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1-Diphenylphosphanyl-2-(diphenylphosphoryl)-hydrazine

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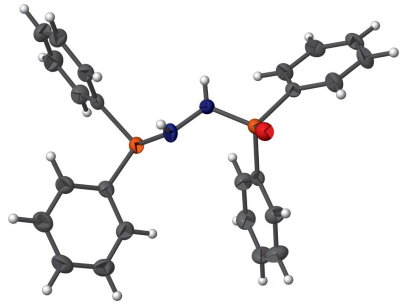
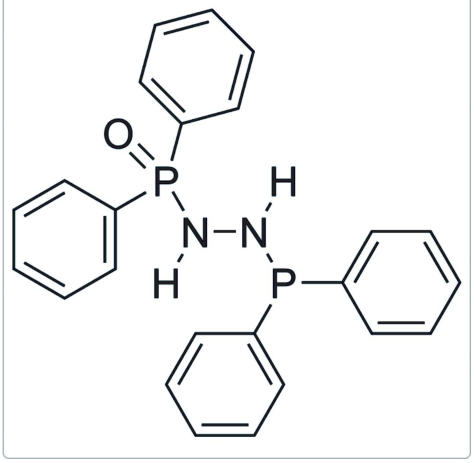
The title compound, $C_{24}H_{22}N_2OP_2$, is an asymmetrically substituted hydrazine derivative bearing a phosphoryl and a phosphanyl substituent. The PNNP backbone has a torsion angle of −131.01 (8)°. In the crystal, molecules form centrosymmetric dimers by intermolecular N—H···O hydrogen bonds, which are further linked into a three-dimensional network by weak C—H···O and C—H···π interactions.

3D view



Chemical scheme



Structure description

The title compound $C_{24}H_{22}N_2OP_2$ (Fig. 1) is an asymmetrically substituted hydrazine derivative containing a phosphoryl and phosphane entity. The PNNP backbone has a torsion angle of −131.01 (8)°. As a result of the asymmetrical substitution, the P—N bond lengths have significantly different values. Even if both P—N bond lengths are shortened when compared to the sum of the covalent radii calculated by Pyykkö (2015) [single: Σr_{cov}(P—N) = 1.82 Å, double: Σr_{cov}(P—N) = 1.62 Å], the P^V—N distance [P1—N1 = 1.6561 (11) Å] is noticeably shorter than the P^{III}—N distance [P2—N2 = 1.7049 (11) Å]. The more pronounced reduction of P^V—N bond lengths of phosphoryl hydrazine entities [range from 1.6587 (15) to 1.6989 (10) Å; Gholivand *et al.*, 2012, 2016; Höhne *et al.*, 2018] in comparison to phosphane hydrazine P^{III}—N distances [range from 1.692 (2) to 1.728 (2) Å; Kriel *et al.*, 2010; Aluri *et al.*, 2010; Sushev *et al.*, 2008] is documented. The N—N distance within the hydrazine unit amounts to 1.4256 (16) Å and conforms to the sum of the covalent radii calculated by Pyykkö (2015) [Σr_{cov}(N—N) = 1.42 Å].

In the crystal, centrosymmetrically related molecules of the title compound are linked by pairs of intermolecular N—H···O hydrogen bonds (Table 1) forming dimers, which

