

Niverville Check Engine (431)374-9988 349 Bronstone Dr, Niverville, MB R0A 0A1

YMMS: 2016 Porsche 911 Carrera GTS

Oct 15, 2020

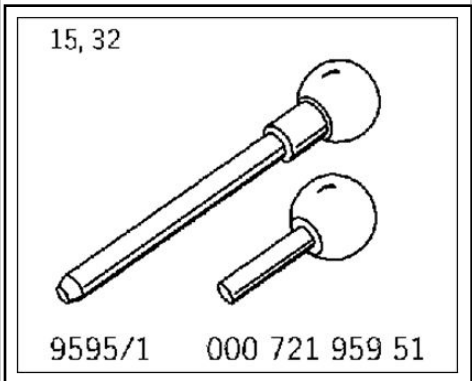
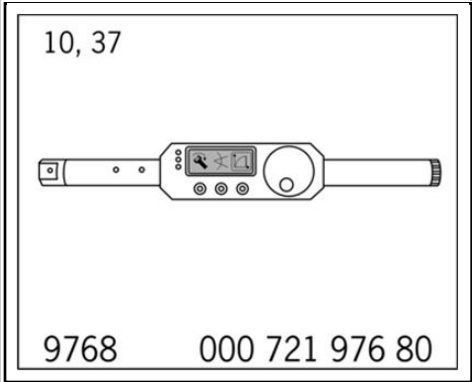
Engine: 3.8L Eng

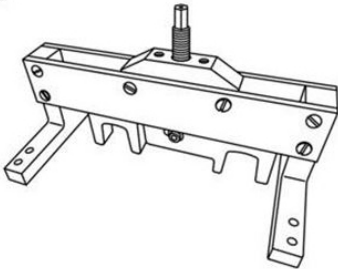
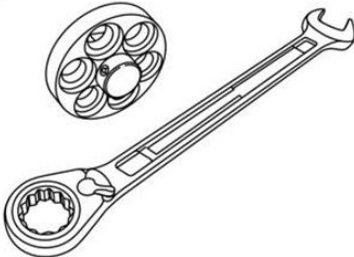
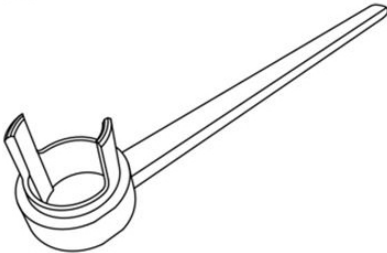
License:

VIN:

Odometer:

WM 150520 REMOVING AND INSTALLING CAMSHAFTS (INCLUDES SETTING TIMING) (EXCEPT CARRERA "EDITION", CARRERA CABRIOLET "EDITION", CARRERA 4 "EDITION", CARRERA 4 CABRIOLET "EDITION", GT3, GT3 RS)**Tools**

Designation	Type	Number	Description	
locating pin	Special tool	9595/1		 15, 32 9595/1 000 721 959 51
Electronic torque wrench, 2 - 100 Nm/1.5 - 74 ftlb.	Special tool	9768		 10, 37 9768 000 721 976 80
staking tool	Special tool	9772		

			15  9772000 721 977 20
turning device	Special tool	9773	10  9773000 721 977 30
holding wrench	Special tool	9775	15  9775000 721 977 50

Technical Values

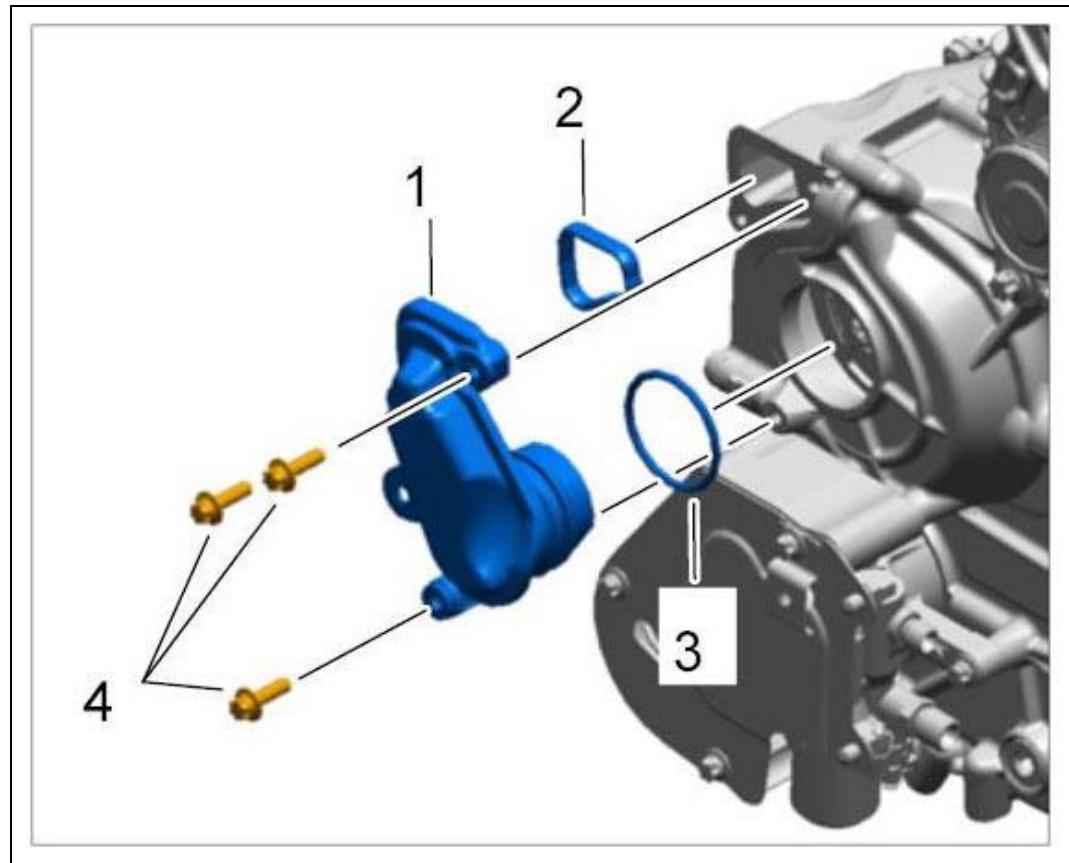
Location	Description	Type	Basic value	Tolerance 1	Tolerance 2
Chain tensioner	M22 x 1.5; replace sealing ring	Tightening torque	80 Nm (59 ftlb.)		

Camshaft bearing cover	External Torx, M6 x 37	Initial tightening	5 Nm (3.5 ftlb.)		
Camshaft bearing cover	External Torx screw, M6 x 37 - set threshold torque of 5 Nm (3.5 ftlb.)	Torque angle	50°		
Camshaft controller to camshaft	Internal Torx screw, M12 x 1.5 x 110 - replace friction washer	Initial tightening	5 Nm (3.5 ftlb.)		
Camshaft controller to camshaft	Internal Torx screw, M12 x 1.5 x 110 - replace friction washer - set threshold torque of 30 Nm (22 ftlb.)	Torque angle	90°		
Sprocket to camshaft	Internal Torx screw, M12 x 1.5 x 60 - replace friction washer	Tightening torque	5 Nm (3.5 ftlb.)		
Sprocket to camshaft	Internal Torx screw, M12 x 1.5 x 60 - replace friction washer - set threshold torque of 30 Nm (22 ftlb.)	Torque angle	65°		

Preliminary Work

1. Remove engine. → REMOVING ENGINE
2. Remove engine carrier. → REMOVING ENGINE CARRIER
3. Remove turbocharger. → REMOVING TURBOCHARGER
4. Remove spark plugs. → REMOVING SPARK PLUGS
5. Remove cylinder head cover. → Removing Cylinder Head Cover
6. Remove high-pressure pump. → REMOVING HIGH-PRESSURE PUMP
7. Remove vacuum pump. → REMOVING VACUUM PUMP
8. Remove cover **-1-** on positive crankcase ventilation line.
 1. 8.1. Cylinder bank 1-3: Unscrew external Torx screws **-4-** and replace O-ring **-3-** and molded seal **-2-** .

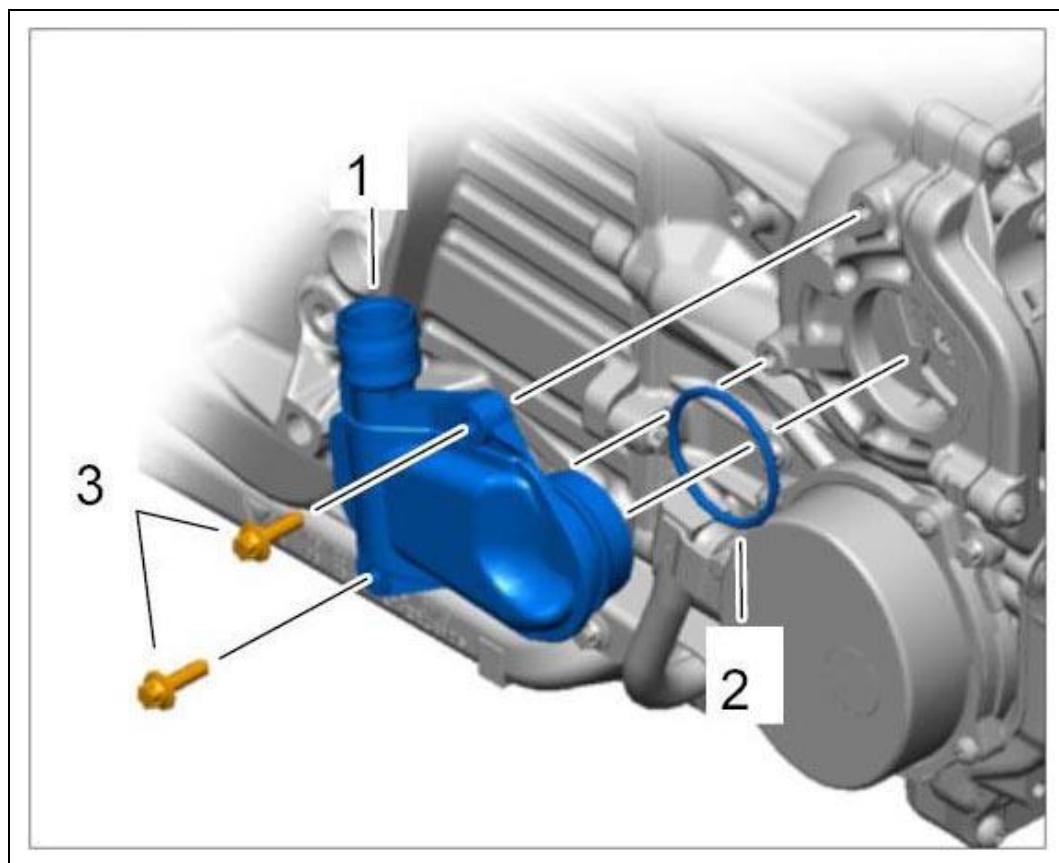
Fig 1: Removing Positive Crankcase Ventilation Cover 1-3



Courtesy of PORSCHE CARS NORTH AMERICA, INC.

2. 8.2. Cylinder bank 4-6: Unscrew external Torx screws -3- and replace O-ring -2- .

Fig 2: Removing Positive Crankcase Ventilation Cover 4-6



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Removing Camshafts

NOTE: *Dirt and contamination*

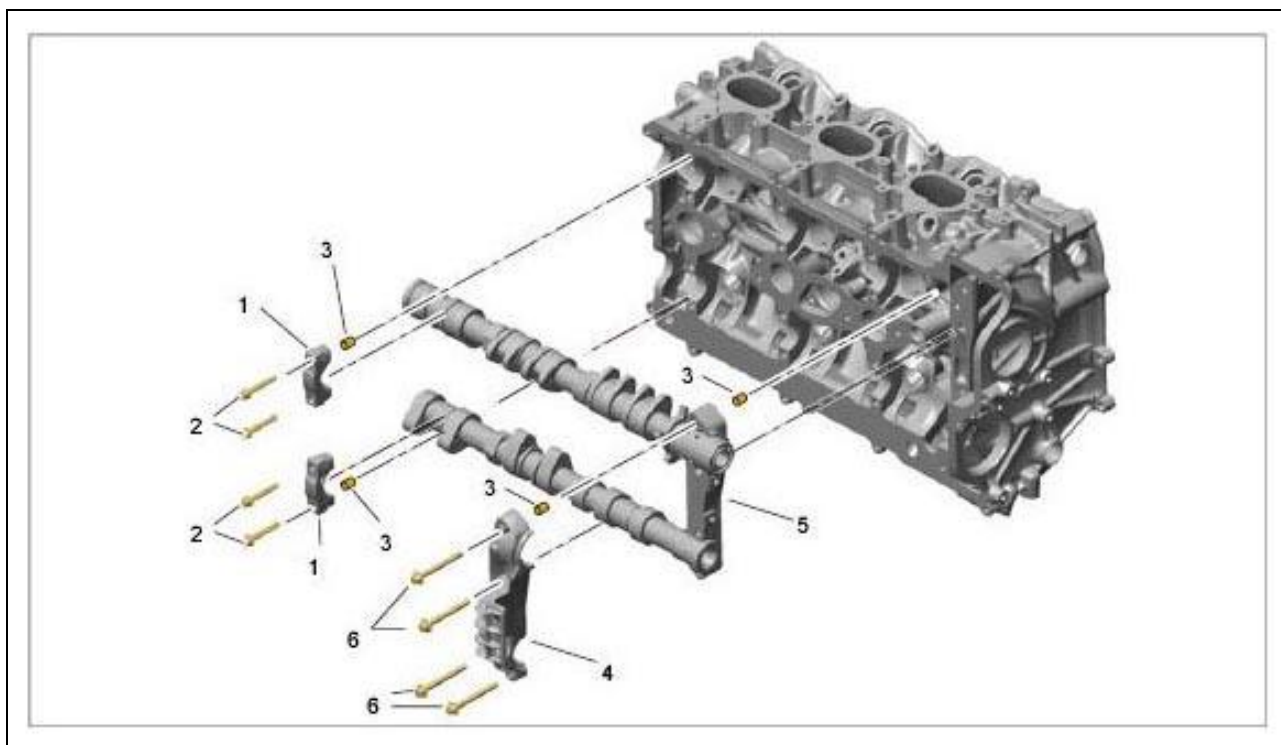
- *Risk of damage to units or components*

→ Protect components from dirt and contamination.

→ Clean or replace dirty components.

