604 (16) | 0.086 (2) | 0.0720 (18) | 0.0027 (14) | −0.0156 (13) | 0.0485 (16) |
| N1 | 0.0423 (12) | 0.0298 (11) | 0.0371 (12) | 0.0160 (10) | 0.0161 (10) | 0.0214 (10) |
| N2 | 0.0426 (12) | 0.0285 (11) | 0.0242 (10) | 0.0036 (9) | 0.0050 (9) | 0.0125 (9) |
| N3 | 0.0407 (12) | 0.0255 (11) | 0.0275 (11) | 0.0144 (9) | 0.0046 (9) | 0.0102 (9) |
| N4 | 0.0345 (11) | 0.0289 (11) | 0.0335 (11) | 0.0088 (9) | 0.0063 (9) | 0.0124 (9) |
| C1 | 0.0433 (15) | 0.0221 (12) | 0.0348 (14) | 0.0048 (10) | 0.0100 (11) | 0.0110 (11) |
| C2 | 0.0432 (15) | 0.0284 (13) | 0.0326 (13) | 0.0090 (11) | 0.0007 (11) | 0.0178 (11) |
| C3 | 0.0417 (15) | 0.0264 (13) | 0.0327 (14) | 0.0086 (11) | −0.0005 (11) | 0.0066 (11) |
| C4 | 0.0443 (15) | 0.0376 (15) | 0.0404 (15) | 0.0219 (12) | 0.0136 (12) | 0.0226 (12) |
| C5 | 0.0452 (15) | 0.0399 (15) | 0.0314 (13) | 0.0217 (12) | 0.0167 (11) | 0.0214 (12) |
| C6 | 0.0427 (15) | 0.0337 (14) | 0.0326 (14) | 0.0055 (11) | 0.0128 (11) | 0.0167 (11) |

*Geometric parameters (Å, º)*

| | | | |
|---|---|---|---|
| Zn1—O2$^{i}$ | 2.0269 (18) | N2—C2 | 1.476 (3) |
| Zn1—O2 | 2.0269 (18) | N2—C1 | 1.481 (3) |
| Zn1—O1 | 2.0507 (17) | N3—C3 | 1.472 (4) |
| Zn1—O1$^{i}$ | 2.0507 (17) | N3—C5 | 1.476 (3) |
| Zn1—O3$^{i}$ | 2.0595 (18) | N3—C2 | 1.477 (3) |
| Zn1—O3 | 2.0595 (18) | N4—C4 | 1.477 (4) |
| O1—H1W | 0.8223 | N4—C3 | 1.478 (3) |
| O1—H2W | 0.8281 | N4—C6 | 1.479 (4) |
| O2—H3W | 0.8279 | C1—H1A | 0.9700 |
| O2—H4W | 0.8360 | C1—H1B | 0.9700 |

| | | | |
|---|---|---|---|
| O3—H5W | 0.8221 | C2—H2A | 0.9700 |
| O3—H6W | 0.8267 | C2—H2B | 0.9700 |
| O4—H7W | 0.8326 | C3—H3A | 0.9700 |
| O4—H8W | 0.8374 | C3—H3B | 0.9700 |
| O5—H9W | 0.8338 | C4—H4A | 0.9700 |
| O5—H10W | 0.8316 | C4—H4B | 0.9700 |
| N1—C1 | 1.470 (4) | C5—H5A | 0.9700 |
| N1—C4 | 1.476 (4) | C5—H5B | 0.9700 |
| N1—C5 | 1.479 (3) | C6—H6A | 0.9700 |
| N2—C6 | 1.471 (4) | C6—H6B | 0.9700 |