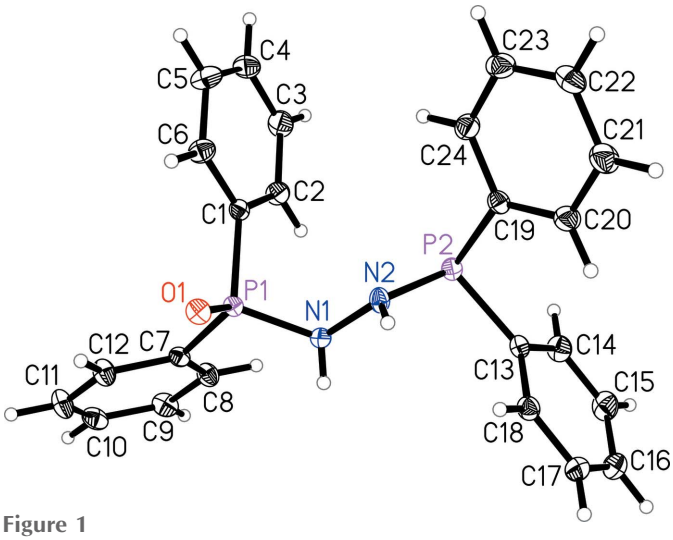


Figure 1
The molecular structure of the title compound with displacement ellipsoids drawn at the 30% probability level.

are further linked by weak C—H···O and C—H···π interactions into a three-dimensional network.

Synthesis and crystallization

A solution of NEt_3 (7.7 ml, 55.0 mmol) in THF was added to another solution of N_2H_4·HCl (0.685 g, 10.0 mmol) and Ph_2PCl (3.7 ml, 20.0 mmol) in THF (20.0 ml). The mixture was stirred for 24 h at room temperature. Afterwards it was filtered; the solvent was removed in vacuum. 7.0 ml of toluene were added. The microcrystalline product was identified by NMR to be $(Ph_2P)_2N—NH_2$. During the repeated attempts to crystallize $(Ph_2P)_2N—NH_2$, the compound could have had some air contact, followed by rearrangement. The title compound was recrystallized from toluene.

Refinement

Crystal data, data collection and structure refinement details are summarized in Table 2.

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

*Cg*1 and *Cg*2 are the centroids of the C19–C24 and C7–C12 phenyl rings, respectively.

D—H···*A*	*D*—H	H···*A*	*D*···*A*	*D*—H···*A*
N2—H2*B*···O1^{i}	0.828 (18)	2.132 (18)	2.9357 (14)	163.6 (17)
C10—H10*A*···O1^{ii}	0.95	2.50	3.2854 (19)	140
C15—H15*A*···*Cg*1^{iii}	0.95	2.70	3.6125 (17)	162
C17—H17*A*···*Cg*2^{iv}	0.95	2.91	3.7171 (18)	144

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

Table 2
Experimental details.

Crystal data	
Chemical formula	$C_{24}H_{22}N_2OP_2$
M_r	416.37
Crystal system, space group	Triclinic, $P\overline{1}$
Temperature (K)	200
a, *b*, *c* (Å)	8.4464 (4), 10.4163 (5), 13.4880 (6)
α, β, γ (°)	71.550 (4), 76.477 (4), 71.750 (4)
V (Å^3)	1057.04 (9)
Z	2
Radiation type	Mo *K*α
μ (mm^{-1})	0.22
Crystal size (mm)	0.43 × 0.20 × 0.16
Data collection	
Diffractometer	Stoe IPDS II
No. of measured, independent and observed [$I > 2\sigma(I)$] reflections	18510, 5106, 3786
R_{int}	0.034
(sin $\theta/\lambda)_{max}$ (Å^{-1})	0.661
Refinement	
$R[F^2 > 2\sigma(F^2)]$, $wR(F^2)$, *S*	0.031, 0.075, 0.89
No. of reflections	5106
No. of parameters	270
H-atom treatment	H atoms treated by a mixture of independent and constrained refinement
$\Delta\rho_{max}$, $\Delta\rho_{min}$ (e Å^{-3})	0.38, −0.22

Computer programs: *X-AREA* (Stoe & Cie, 2012), *XP* in *SHELXTL* and *SHELXS97* (Sheldrick, 2008), *SHELXL2014* (Sheldrick, 2015) and *publCIF* (Westrip, 2010).