Component overview of cylinder head/camshafts (view of bank 1-3):

Fig 3: Overview Of Cylinder Head/Camshafts

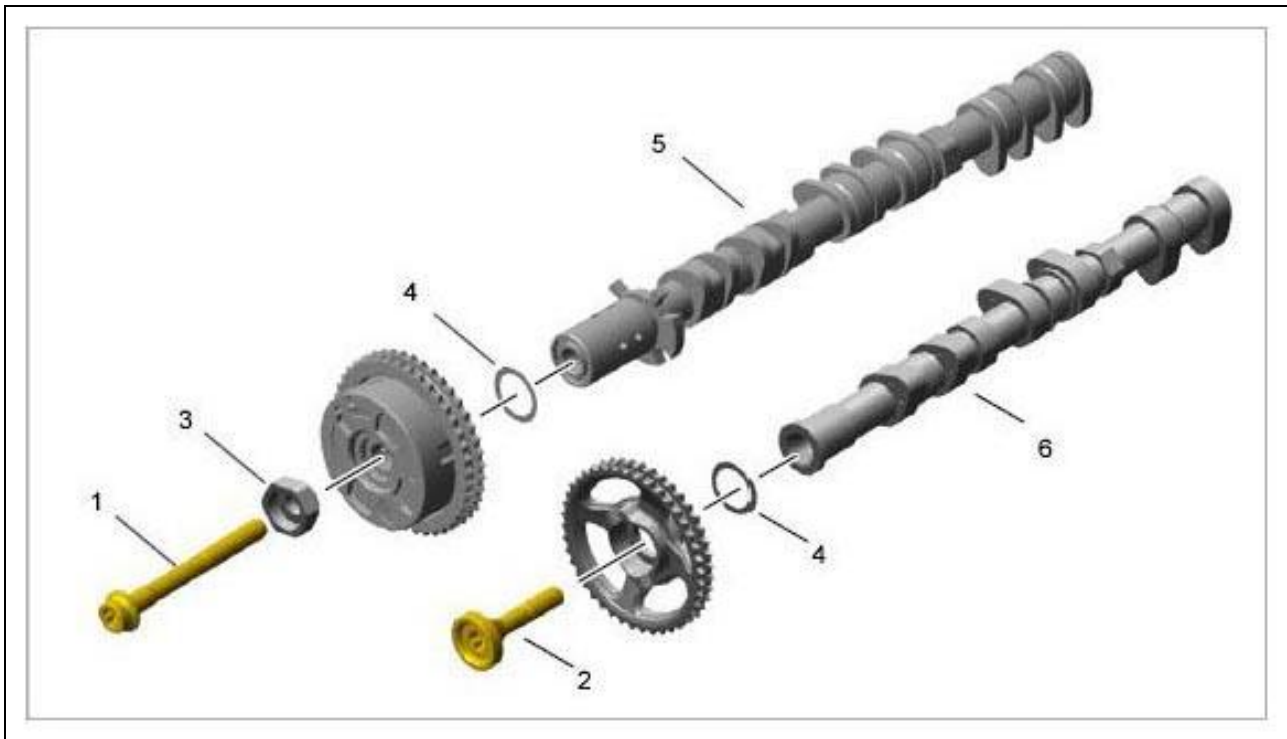


Courtesy of PORSCHE CARS NORTH AMERICA, INC.

1. Camshaft mounting saddle
2. External Torx screw, M6 x 37
3. Dowel sleeves for cylinder head - replace if damaged
4. Bearing saddle (upper part)
5. Bearing saddle (lower part)
6. External Torx screw, M6 x 55

Individual parts of camshafts:

Fig 4: Identifying Camshafts Parts



Courtesy of PORSCHE CARS NORTH AMERICA, INC.

1. Central screw for camshaft controller, M12 x 110 (replace screw)
2. Central screw for sprocket, M12 x 60 (replace screw)
3. Driver for camshaft controller
4. Friction plate (replace)
5. Intake camshaft
6. Outlet camshaft

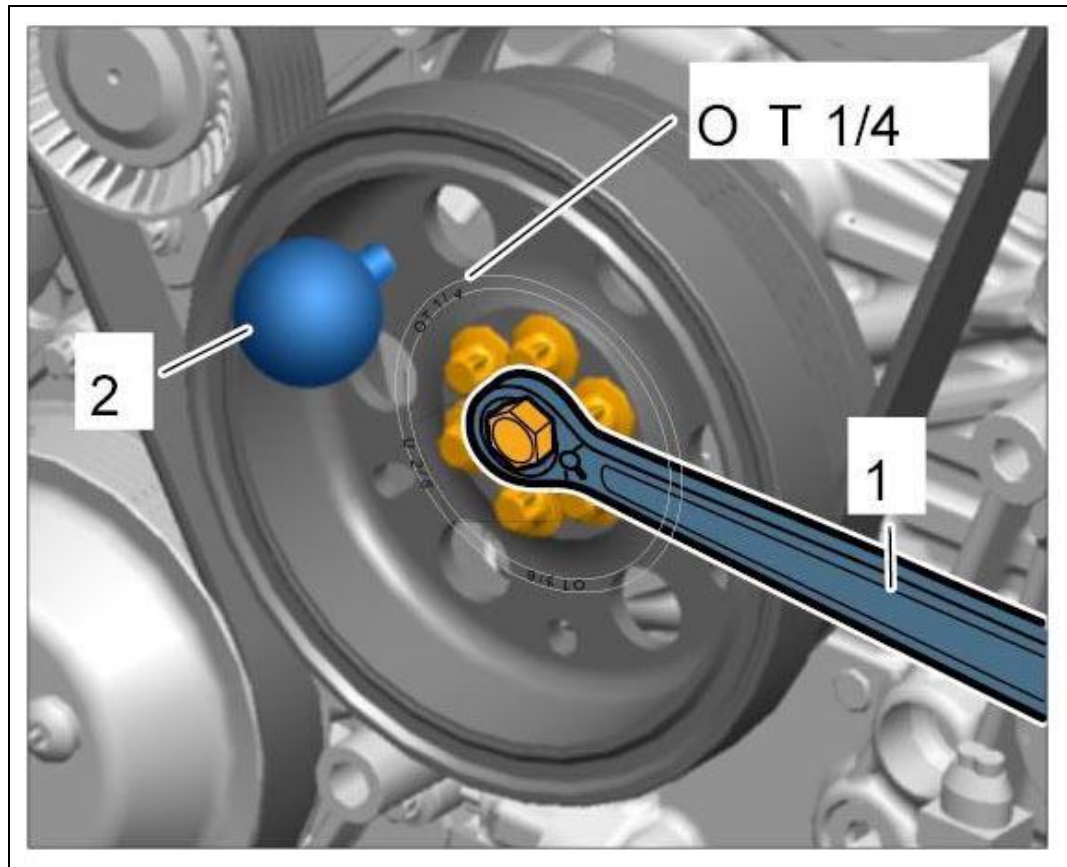
Information

- The camshafts can only be removed in the overlapping position at the top dead center of pistons 1 or 4.
- Only at this position can you be sure that the valves are not touching against the pistons and cannot be damaged when the engine turns.

1. Turn the engine at the assembly support so that the cylinder bank to be worked on is at the top.
2. Use special tool **turning device 9773 -1-** to turn the crankshaft clockwise at the vibration damper as far as the **TDC marking on cylinder 1/4** .

1. 2.1. Fix the vibration damper in place above the staking bore using a **locating pin 9595/1 -2-** .

Fig 5: Identifying TDC Marking On Cylinder 1/4 On Vibration Damper

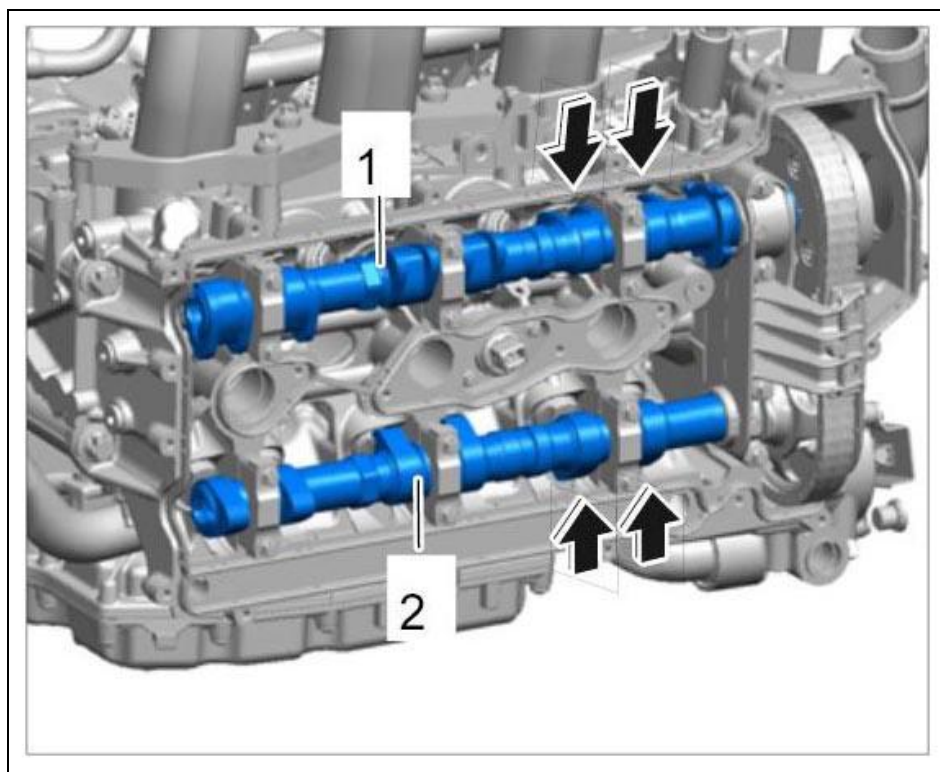


Courtesy of PORSCHE CARS NORTH AMERICA, INC.

3. Check cam position on cylinders 1 and 4.

1. 3.1. Check the position of the data matrix code on both camshafts. These must be facing the observer at overlapping position.
2. 3.2. **Overlap of cylinder 1:** The cams must be facing downwards at an angle to the cylinder head wall **-arrows-** .
 1. Intake camshaft 1-3
 2. Outlet camshaft 1-3

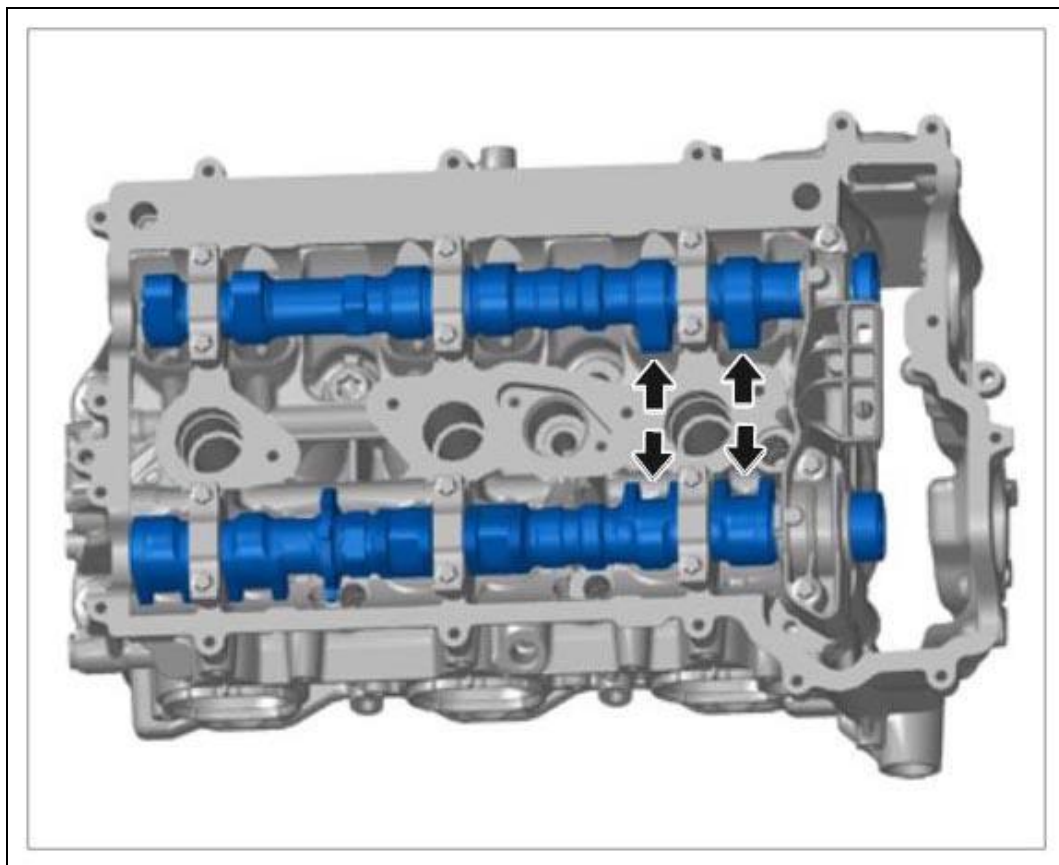
Fig 6: Locating Cam Position For Cylinder 1 On Overlap



Courtesy of PORSCHE CARS NORTH AMERICA, INC.

3. 3.3. **Overlap of cylinder 4 (viewed from above):** The cams are facing each other and are at a slight angle with respect to the spark-plug recess -**arrows**- .

Fig 7: Locating Cam Position Of Cylinder 4 On Overlap

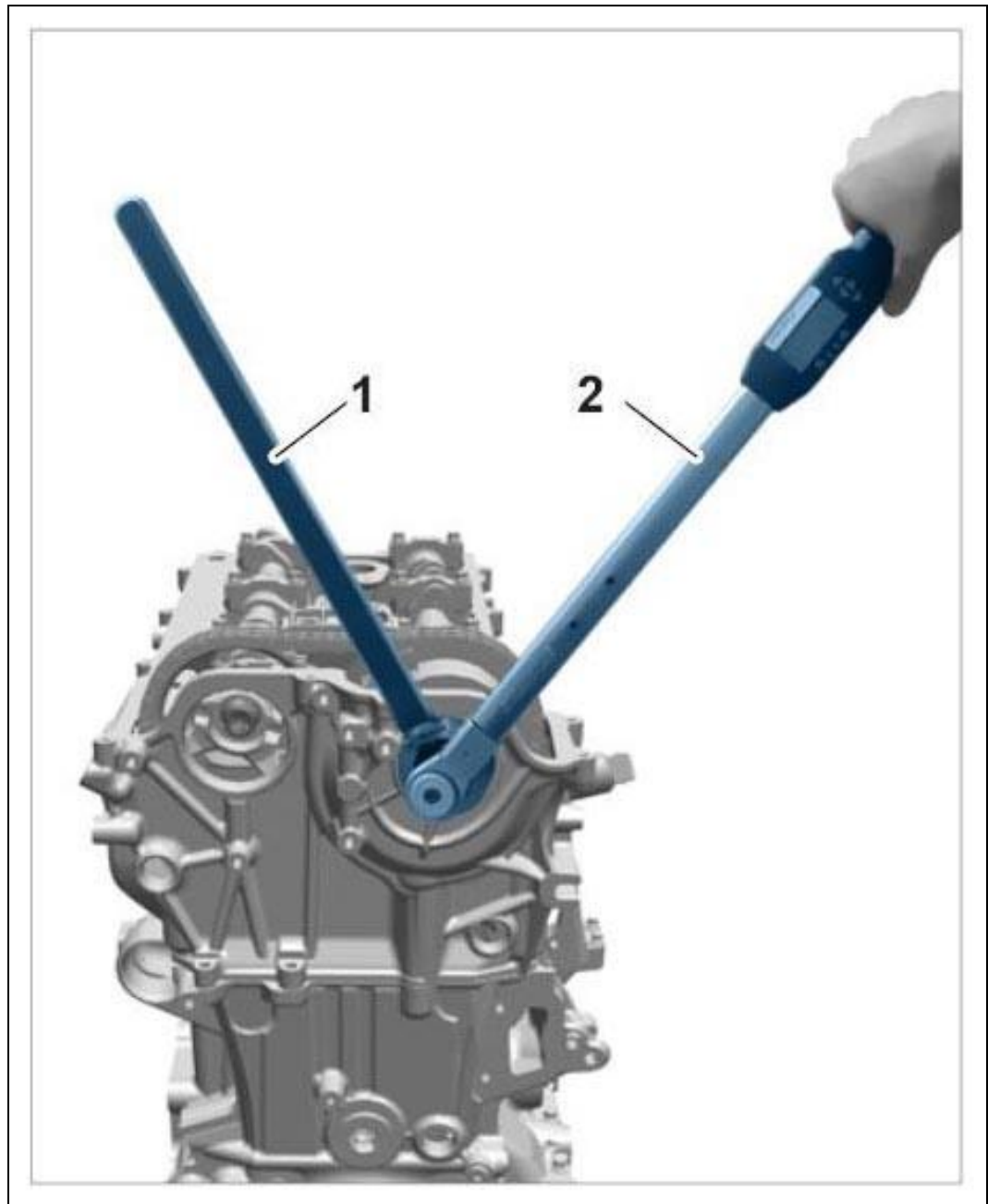


Courtesy of PORSCHE CARS NORTH AMERICA, INC.