| | | | |
|---|---|---|---|
| O2$^{i}$—Zn1—O2 | 180.00 (11) | C3—N4—C6 | 107.8 (2) |
| O2$^{i}$—Zn1—O1 | 92.66 (8) | N1—C1—N2 | 111.7 (2) |
| O2—Zn1—O1 | 87.34 (8) | N1—C1—H1A | 109.3 |
| O2$^{i}$—Zn1—O1$^{i}$ | 87.34 (8) | N2—C1—H1A | 109.3 |
| O2—Zn1—O1$^{i}$ | 92.66 (8) | N1—C1—H1B | 109.3 |
| O1—Zn1—O1$^{i}$ | 180.00 (12) | N2—C1—H1B | 109.3 |
| O2$^{i}$—Zn1—O3$^{i}$ | 89.59 (9) | H1A—C1—H1B | 107.9 |
| O2—Zn1—O3$^{i}$ | 90.41 (9) | N2—C2—N3 | 111.6 (2) |
| O1—Zn1—O3$^{i}$ | 86.57 (8) | N2—C2—H2A | 109.3 |
| O1$^{i}$—Zn1—O3$^{i}$ | 93.43 (8) | N3—C2—H2A | 109.3 |
| O2$^{i}$—Zn1—O3 | 90.41 (9) | N2—C2—H2B | 109.3 |
| O2—Zn1—O3 | 89.59 (9) | N3—C2—H2B | 109.3 |
| O1—Zn1—O3 | 93.43 (8) | H2A—C2—H2B | 108.0 |
| O1$^{i}$—Zn1—O3 | 86.57 (8) | N3—C3—N4 | 112.2 (2) |
| O3$^{i}$—Zn1—O3 | 180.00 (19) | N3—C3—H3A | 109.2 |
| Zn1—O1—H1W | 109.5 | N4—C3—H3A | 109.2 |
| Zn1—O1—H2W | 126.6 | N3—C3—H3B | 109.2 |
| H1W—O1—H2W | 113.2 | N4—C3—H3B | 109.2 |
| Zn1—O2—H3W | 124.5 | H3A—C3—H3B | 107.9 |
| Zn1—O2—H4W | 124.2 | N1—C4—N4 | 112.2 (2) |
| H3W—O2—H4W | 111.0 | N1—C4—H4A | 109.2 |
| Zn1—O3—H5W | 109.6 | N4—C4—H4A | 109.2 |
| Zn1—O3—H6W | 123.5 | N1—C4—H4B | 109.2 |
| H5W—O3—H6W | 113.5 | N4—C4—H4B | 109.2 |
| H7W—O4—H8W | 110.1 | H4A—C4—H4B | 107.9 |
| H9W—O5—H10W | 111.5 | N3—C5—N1 | 111.7 (2) |
| C1—N1—C4 | 108.4 (2) | N3—C5—H5A | 109.3 |
| C1—N1—C5 | 108.2 (2) | N1—C5—H5A | 109.3 |
| C4—N1—C5 | 108.3 (2) | N3—C5—H5B | 109.3 |
| C6—N2—C2 | 108.5 (2) | N1—C5—H5B | 109.3 |
| C6—N2—C1 | 108.5 (2) | H5A—C5—H5B | 108.0 |
| C2—N2—C1 | 108.0 (2) | N2—C6—N4 | 112.0 (2) |
| C3—N3—C5 | 108.7 (2) | N2—C6—H6A | 109.2 |
| C3—N3—C2 | 108.4 (2) | N4—C6—H6A | 109.2 |
| C5—N3—C2 | 107.9 (2) | N2—C6—H6B | 109.2 |
| C4—N4—C3 | 108.0 (2) | N4—C6—H6B | 109.2 |
| C4—N4—C6 | 108.1 (2) | H6A—C6—H6B | 107.9 |

| | | | |
|---|---|---|---|
| C4—N1—C1—N2 | 58.4 (3) | C1—N1—C4—N4 | −58.6 (3) |
| C5—N1—C1—N2 | −58.8 (3) | C5—N1—C4—N4 | 58.6 (3) |
| C6—N2—C1—N1 | −58.6 (3) | C3—N4—C4—N1 | −58.3 (3) |
| C2—N2—C1—N1 | 58.9 (3) | C6—N4—C4—N1 | 58.1 (3) |
| C6—N2—C2—N3 | 58.3 (3) | C3—N3—C5—N1 | 58.1 (3) |
| C1—N2—C2—N3 | −59.1 (3) | C2—N3—C5—N1 | −59.2 (3) |
| C3—N3—C2—N2 | −58.2 (3) | C1—N1—C5—N3 | 59.2 (3) |
| C5—N3—C2—N2 | 59.4 (3) | C4—N1—C5—N3 | −58.1 (3) |
| C5—N3—C3—N4 | −58.3 (3) | C2—N2—C6—N4 | −58.8 (3) |
| C2—N3—C3—N4 | 58.7 (3) | C1—N2—C6—N4 | 58.4 (3) |
| C4—N4—C3—N3 | 58.0 (3) | C4—N4—C6—N2 | −58.0 (3) |
| C6—N4—C3—N3 | −58.6 (3) | C3—N4—C6—N2 | 58.5 (3) |

Symmetry code: (i) $-x+1, -y, -z$.

*Hydrogen-bond geometry (Å, º)*

| *D*—H···*A* | *D*—H | H···*A* | *D*···*A* | *D*—H···*A* |
|---|---|---|---|---|
| O1—H1*W*···N3 | 0.82 | 2.05 | 2.827 (3) | 158 |
| O1—H2*W*···O5$^{ii}$ | 0.83 | 1.94 | 2.743 (3) | 162 |
| O2—H3*W*···N2$^{iii}$ | 0.83 | 1.99 | 2.804 (3) | 167 |
| O2—H4*W*···O4$^{iii}$ | 0.84 | 1.90 | 2.711 (3) | 165 |
| O3—H5*W*···Cl1 | 0.82 | 2.55 | 3.197 (2) | 137 |
| O3—H6*W*···N1$^{iv}$ | 0.83 | 2.01 | 2.813 (3) | 165 |
| O4—H7*W*···Cl1 | 0.83 | 2.36 | 3.175 (2) | 168 |
| O4—H8*W*···N4$^{v}$ | 0.84 | 2.00 | 2.835 (3) | 174 |
| O5—H9*W*···Cl1 | 0.83 | 2.43 | 3.255 (3) | 168 |
| O5—H10*W*···Cl1$^{vi}$ | 0.83 | 2.38 | 3.213 (3) | 175 |

Symmetry codes: (ii) $x, y, z-1$; (iii) $-x+1, -y+1, -z+1$; (iv) $x, y-1, z$; (v) $-x, -y+1, -z+1$; (vi) $-x, -y, -z+1$.