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full crystallographic data

IUCrData (2018). **3**, x181784 [https://doi.org/10.1107/S2414314618017844]

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Crystal data

$C_{24}H_{22}N_2OP_2$
M_r = 416.37
Triclinic, $P\overline{1}$
a = 8.4464 (4) Å
b = 10.4163 (5) Å
c = 13.4880 (6) Å
α = 71.550 (4)°
β = 76.477 (4)°
γ = 71.750 (4)°
V = 1057.04 (9) Å^3
Z = 2
$F(000)$ = 436
D_x = 1.308 Mg m^{-3}
Mo $K\alpha$ radiation, λ = 0.71073 Å
Cell parameters from 7632 reflections
θ = 2.1–29.7°
μ = 0.22 mm^{-1}
T = 200 K
Prism, colourless
0.43 × 0.20 × 0.16 mm

Data collection

Stoe IPDS II diffractometer
Radiation source: fine-focus sealed tube
Graphite monochromator
ω scans
18510 measured reflections
5106 independent reflections
3786 reflections with $I > 2\sigma(I)$
R_{int} = 0.034
θ_{max} = 28.0°, θ_{min} = 2.1°
h = −11→10
k = −13→13
l = −17→17

Refinement

Refinement on F^2
Least-squares matrix: full
$R[F^2 > 2\sigma(F^2)]$ = 0.031
$wR(F^2)$ = 0.075
S = 0.89
5106 reflections
270 parameters
0 restraints
Hydrogen site location: mixed
H atoms treated by a mixture of independent and constrained refinement
$w = 1/[\sigma^2(F_o^2) + (0.0467P)^2]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max}$ = 0.001
$\Delta\rho_{max}$ = 0.38 e Å^{-3}
$\Delta\rho_{min}$ = −0.22 e Å^{-3}

Special details

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

Refinement. The N-bound hydrogen atoms H1 and H2B could be found from the difference Fourier map and were refined freely. All other H atoms were placed in idealized positions with d(C—H) = 0.95 Å and refined using a riding model with U_{iso}(H) fixed at 1.2 U_{eq}(C).

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

	x	*y*	*z*	U_{iso}*/U_{eq}
C1	0.48544 (17)	0.69757 (13)	0.19890 (10)	0.0229 (3)
C2	0.5326 (2)	0.64375 (15)	0.29896 (11)	0.0315 (3)
H2A	0.6299	0.5676	0.3110	0.038*
C3	0.4392 (2)	0.70007 (17)	0.38115 (12)	0.0396 (4)
H3A	0.4725	0.6630	0.4494	0.048*
C4	0.2977 (2)	0.81011 (17)	0.36409 (13)	0.0416 (4)
H4A	0.2326	0.8481	0.4208	0.050*
C5	0.2506 (2)	0.86493 (18)	0.26515 (14)	0.0439 (4)
H5A	0.1534	0.9413	0.2536	0.053*
C6	0.34393 (19)	0.80947 (15)	0.18232 (12)	0.0328 (3)
H6A	0.3111	0.8481	0.1140	0.039*
C7	0.80465 (17)	0.66634 (13)	0.05663 (10)	0.0229 (3)
C8	0.93398 (19)	0.59595 (15)	0.11728 (11)	0.0302 (3)
H8A	0.9210	0.5185	0.1762	0.036*
C9	1.08141 (19)	0.63851 (17)	0.09194 (12)	0.0347 (3)
H9A	1.1696	0.5900	0.1334	0.042*
C10	1.10071 (19)	0.75072 (17)	0.00700 (12)	0.0344 (3)
H10A	1.2014	0.7805	−0.0094	0.041*
C11	0.9744 (2)	0.82020 (17)	−0.05451 (12)	0.0382 (4)
H11A	0.9888	0.8970	−0.1136	0.046*
C12	0.82649 (19)	0.77819 (15)	−0.03034 (11)	0.0319 (3)
H12A	0.7400	0.8258	−0.0732	0.038*
C13	0.61345 (17)	0.11965 (13)	0.30235 (10)	0.0246 (3)
C14	0.6910 (2)	0.02742 (16)	0.38775 (12)	0.0351 (3)
H14A	0.6779	0.0565	0.4499	0.042*
C15	0.7867 (2)	−0.10579 (17)	0.38350 (13)	0.0429 (4)
H15A	0.8378	−0.1679	0.4428	0.052*
C16	0.8082 (2)	−0.14876 (16)	0.29358 (14)	0.0414 (4)
H16A	0.8756	−0.2398	0.2902	0.050*
C17	0.7314 (2)	−0.05915 (15)	0.20848 (12)	0.0365 (3)
H17A	0.7451	−0.0891	0.1467	0.044*
C18	0.63471 (19)	0.07405 (14)	0.21248 (11)	0.0287 (3)
H18A	0.5823	0.1349	0.1534	0.034*
C19	0.28166 (18)	0.29918 (14)	0.33548 (10)	0.0261 (3)
C20	0.2203 (2)	0.19537 (16)	0.32568 (12)	0.0354 (3)
H20A	0.2967	0.1167	0.3042	0.042*
C21	0.0494 (2)	0.20513 (18)	0.34677 (14)	0.0419 (4)
H21A	0.0093	0.1337	0.3390	0.050*
C22	−0.0634 (2)	0.31765 (17)	0.37906 (12)	0.0377 (4)
H22A	−0.1808	0.3240	0.3936	0.045*
C23	−0.0042 (2)	0.42118 (16)	0.39012 (12)	0.0384 (4)
H23A	−0.0811	0.4987	0.4128	0.046*
C24	0.1660 (2)	0.41228 (15)	0.36827 (12)	0.0339 (3)
H24A	0.2052	0.4844	0.3757	0.041*
N1	0.65219 (16)	0.45605 (12)	0.14559 (9)	0.0252 (2)