4. Remove central screws on camshaft timing gears.

1. 4.1. Loosen internal Torx central screw on the outlet sprocket. To do this, counter with special tool **holding wrench 9775 -1-** .

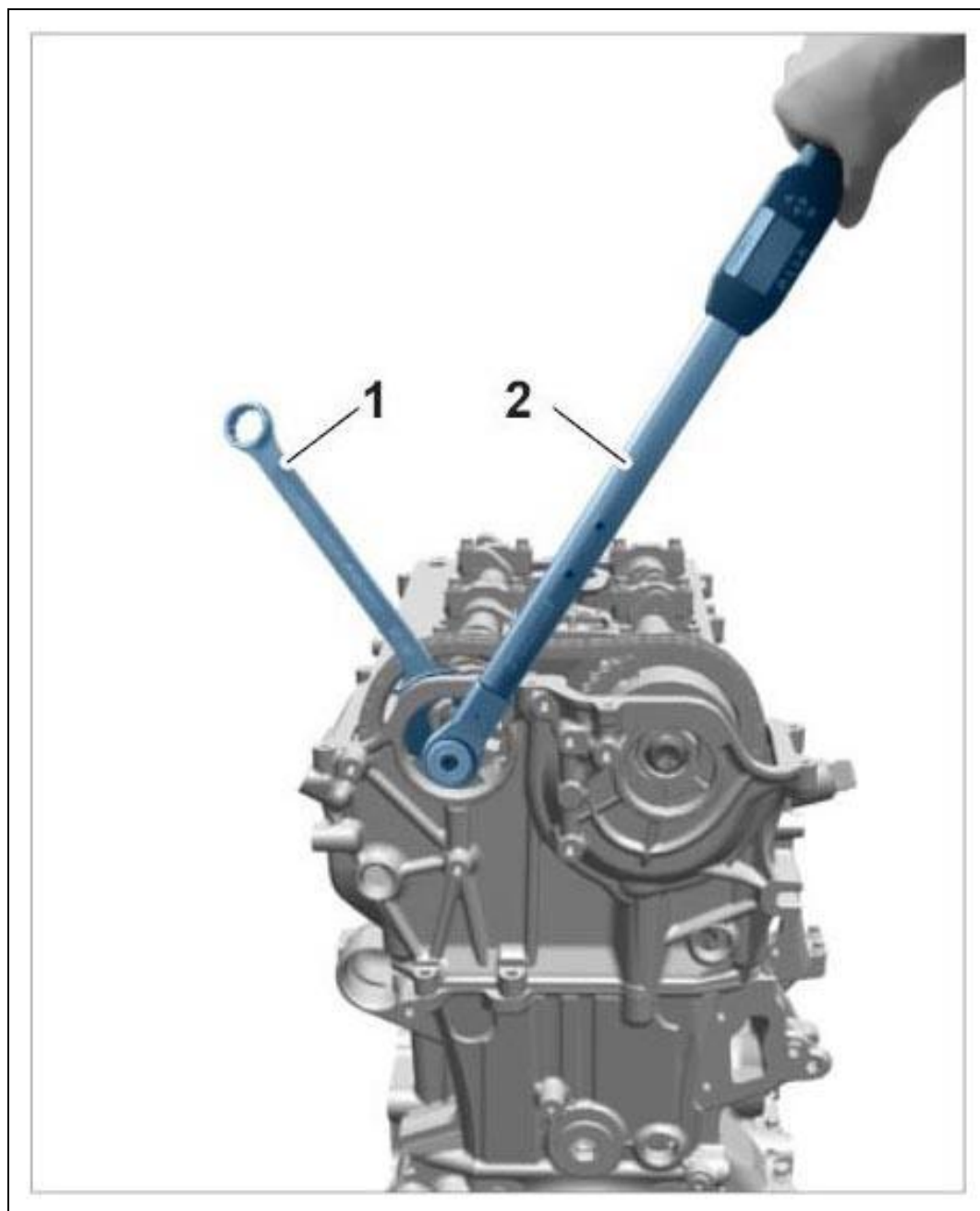
Fig 8: Loosening Outlet Sprocket



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2. 4.2. Loosen internal Torx central screw on the camshaft controller. To do this, counter with a long open-ended wrench (a/f 32) -1- .

Fig 9: Loosening Camshaft Controller



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5. Remove chain tensioner.

1. 5.1. **Cylinder bank 1-3:** The chain tensioner is on the exhaust side.
2. 5.2. **Cylinder bank 4-6:** Chain tensioner is on top of cylinder head.
3. 5.3. Replace sealing ring.

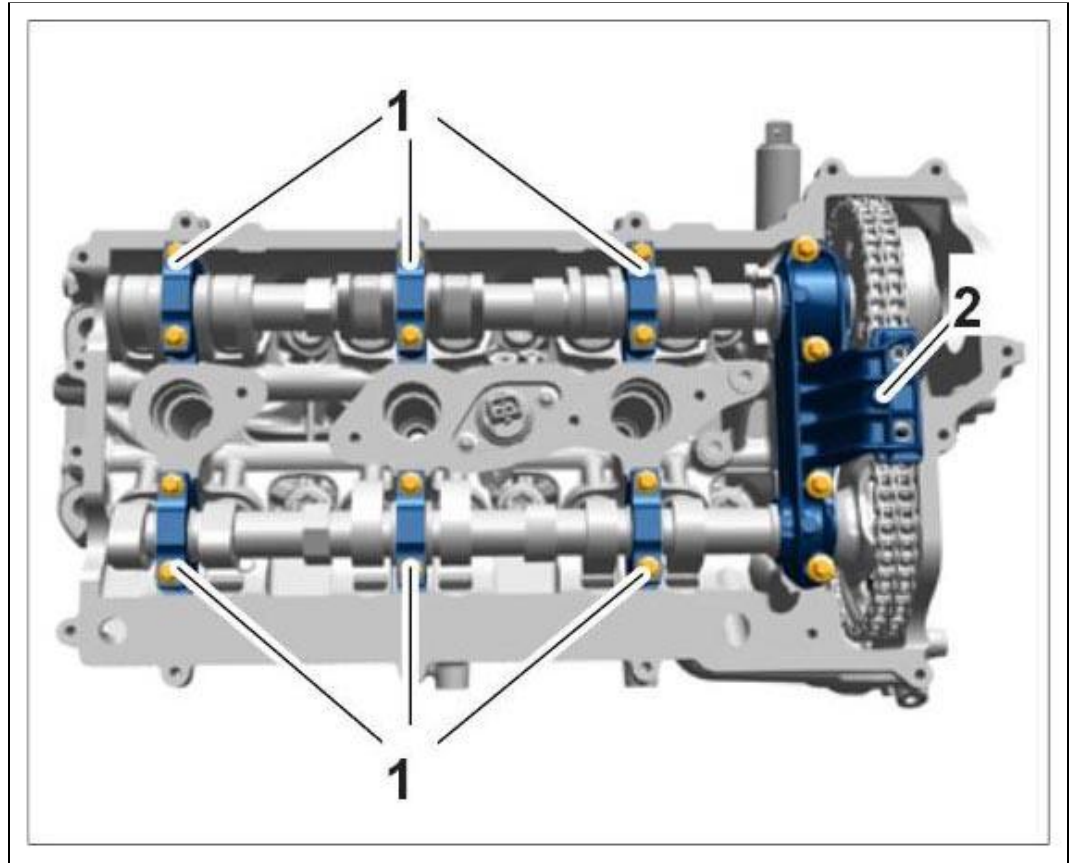
6. Loosen camshafts.

1. 6.1. Loosen and unscrew external Torx screws on the bearing saddle **-2-**.
2. 6.2. Loosen and unscrew external Torx screws for the mounting saddles **-1-** from the

outside to the inside.

3. 6.3. Remove bearing saddle and mounting saddles.

Fig 10: Identifying Camshaft Mount



Courtesy of PORSCHE CARS NORTH AMERICA, INC.

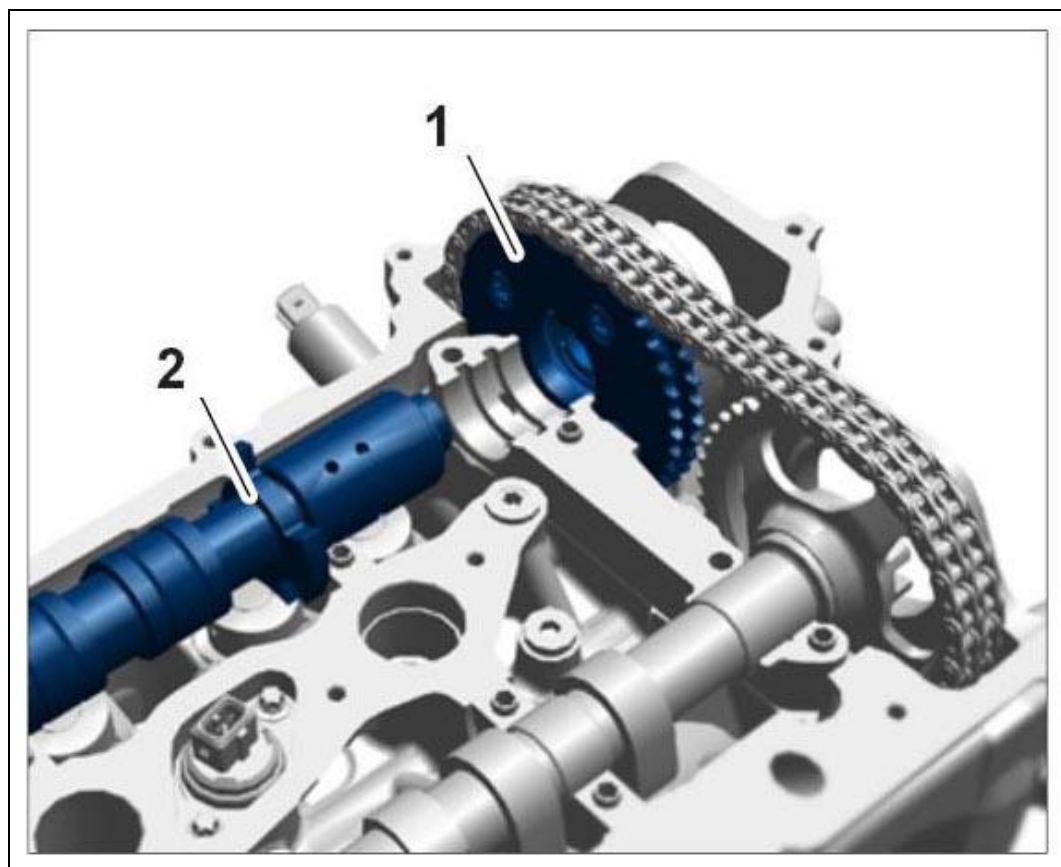
7. Lift camshafts out of the cylinder head. Lay the timing chain into the chain housing in the cylinder head.

1. 7.1. Unscrew central screw on the camshaft controller **-1-** .

2. 7.2. Lift up the camshaft controller with the intake camshaft and pull the camshaft **-2-** to the flywheel side using one hand. Lift up the timing chain and remove the camshaft controller.

Be particularly careful with the friction plate!

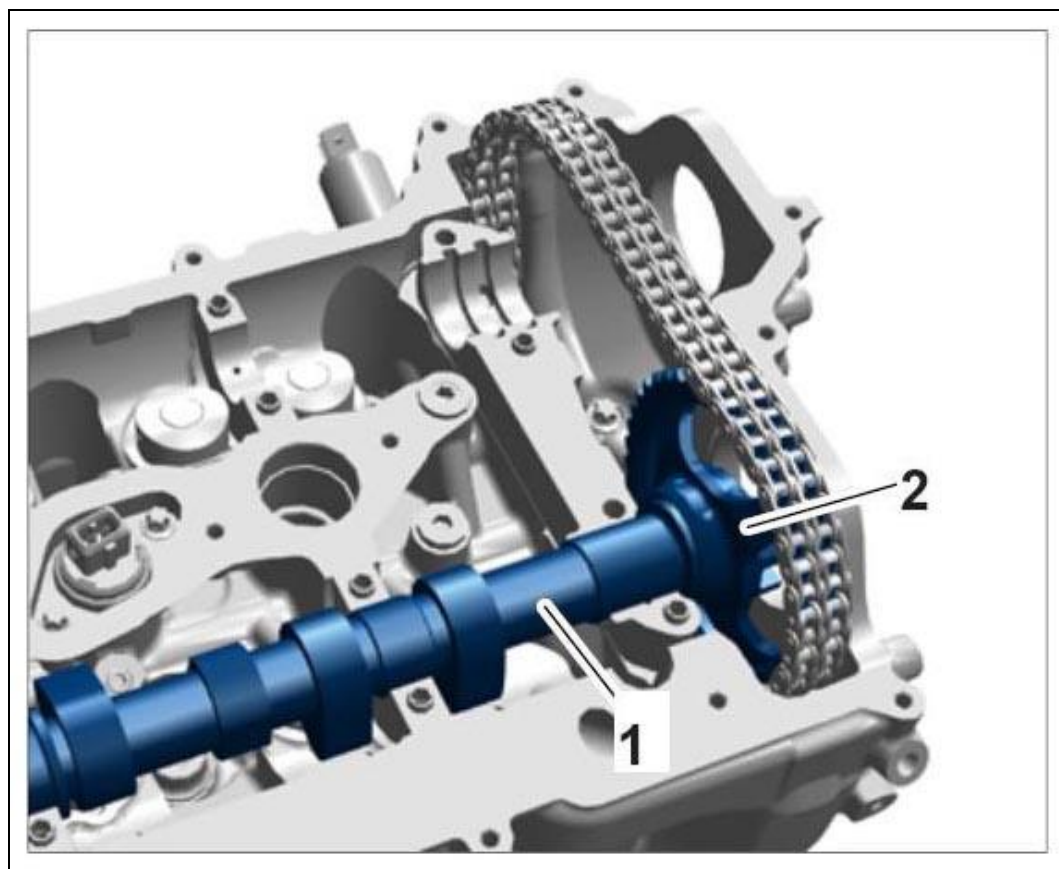
Fig 11: Identifying Intake Camshaft With Camshaft Controller



Courtesy of PORSCHE CARS NORTH AMERICA, INC.

3. 7.3. Place the camshaft controller on the intake camshaft again for storage. Tighten screw only slightly.
4. 7.4. Remove outlet camshafts -1- complete with the sprocket -2- .

Fig 12: Identifying Outlet Camshaft With Sprocket



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8. Replace the friction plates of the sprocket and camshaft controller.

Information

1. The camshaft controller must not be cleaned in a parts washer.
2. Only the outside can be cleaned using a clean, lint-free cloth.