N2	0.50757 (15)	0.40184 (11)	0.18533 (9)	0.0259 (2)
O1	0.50978 (12)	0.68341 (10)	−0.00130 (7)	0.0275 (2)
P1	0.60334 (4)	0.62701 (3)	0.09005 (3)	0.02070 (8)
P2	0.50410 (5)	0.29827 (4)	0.31182 (3)	0.02479 (9)
H1	0.732 (2)	0.4119 (19)	0.1144 (15)	0.044 (5)*
H2B	0.482 (2)	0.3803 (18)	0.1384 (14)	0.036 (5)*

Atomic displacement parameters (Å²)

	U^{11}	U^{22}	U^{33}	U^{12}	U^{13}	U^{23}
C1	0.0239 (7)	0.0243 (6)	0.0238 (6)	−0.0102 (5)	−0.0020 (5)	−0.0081 (5)
C2	0.0354 (8)	0.0317 (7)	0.0270 (7)	−0.0057 (6)	−0.0070 (6)	−0.0082 (5)
C3	0.0557 (11)	0.0402 (8)	0.0244 (7)	−0.0137 (8)	−0.0051 (7)	−0.0098 (6)
C4	0.0500 (10)	0.0414 (8)	0.0338 (8)	−0.0118 (7)	0.0067 (7)	−0.0200 (7)
C5	0.0395 (10)	0.0407 (9)	0.0474 (9)	0.0040 (7)	−0.0058 (8)	−0.0210 (7)
C6	0.0328 (8)	0.0334 (7)	0.0328 (7)	−0.0032 (6)	−0.0082 (6)	−0.0123 (6)
C7	0.0221 (7)	0.0266 (6)	0.0212 (6)	−0.0075 (5)	−0.0023 (5)	−0.0075 (5)
C8	0.0279 (8)	0.0342 (7)	0.0258 (6)	−0.0087 (6)	−0.0059 (6)	−0.0022 (5)
C9	0.0244 (8)	0.0465 (9)	0.0335 (7)	−0.0072 (7)	−0.0087 (6)	−0.0097 (6)
C10	0.0252 (8)	0.0479 (9)	0.0358 (8)	−0.0172 (7)	0.0020 (6)	−0.0159 (7)
C11	0.0368 (9)	0.0422 (8)	0.0333 (8)	−0.0204 (7)	−0.0036 (7)	0.0021 (6)
C12	0.0288 (8)	0.0362 (7)	0.0286 (7)	−0.0112 (6)	−0.0088 (6)	0.0000 (6)
C13	0.0242 (7)	0.0254 (6)	0.0246 (6)	−0.0102 (5)	−0.0031 (5)	−0.0036 (5)
C14	0.0407 (9)	0.0359 (7)	0.0277 (7)	−0.0094 (7)	−0.0106 (6)	−0.0038 (6)
C15	0.0464 (10)	0.0344 (8)	0.0391 (9)	−0.0046 (7)	−0.0149 (7)	0.0029 (6)
C16	0.0439 (10)	0.0265 (7)	0.0462 (9)	−0.0045 (7)	−0.0028 (7)	−0.0065 (6)
C17	0.0447 (10)	0.0316 (7)	0.0334 (8)	−0.0114 (7)	0.0008 (7)	−0.0122 (6)
C18	0.0328 (8)	0.0293 (7)	0.0237 (6)	−0.0099 (6)	−0.0041 (6)	−0.0046 (5)
C19	0.0291 (7)	0.0288 (6)	0.0193 (6)	−0.0092 (6)	−0.0026 (5)	−0.0039 (5)
C20	0.0316 (8)	0.0380 (8)	0.0405 (8)	−0.0126 (6)	0.0012 (7)	−0.0167 (7)
C21	0.0352 (9)	0.0490 (9)	0.0476 (9)	−0.0188 (7)	−0.0009 (7)	−0.0171 (8)
C22	0.0266 (8)	0.0475 (9)	0.0308 (7)	−0.0078 (7)	−0.0032 (6)	−0.0016 (6)
C23	0.0347 (9)	0.0360 (8)	0.0339 (8)	0.0006 (7)	−0.0035 (7)	−0.0058 (6)
C24	0.0383 (9)	0.0288 (7)	0.0324 (7)	−0.0066 (6)	−0.0052 (6)	−0.0073 (6)
N1	0.0251 (6)	0.0233 (5)	0.0266 (6)	−0.0070 (5)	0.0006 (5)	−0.0080 (4)
N2	0.0336 (7)	0.0259 (5)	0.0226 (5)	−0.0143 (5)	−0.0060 (5)	−0.0045 (4)
O1	0.0285 (5)	0.0326 (5)	0.0238 (5)	−0.0090 (4)	−0.0077 (4)	−0.0070 (4)
P1	0.02160 (18)	0.02251 (16)	0.01936 (15)	−0.00718 (13)	−0.00382 (12)	−0.00538 (12)
P2	0.0297 (2)	0.02590 (17)	0.02158 (16)	−0.01021 (14)	−0.00453 (14)	−0.00654 (13)

Geometric parameters (Å, º)

C1—C6	1.3874 (19)	C14—C15	1.381 (2)
C1—C2	1.3883 (18)	C14—H14A	0.9500
C1—P1	1.7967 (13)	C15—C16	1.376 (2)
C2—C3	1.382 (2)	C15—H15A	0.9500
C2—H2A	0.9500	C16—C17	1.378 (2)
C3—C4	1.378 (2)	C16—H16A	0.9500

C3—H3A	0.9500	C17—C18	1.383 (2)
C4—C5	1.374 (2)	C17—H17A	0.9500
C4—H4A	0.9500	C18—H18A	0.9500
C5—C6	1.384 (2)	C19—C20	1.389 (2)
C5—H5A	0.9500	C19—C24	1.395 (2)
C6—H6A	0.9500	C19—P2	1.8283 (15)
C7—C12	1.3914 (19)	C20—C21	1.382 (2)
C7—C8	1.3916 (19)	C20—H20A	0.9500
C7—P1	1.7953 (14)	C21—C22	1.379 (2)
C8—C9	1.384 (2)	C21—H21A	0.9500
C8—H8A	0.9500	C22—C23	1.382 (2)
C9—C10	1.375 (2)	C22—H22A	0.9500
C9—H9A	0.9500	C23—C24	1.378 (2)
C10—C11	1.379 (2)	C23—H23A	0.9500
C10—H10A	0.9500	C24—H24A	0.9500
C11—C12	1.386 (2)	N1—N2	1.4256 (16)
C11—H11A	0.9500	N1—P1	1.6561 (11)
C12—H12A	0.9500	N1—H1	0.80 (2)
C13—C18	1.3915 (18)	N2—P2	1.7049 (12)
C13—C14	1.3918 (19)	N2—H2B	0.828 (18)
C13—P2	1.8304 (14)	O1—P1	1.4813 (9)