9. Clean components.

1. 9.1. **Do not clean the camshaft controller in a parts washer!**

Installing Camshafts And Setting Timing

Component Markings And Distinguishing Features

Information

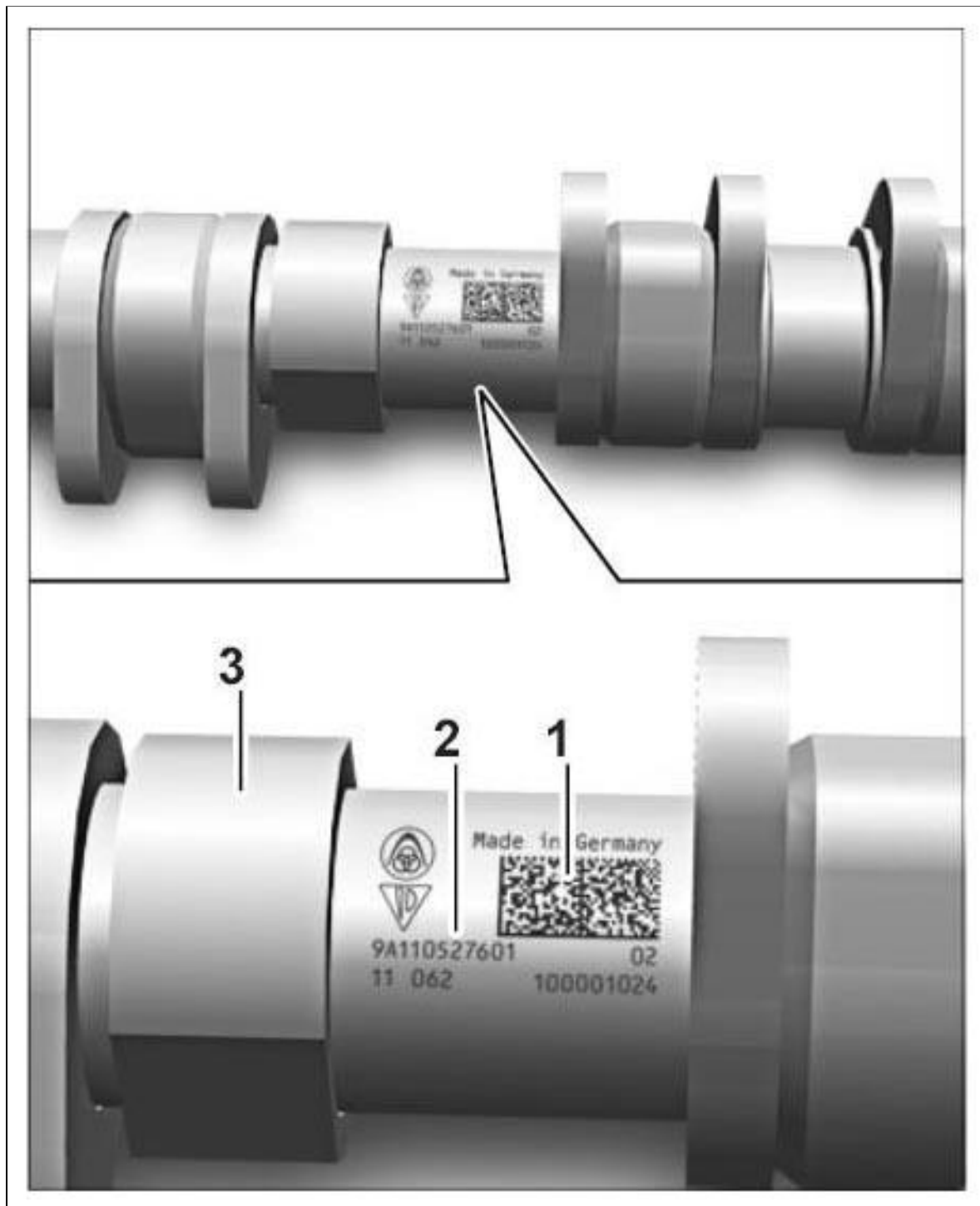
- The camshaft markings are on a surface next to the dihedron.
- The part number and data matrix code (helps when inserting the camshafts) are important.

Identification markings:

1. Data matrix code
2. Part No.

3. Conical dihedron for setting the timing

Fig 13: Identifying Part Number And Data Matrix Code Marking On Camshaft



Courtesy of PORSCHE CARS NORTH AMERICA, INC.

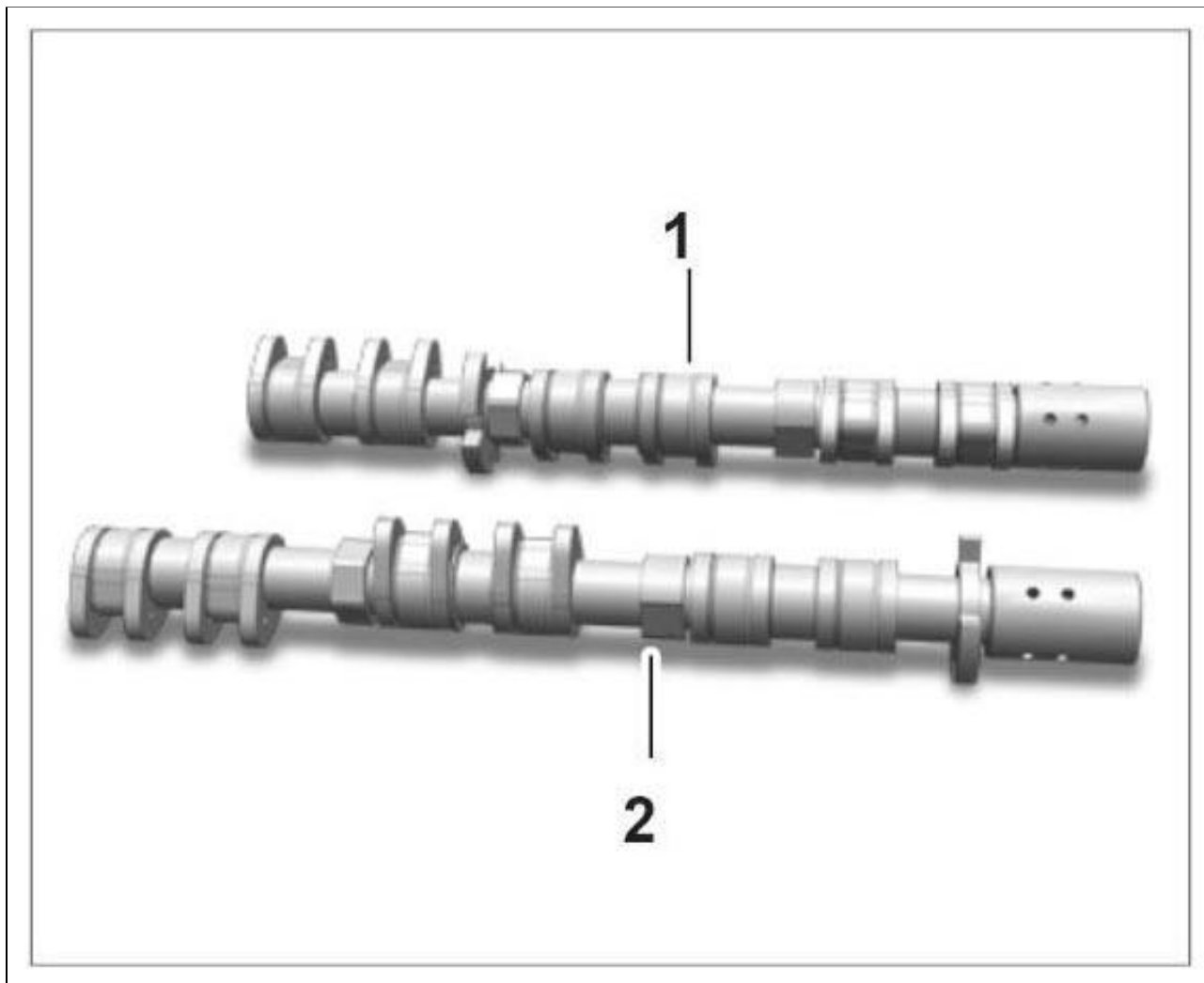
Part numbers on camshafts:

Intake side:

1. **3.8-litre engine - MA 1.03:** Intake camshaft (short) on cylinder bank 4-6, marking:
9A1.105.276.01

2. **3.8-litre engine - MA 1.03:** Intake camshaft on cylinder bank 1-3, marking: 9A1.105.275.01
3. **3.4-litre engine - MA 1.04:** Intake camshaft (short) on cylinder bank 4-6, marking: 9A1.105.284.01
4. **3.4-litre engine - MA 1.04:** Intake camshaft on cylinder bank 1-3, marking: 9A1.105.283.01

Fig 14: Identifying Intake Camshafts

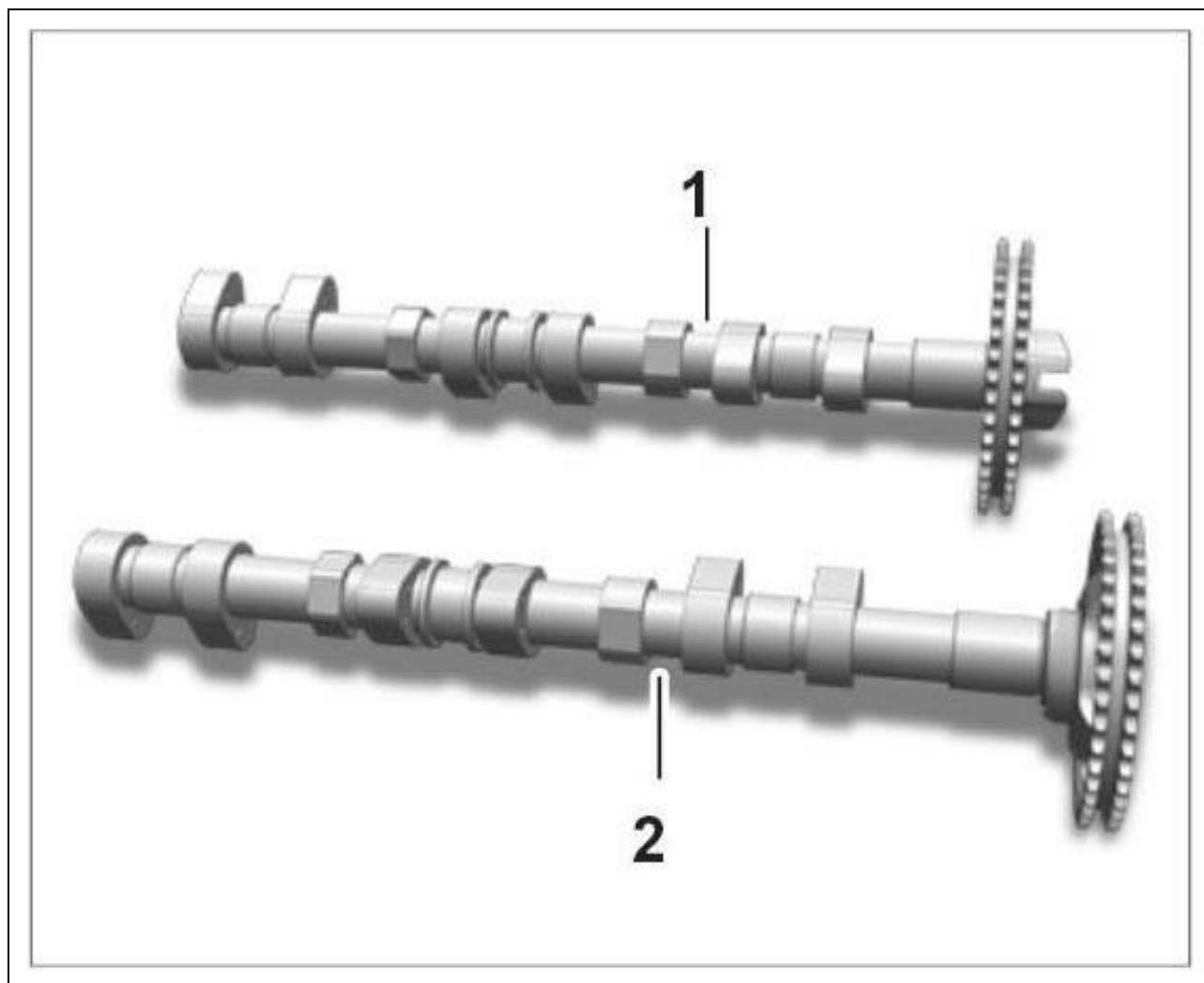


Courtesy of PORSCHE CARS NORTH AMERICA, INC.

Outlet side:

1. **3.8-litre engine - MA 1.03:** Outlet camshaft (short) on cylinder bank 4-6, marking: 9A1.105.278.01
2. **3.8-litre engine - MA 1.03:** Outlet camshaft on cylinder bank 1-3, marking: 9A1.105.277.01
3. **3.4-litre engine - MA 1.04:** Outlet camshaft (short) on cylinder bank 4-6, marking: 9A1.105.286.01
4. **3.4-litre engine - MA 1.04:** Outlet camshaft on cylinder bank 1-3, marking: 9A1.105.285.01

Fig 15: Identifying Outlet Camshafts



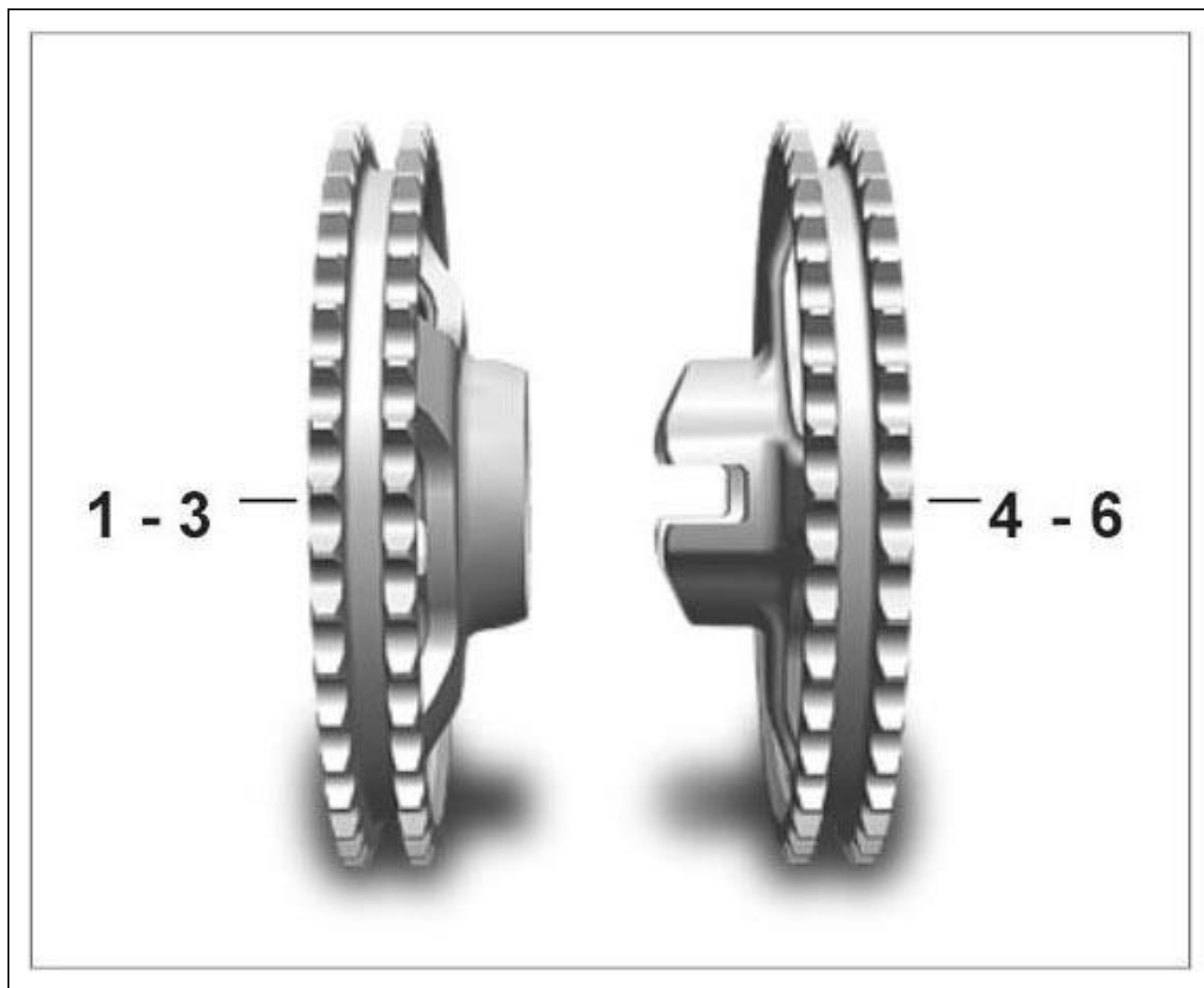
Courtesy of PORSCHE CARS NORTH AMERICA, INC.