C6—C1—C2	119.11 (13)	C14—C15—H15A	119.9
C6—C1—P1	119.08 (10)	C15—C16—C17	119.71 (15)
C2—C1—P1	121.82 (10)	C15—C16—H16A	120.1
C3—C2—C1	120.48 (14)	C17—C16—H16A	120.1
C3—C2—H2A	119.8	C16—C17—C18	120.43 (14)
C1—C2—H2A	119.8	C16—C17—H17A	119.8
C4—C3—C2	119.92 (14)	C18—C17—H17A	119.8
C4—C3—H3A	120.0	C17—C18—C13	120.55 (13)
C2—C3—H3A	120.0	C17—C18—H18A	119.7
C5—C4—C3	120.08 (14)	C13—C18—H18A	119.7
C5—C4—H4A	120.0	C20—C19—C24	118.04 (14)
C3—C4—H4A	120.0	C20—C19—P2	125.26 (11)
C4—C5—C6	120.32 (15)	C24—C19—P2	116.68 (11)
C4—C5—H5A	119.8	C21—C20—C19	120.75 (14)
C6—C5—H5A	119.8	C21—C20—H20A	119.6
C5—C6—C1	120.08 (14)	C19—C20—H20A	119.6
C5—C6—H6A	120.0	C22—C21—C20	120.52 (15)
C1—C6—H6A	120.0	C22—C21—H21A	119.7
C12—C7—C8	119.27 (13)	C20—C21—H21A	119.7
C12—C7—P1	117.66 (10)	C21—C22—C23	119.42 (15)
C8—C7—P1	122.95 (10)	C21—C22—H22A	120.3
C9—C8—C7	120.12 (13)	C23—C22—H22A	120.3
C9—C8—H8A	119.9	C24—C23—C22	120.17 (14)
C7—C8—H8A	119.9	C24—C23—H23A	119.9
C10—C9—C8	120.22 (14)	C22—C23—H23A	119.9
C10—C9—H9A	119.9	C23—C24—C19	121.09 (14)

C8—C9—H9A	119.9	C23—C24—H24A	119.5
C9—C10—C11	120.22 (14)	C19—C24—H24A	119.5
C9—C10—H10A	119.9	N2—N1—P1	112.75 (9)
C11—C10—H10A	119.9	N2—N1—H1	117.6 (14)
C10—C11—C12	120.14 (14)	P1—N1—H1	114.7 (14)
C10—C11—H11A	119.9	N1—N2—P2	114.25 (9)
C12—C11—H11A	119.9	N1—N2—H2B	110.2 (12)
C11—C12—C7	120.01 (13)	P2—N2—H2B	121.8 (12)
C11—C12—H12A	120.0	O1—P1—N1	119.35 (6)
C7—C12—H12A	120.0	O1—P1—C7	111.77 (6)
C18—C13—C14	118.22 (13)	N1—P1—C7	102.73 (6)
C18—C13—P2	124.11 (10)	O1—P1—C1	110.99 (6)
C14—C13—P2	117.48 (10)	N1—P1—C1	102.73 (6)
C15—C14—C13	120.97 (14)	C7—P1—C1	108.36 (6)
C15—C14—H14A	119.5	N2—P2—C19	96.79 (6)
C13—C14—H14A	119.5	N2—P2—C13	106.30 (6)
C16—C15—C14	120.11 (14)	C19—P2—C13	103.11 (6)
C16—C15—H15A	119.9		