Distinguishing features of outlet sprockets:

1-3 - Sprocket for outlet camshaft on cylinder 1-3, driver for high-pressure pump: Recess 13.5 mm and 11.6 mm deep.

4-6 - Sprocket for outlet camshaft on cylinder 4-6, driver for vacuum pump, both recesses 11.6 mm deep.

Fig 16: Identifying Outlet Sprockets



Courtesy of PORSCHE CARS NORTH AMERICA, INC.

Camshaft mount:

- **Bearing saddle:** Matching number for cylinder head, upper and lower part on the front (chain box side)
- **Bearing cover:** Matching number for cylinder head and allocation to intake and outlet side of cylinder (e.g. A1 for outlet cylinder 1)

Installing Camshafts, Setting Timing - Cylinder Bank 4-6

NOTE: *Dirt and contamination*

- *Risk of damage to units or components*

→ Protect components from dirt and contamination.

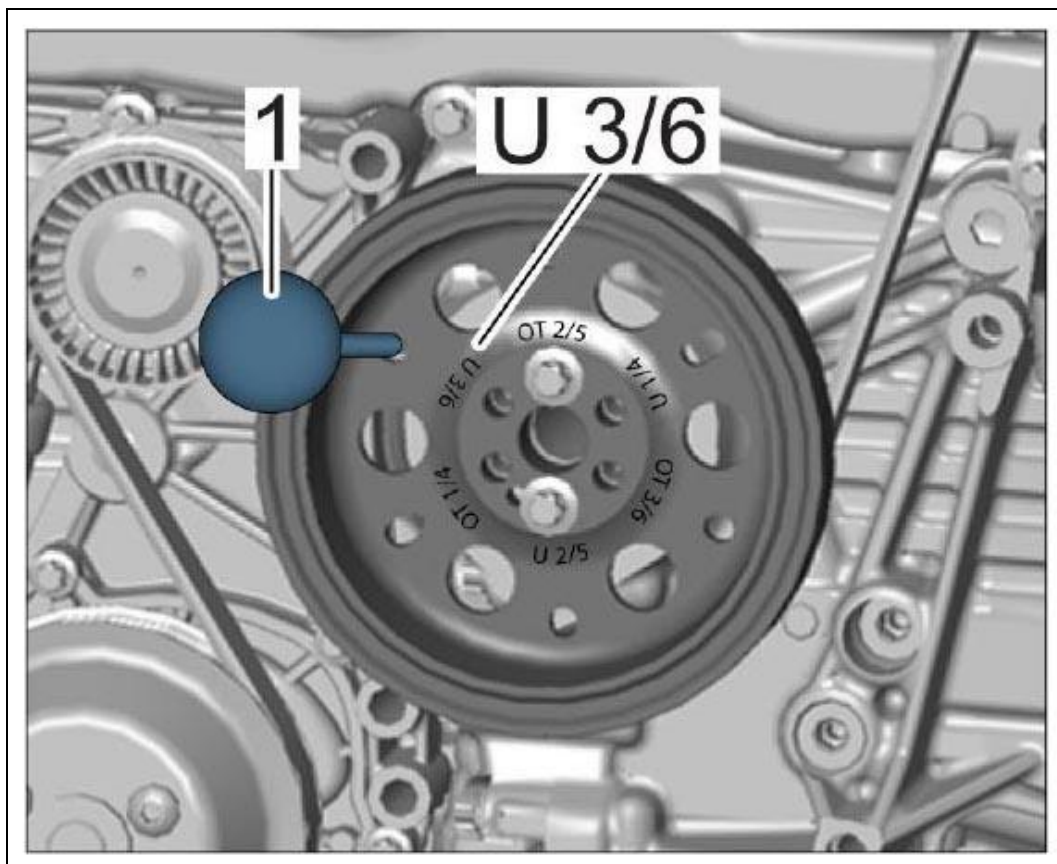
→ Clean or replace dirty components.

1. Turn the crankshaft **clockwise (direction of rotation of engine)** to 60° before TDC at the vibration damper.

1. 1.1. This position is marked **U 3/6** on the surface.

2. 1.2. Fix using a long **locating pin 9595/1 -1-** .

Fig 17: Identifying U 3/6 Marking On Vibration Damper



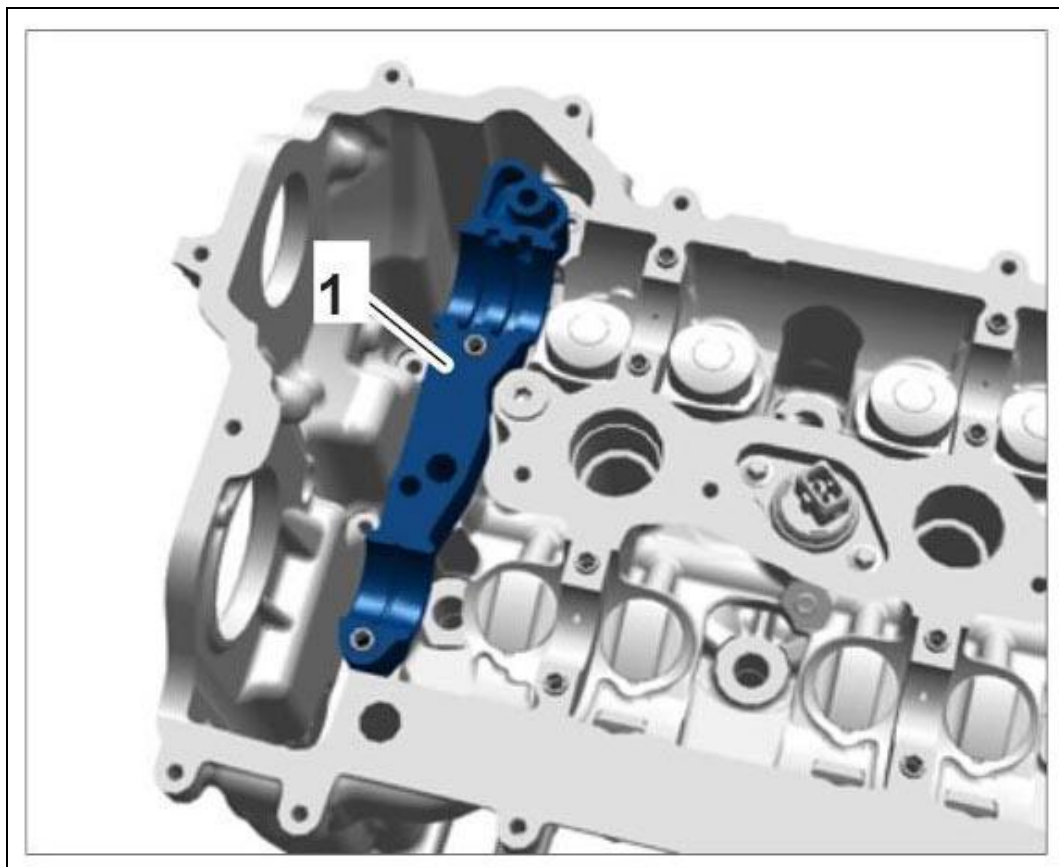
Courtesy of PORSCHE CARS NORTH AMERICA, INC.

2. Turn the engine at the assembly support so that the cylinder bank to be fitted is at the top.

3. Insert lower part of bearing saddle **-1-** . **Check matching number!**

1. 3.1. Check position of oil bores and position and fit the component over the dowel sleeves.

Fig 18: Identifying Lower Part Of Bearing Saddle 4-6



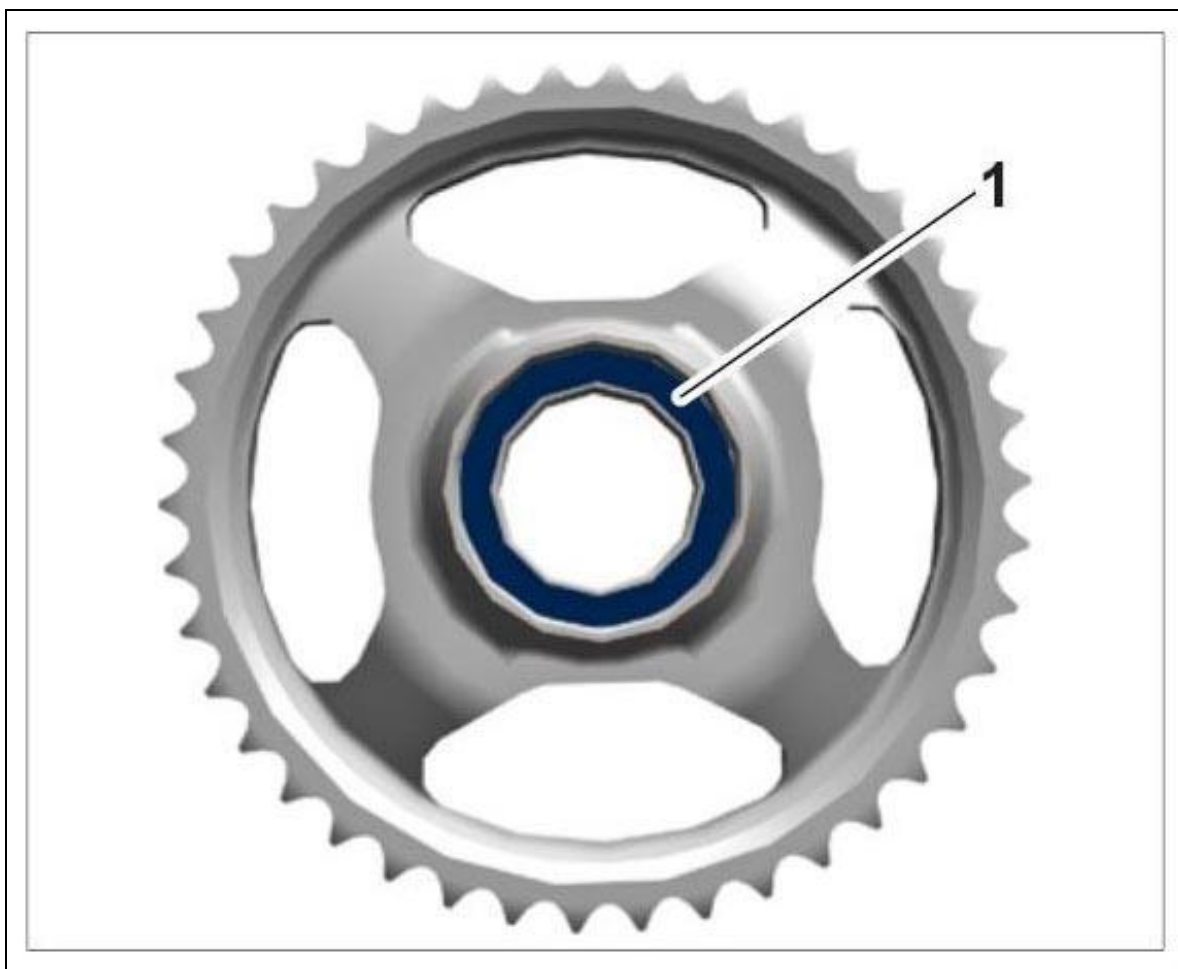
Courtesy of PORSCHE CARS NORTH AMERICA, INC.

4. Oil the bearing surfaces of the camshafts with new engine oil. When rebuilding the engine, apply a light coating of Optimol Optipit grease (Part No. 000.043.204.17) on the bearings.

1. 4.1. Check that all hydraulic tappets are installed correctly.

5. Check that the new friction plate **-1-** is fitted in the outlet sprocket.

Fig 19: Identifying Friction Plate In Outlet Sprocket

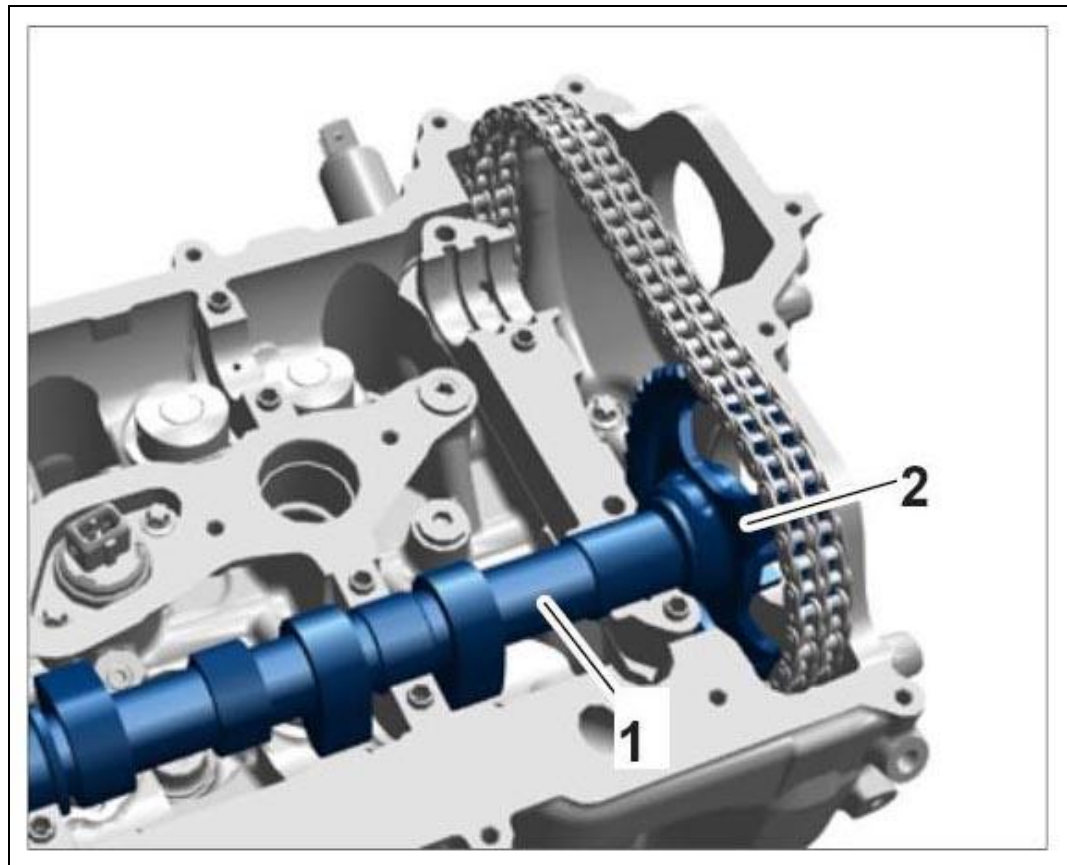


Courtesy of PORSCHE CARS NORTH AMERICA, INC.

6. Fit outlet camshaft **-1-** and sprocket **-2-** .

1. 6.1. Tighten the central screw only slightly so that the sprocket can still turn.
2. 6.2. Lift the timing chain and position the camshaft and sprocket at the overlapping position of cylinder 4. The cams must then be facing downwards at an angle with respect to the spark-plug recess and the camshaft must lie loosely in the bearing positions.

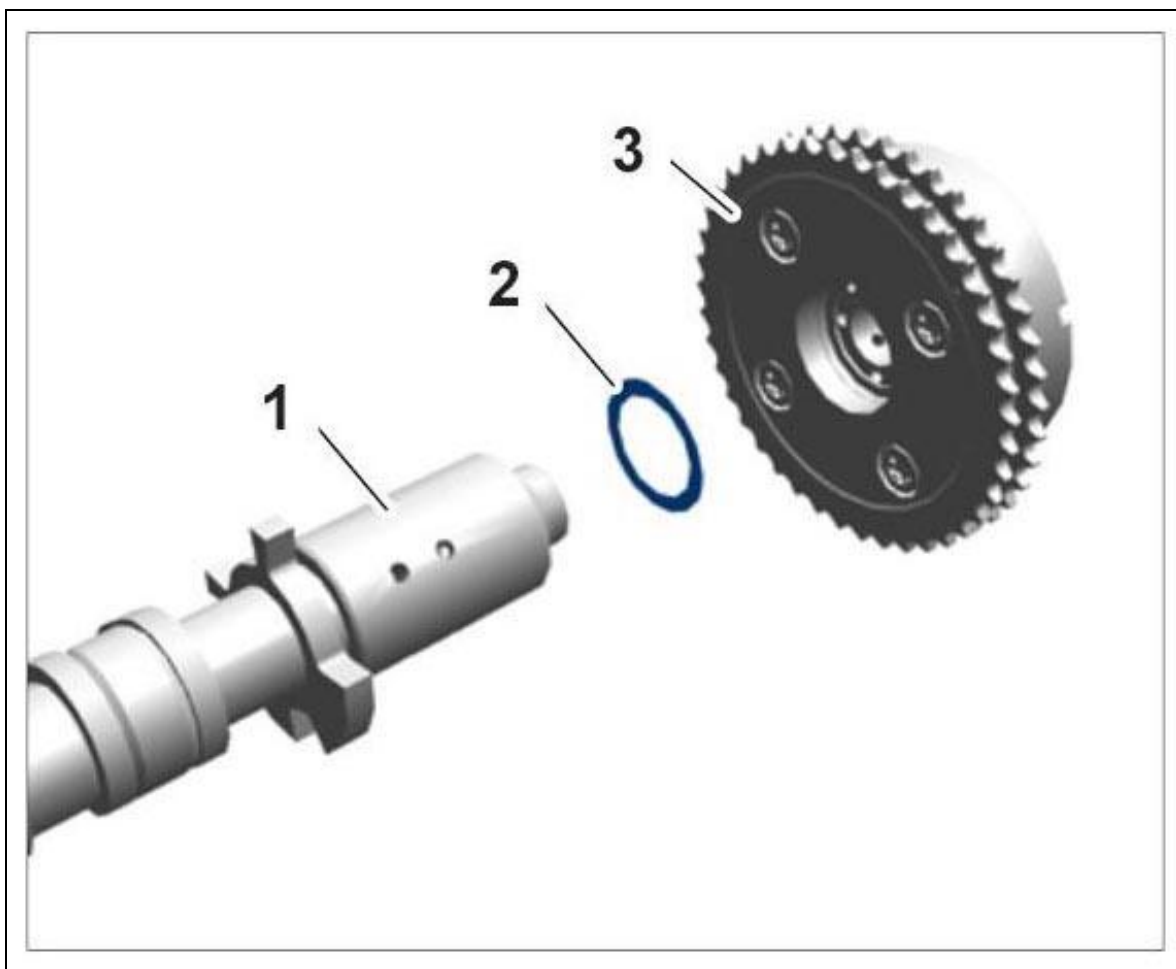
Fig 20: Identifying Outlet Camshaft And Sprocket (Cylinder Bank 1-3)



Courtesy of PORSCHE CARS NORTH AMERICA, INC.

7. Check that the new friction plate **-2-** is fitted in the camshaft controller **-3-** .

Fig 21: Identifying Friction Plate In Camshaft Controller

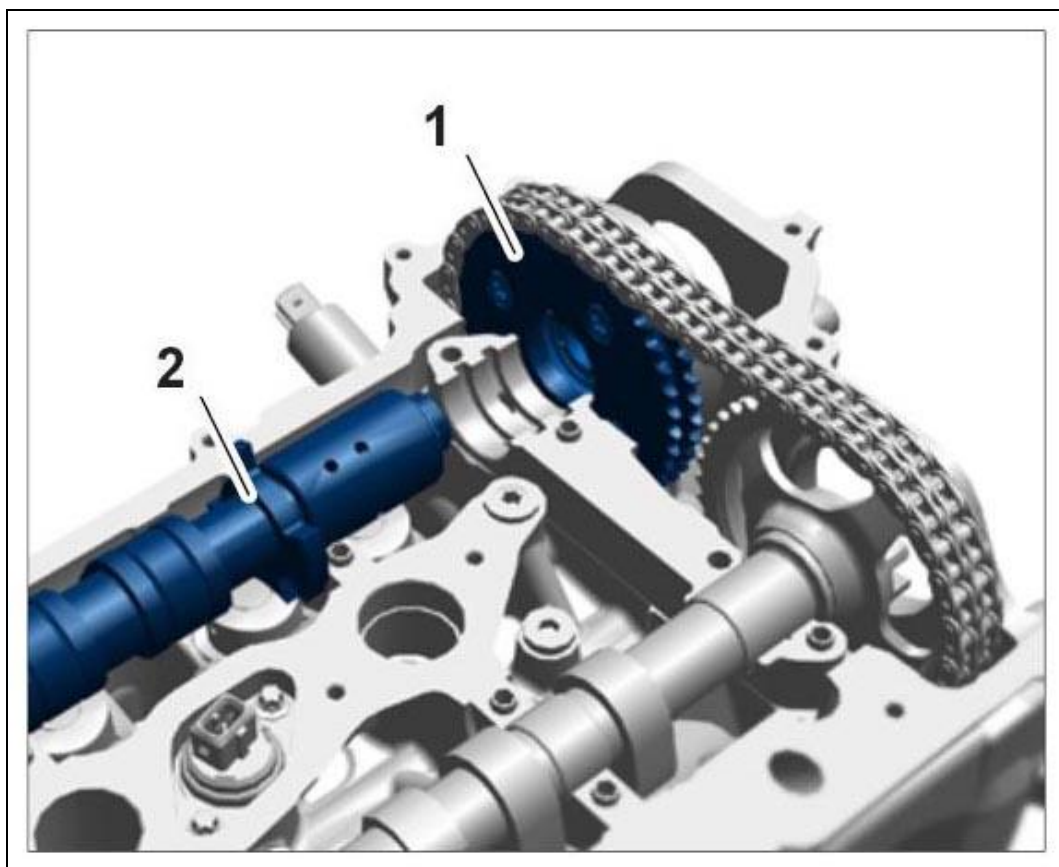


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8. Insert intake camshaft **-2-** .

1. 8.1. Lift the timing chain and engage and secure the camshaft controller **-1-** . Guide the intake camshaft into the controller and set it to the overlapping position of cylinder 4. The cams must then be facing downwards at an angle with respect to the spark-plug recess and the camshaft must lie loosely in the bearing positions.
2. 8.2. Screw in the central screw loosely by hand so that the controller can still turn.

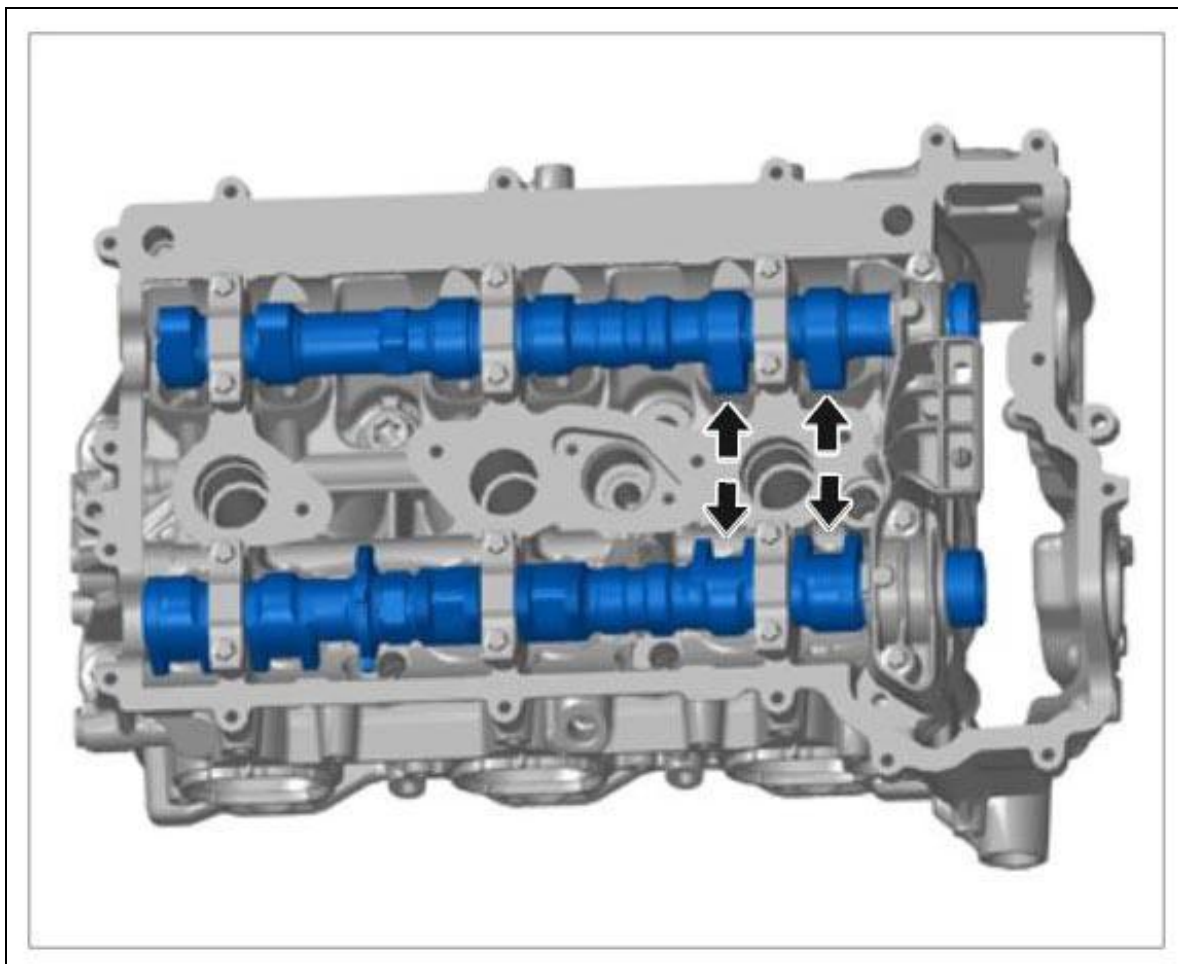
Fig 22: Identifying Intake Camshaft With Camshaft Controller (Cylinder Bank 1-3)



Courtesy of PORSCHE CARS NORTH AMERICA, INC.

9. Check cam position for cylinder 4 again. The cams must be facing downwards at an angle with respect to the spark-plug recess **-arrows-** .

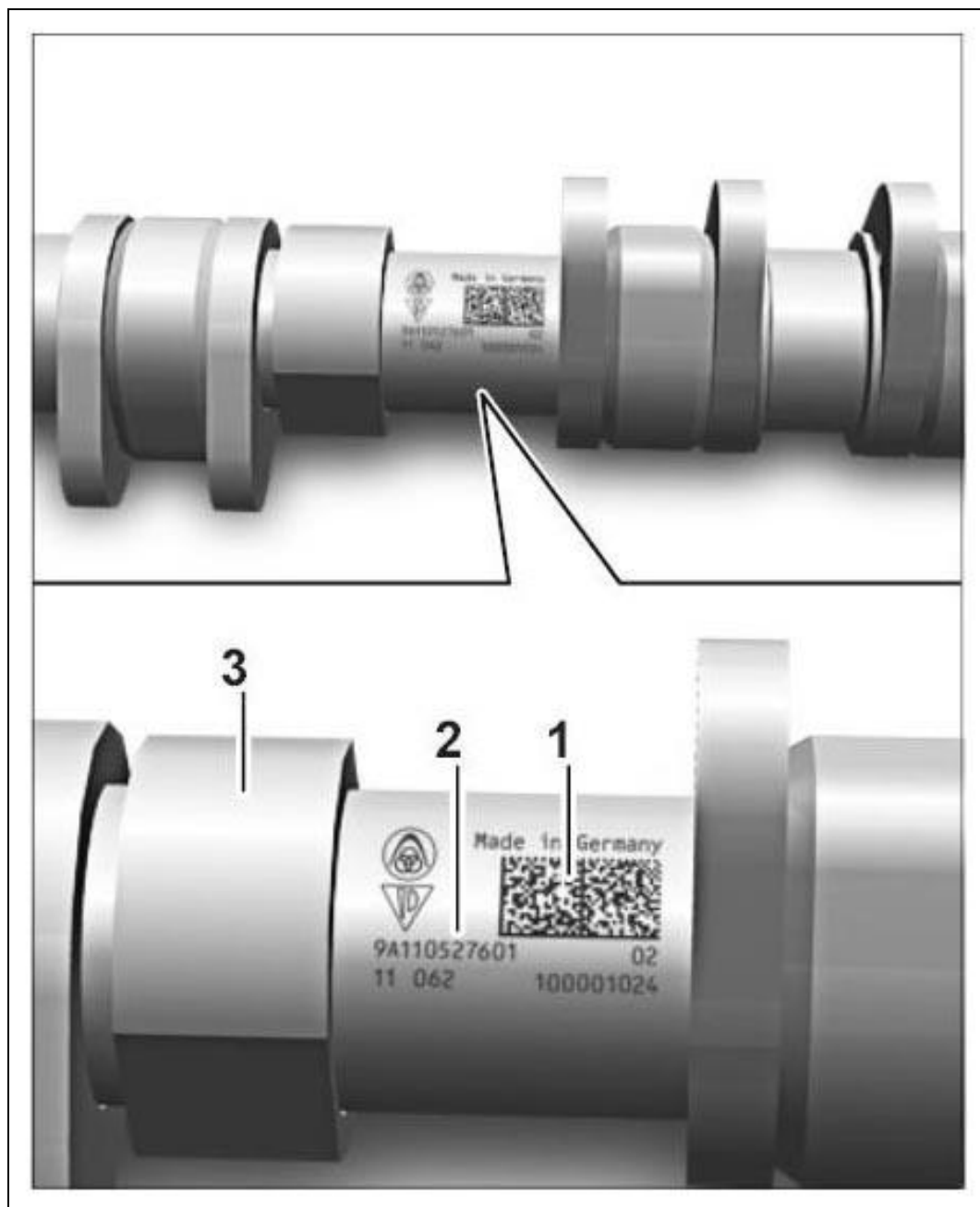
Fig 23: Locating Cam Position On Cylinder 4 (Overlap)



Courtesy of PORSCHE CARS NORTH AMERICA, INC.