C6—C1—C2—C3	0.5 (2)	C22—C23—C24—C19	−0.4 (2)
P1—C1—C2—C3	−179.87 (12)	C20—C19—C24—C23	−0.1 (2)
C1—C2—C3—C4	0.3 (2)	P2—C19—C24—C23	−178.73 (11)
C2—C3—C4—C5	−0.8 (3)	P1—N1—N2—P2	−131.01 (8)
C3—C4—C5—C6	0.5 (3)	N2—N1—P1—O1	−59.52 (11)
C4—C5—C6—C1	0.3 (3)	N2—N1—P1—C7	176.20 (9)
C2—C1—C6—C5	−0.8 (2)	N2—N1—P1—C1	63.73 (10)
P1—C1—C6—C5	179.58 (13)	C12—C7—P1—O1	21.64 (13)
C12—C7—C8—C9	1.0 (2)	C8—C7—P1—O1	−162.43 (11)
P1—C7—C8—C9	−174.91 (11)	C12—C7—P1—N1	150.79 (11)
C7—C8—C9—C10	0.2 (2)	C8—C7—P1—N1	−33.28 (13)
C8—C9—C10—C11	−1.0 (2)	C12—C7—P1—C1	−100.97 (11)
C9—C10—C11—C12	0.7 (2)	C8—C7—P1—C1	74.96 (12)
C10—C11—C12—C7	0.5 (2)	C6—C1—P1—O1	−11.40 (13)
C8—C7—C12—C11	−1.3 (2)	C2—C1—P1—O1	169.00 (11)
P1—C7—C12—C11	174.78 (12)	C6—C1—P1—N1	−140.06 (11)
C18—C13—C14—C15	0.1 (2)	C2—C1—P1—N1	40.34 (13)
P2—C13—C14—C15	−175.06 (13)	C6—C1—P1—C7	111.69 (12)
C13—C14—C15—C16	0.7 (3)	C2—C1—P1—C7	−67.91 (13)
C14—C15—C16—C17	−1.1 (3)	N1—N2—P2—C19	165.14 (9)
C15—C16—C17—C18	0.7 (3)	N1—N2—P2—C13	−89.02 (10)
C16—C17—C18—C13	0.0 (2)	C20—C19—P2—N2	97.04 (13)
C14—C13—C18—C17	−0.4 (2)	C24—C19—P2—N2	−84.50 (11)
P2—C13—C18—C17	174.35 (12)	C20—C19—P2—C13	−11.50 (14)
C24—C19—C20—C21	0.7 (2)	C24—C19—P2—C13	166.97 (10)
P2—C19—C20—C21	179.15 (12)	C18—C13—P2—N2	−21.59 (14)
C19—C20—C21—C22	−0.7 (2)	C14—C13—P2—N2	153.23 (11)
C20—C21—C22—C23	0.1 (2)	C18—C13—P2—C19	79.63 (13)
C21—C22—C23—C24	0.5 (2)	C14—C13—P2—C19	−105.55 (12)

Hydrogen-bond geometry (Å, º)

Cg1 and Cg2 are the centroids of the C19–C24 and C7–C12 phenyl rings, respectively.

D—H···*A*	*D*—H	H···*A*	*D*···*A*	*D*—H···*A*
N2—H2*B*···O1^{i}	0.828 (18)	2.132 (18)	2.9357 (14)	163.6 (17)
C10—H10*A*···O1^{ii}	0.95	2.50	3.2854 (19)	140
C15—H15*A*···*Cg*1^{iii}	0.95	2.70	3.6125 (17)	162
C17—H17*A*···*Cg*2^{iv}	0.95	2.91	3.7171 (18)	144

Symmetry codes: (i) −*x*+1, −*y*+1, −*z*; (ii) *x*+1, *y*, *z*; (iii) −*x*+1, −*y*, −*z*+1; (iv) *x*, *y*−1, *z*.