1. 9.1. Another feature is the data matrix code marking **-1-** on the reconditioned surface next to the dihedral **-3-**. These markings must be facing the observer at overlapping position.

Fig 24: Identifying Part Number And Data Matrix Code Marking On Camshaft



Courtesy of PORSCHE CARS NORTH AMERICA, INC.

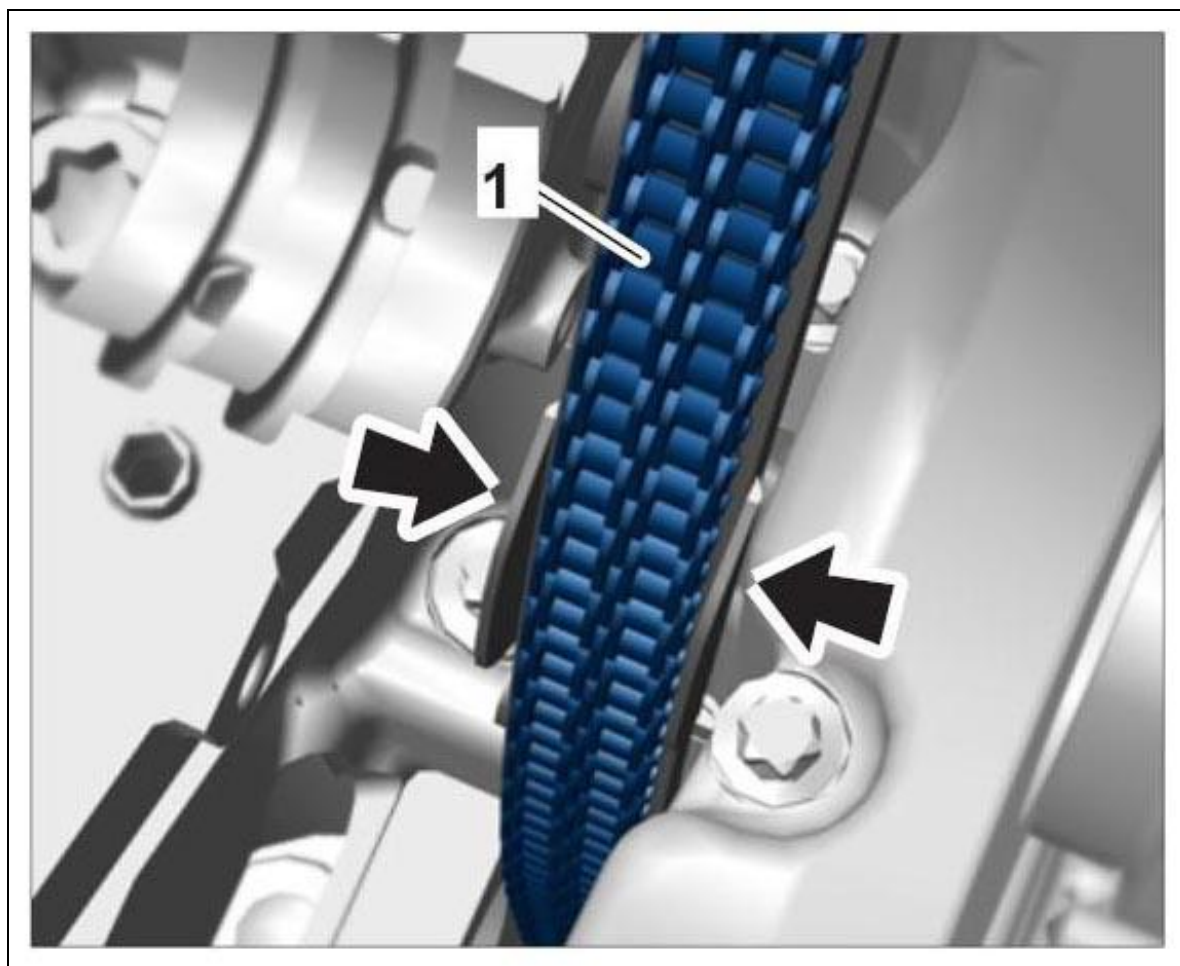
CAUTION: *Timing chains positioned incorrectly*

1. *Too much wear on sprockets and timing chains*
2. *Engine damage*

→ Perform a visual inspection to check the position of the timing chains on the tensioning and guide rails.

10. Use a torch to check that the timing chains -1- are on the tensioning and guide rails between the guide pins -arrows- .

Fig 25: Locating Timing Chain In Tensioning And Guide Rails



Courtesy of PORSCHE CARS NORTH AMERICA, INC.

11. Oil the bearing surfaces of the camshafts with new engine oil. When rebuilding the engine, apply a light coating of Optimol Optipit grease (Part No. 000.043.204.17) on the bearings.

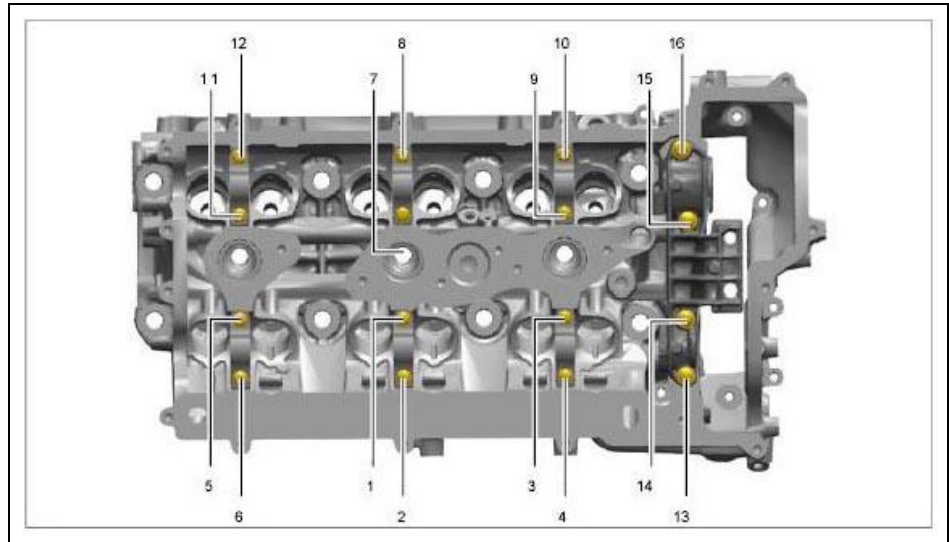
12. Fit bearing saddle and bearing covers.

1. 12.1. Fit bearing saddle and bearing covers and **observe markings!**
2. 12.2. Fit four external Torx screws (M6 x 55) on the bearing saddle.
3. 12.3. Fit two external Torx screws (M6 x 37) on each of the bearing covers.
4. 12.4. Fit and tighten screws according to the tightening sequence **-1 to 16-** .

Tool recommendation: Electronic torque wrench, 2 - 100 Nm/1.5 - 74 ftlb. 9768

1. 12.4.1. **Initial tightening 5 Nm (3.5 ftlb.)**
2. 12.4.2.
3. 12.4.3. Final tightening **Torque angle 50°**

Fig 26: Camshaft Bearing Cover Screws Tightening Sequence



Courtesy of PORSCHE CARS NORTH AMERICA, INC.

13. Check axial bearing clearance by pulling and pressing on the camshaft controller and sprocket.

1. 13.1. **There must be perceptible clearance because otherwise the shafts will have to be re-fitted!**

14. Screw in and tighten chain tensioner with a new seal.

Tightening torque 80 Nm (59 ftlb.)

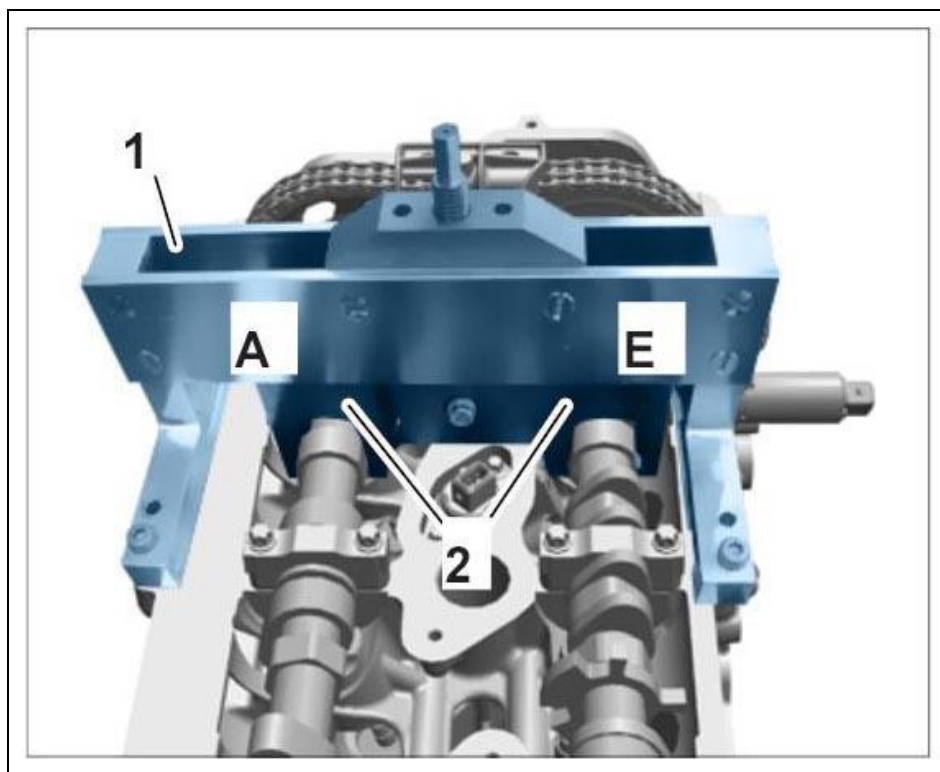
Set the timing, cylinder bank 4-6:

15. Position the **staking tool 9772** on the reconditioned dihedron of the camshafts.

1. 15.1. Check the position of the intake and outlet side.

1. **A** - A = Outlet
2. **E** - E = Intake
3. **1** - Adjustment device
4. **2** - Staking guide

Fig 27: Fitting Camshafts Cylinder Bank 4-6 (Flywheel Side)

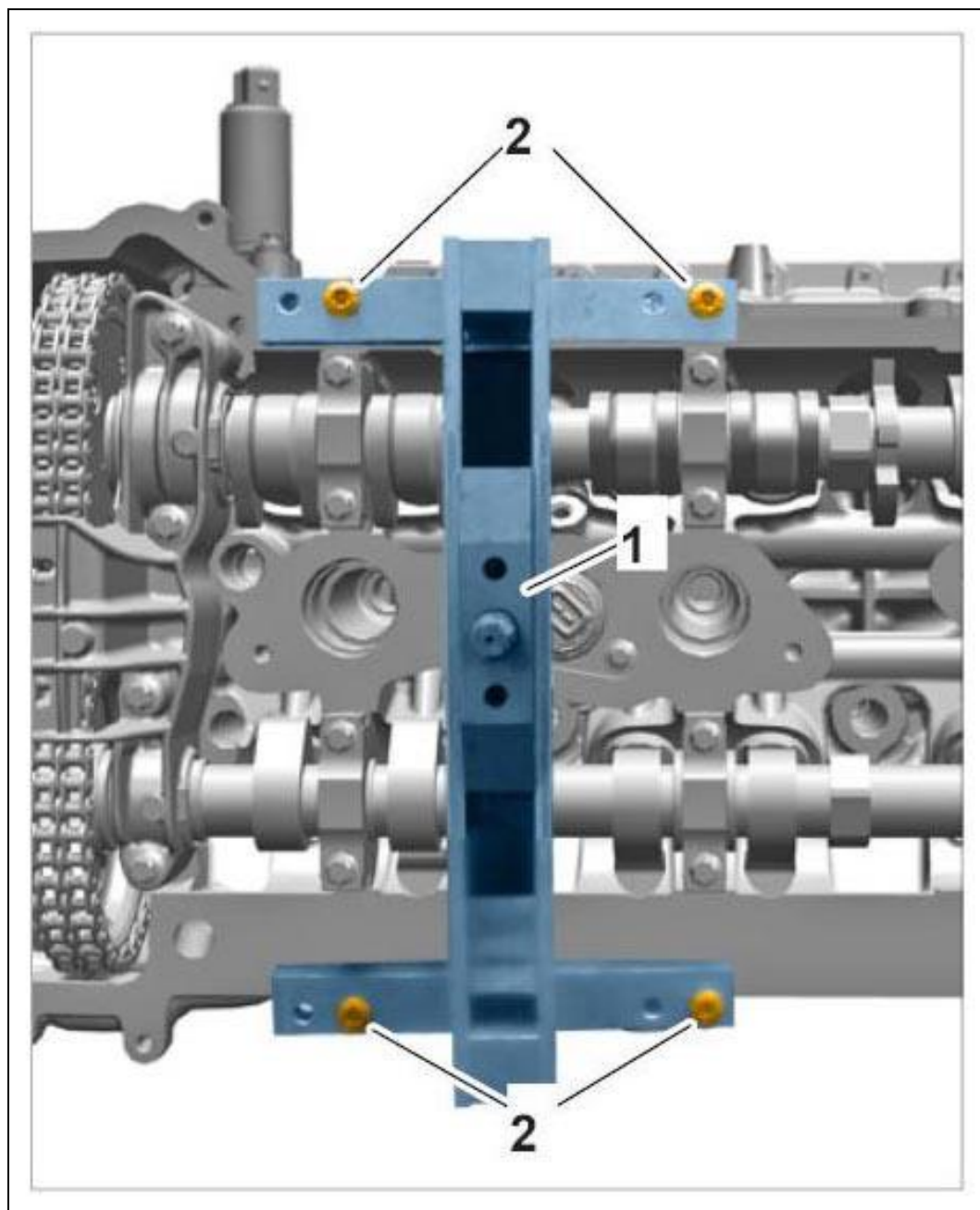


Courtesy of PORSCHE CARS NORTH AMERICA, INC.

16. Fit staking tool **-1-** on the cylinder head and camshafts.

1. 16.1. Secure on the cylinder head with four screws **-2-** (use M6 x 25 screws from the cylinder head cover). Tighten screws only slightly.

Fig 28: Identifying Staking Tool Screws For Cylinder Bank 4-6

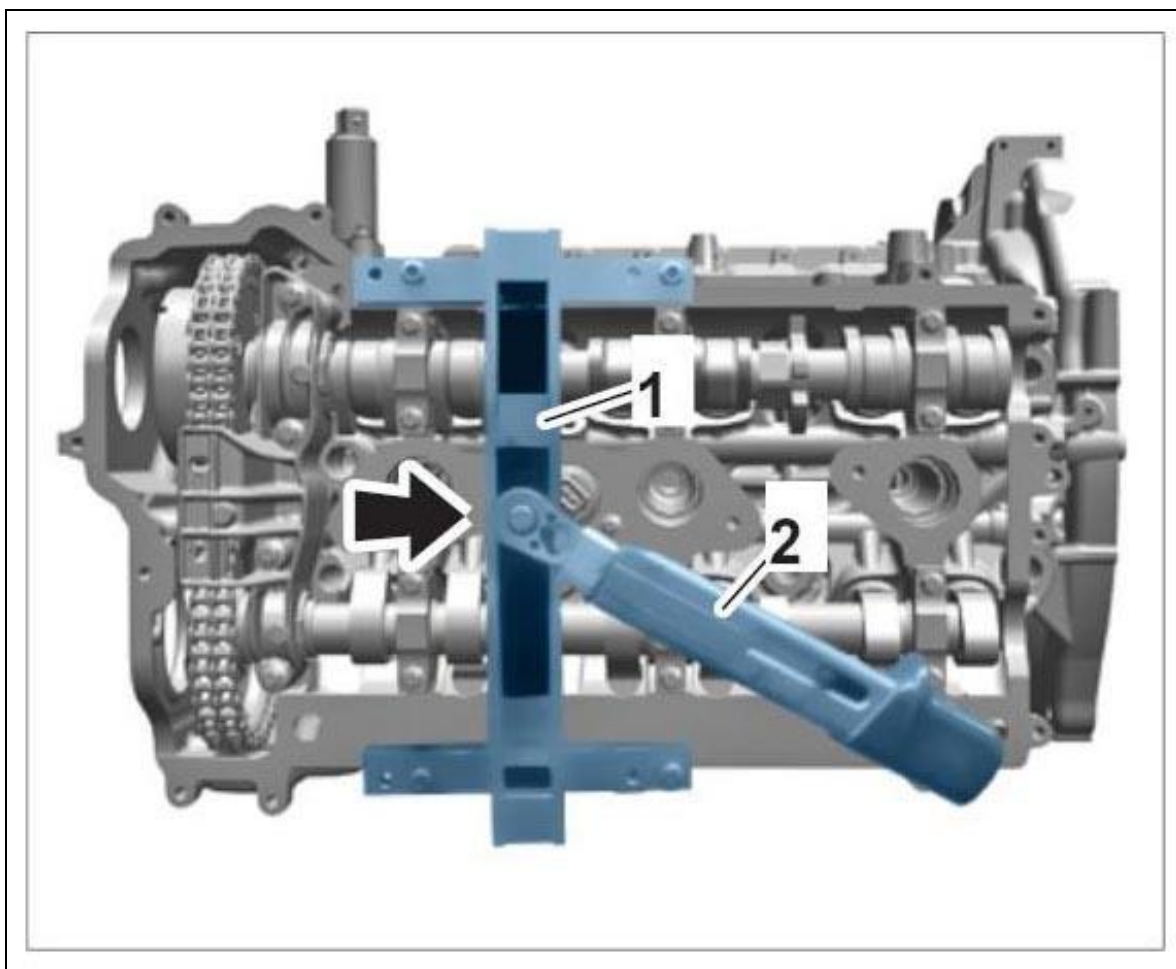


Courtesy of PORSCHE CARS NORTH AMERICA, INC.

17. Tighten adjusting screw **-arrow-** on the staking tool **-1-** using a torque wrench **-2-** .

→ **Tightening torque: 10 Nm (7.5 ftlb.)**

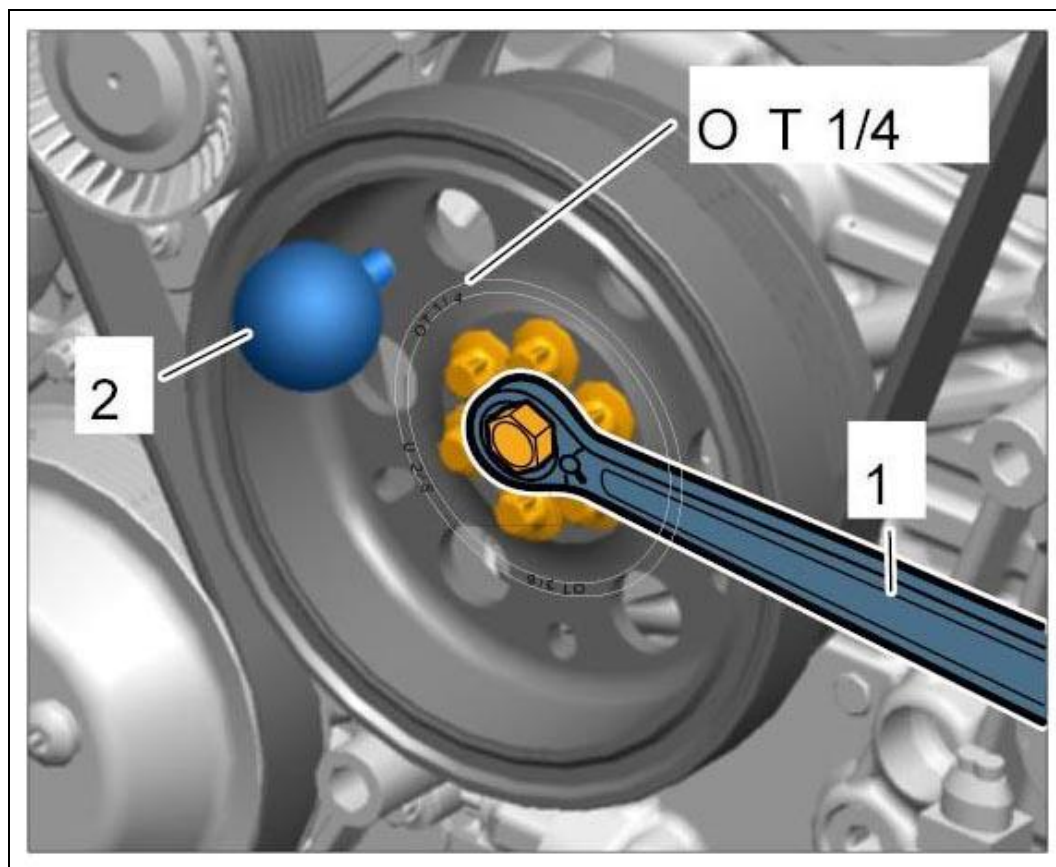
Fig 29: Adjusting Screw On Staking Tool



Courtesy of PORSCHE CARS NORTH AMERICA, INC.

18. Turn the crankshaft **clockwise (direction of rotation of engine)** to the **TDC marking** at the vibration damper.
 1. 18.1. This position is marked **TCD 1/4** on the surface.
 2. 18.2. Fix using a long **locating pin 9595/1 -2-**.

Fig 30: Identifying TDC Marking On Cylinder 1/4 On Vibration Damper



Courtesy of PORSCHE CARS NORTH AMERICA, INC.

19. Pre-tighten central screws for the sprocket and camshaft controller.

1. 19.1. Tighten central screw on sprocket initially and counter with a **holding wrench 9775** while doing this.

Tightening torque 5 Nm (3.5 ftlb.)

2. 19.2. Tighten central screw on camshaft controller initially, countering with a long open-ended wrench (a/f 32) at the driver.

Initial tightening 5 Nm (3.5 ftlb.)

Information

Before final tightening (torque angle) of the central screws, the special tool **staking tool 9772** must be removed.

20. **Staking tool 9772** must now be removed.

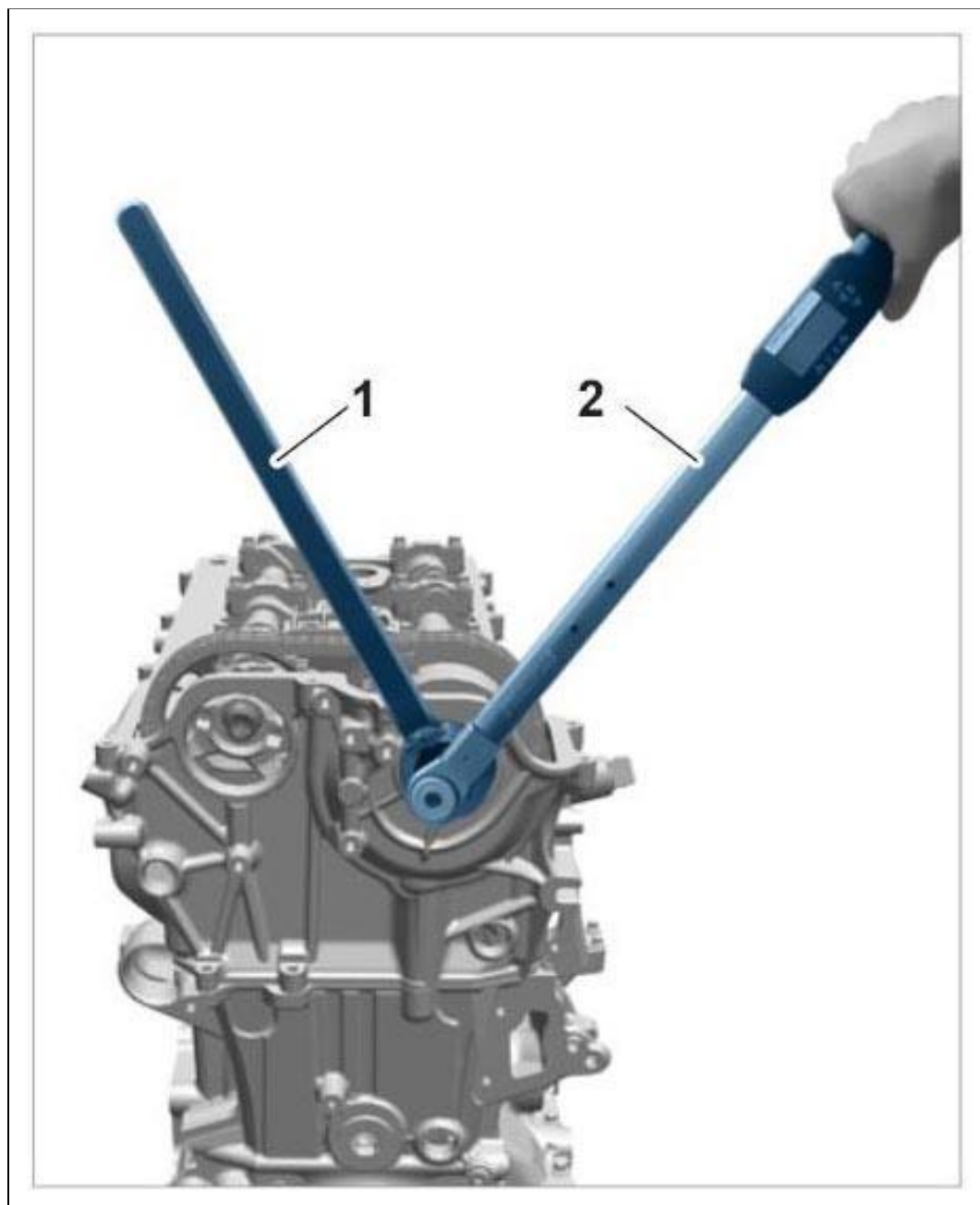
1. 20.1. Loosen the adjusting screw. A creaking noise is completely normal due to the tension in the tool.
2. 20.2. Unscrew fastening screw on the cylinder head and remove the tool.

21. Tighten central screws on the sprocket and camshaft controller to the specified final torque using a torque angle wrench **-2-**.

1. 21.1. Tighten central screw on sprocket and counter with a **holding wrench 9775 -1-** while doing this.

Torque angle 65°

Fig 31: Loosening Outlet Sprocket

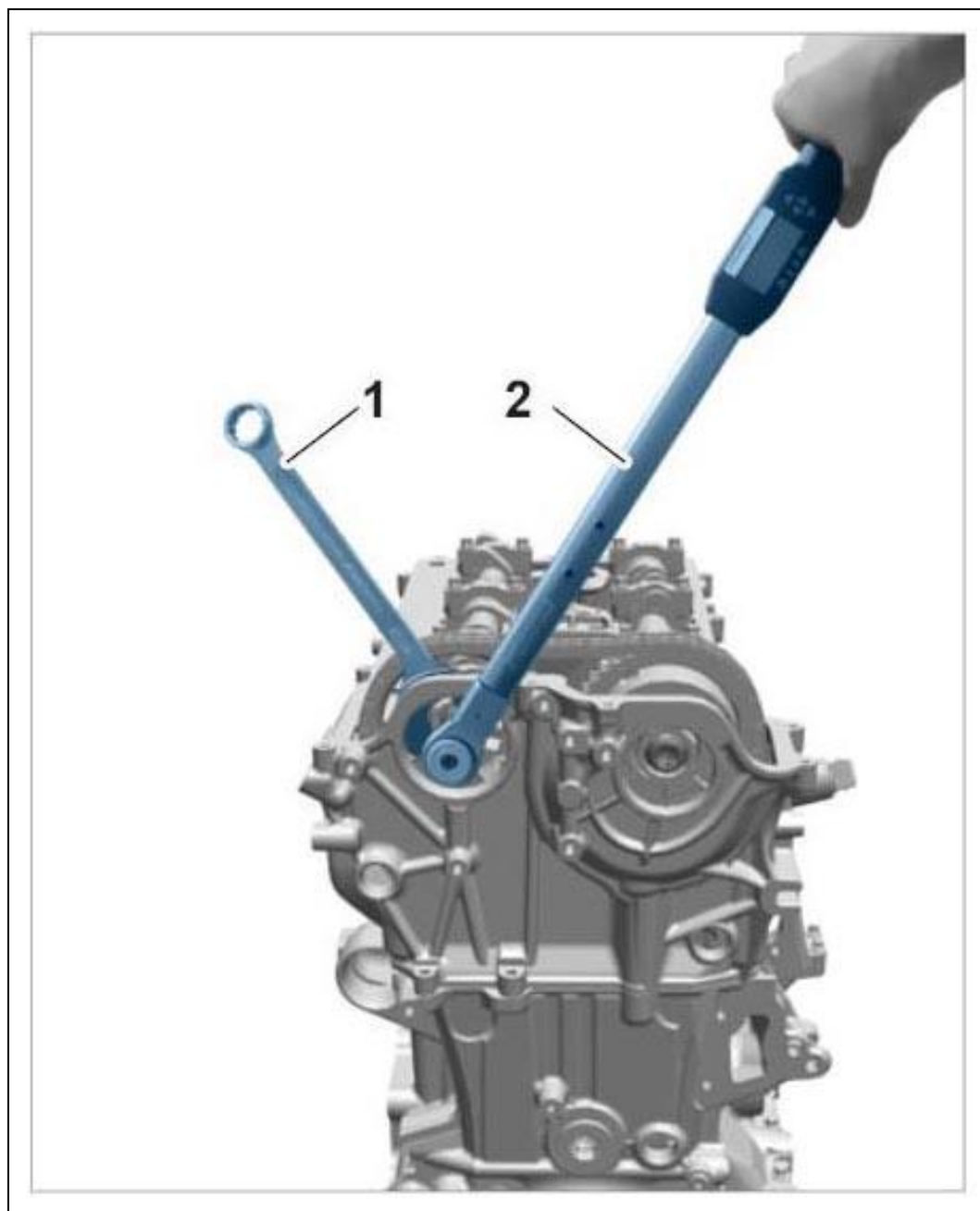


Courtesy of PORSCHE CARS NORTH AMERICA, INC.

2. 21.2. Tighten central screw on camshaft controller, countering with a long open-ended wrench (a/f 32) -1- .

Torque angle 90°

Fig 32: Loosening Camshaft Controller



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Installing Camshafts, Setting Timing - Cylinder Bank 1-3

NOTE: *Dirt and contamination*

- *Risk of damage to units or components*

→ Protect components from dirt and contamination.

→ Clean or replace dirty components.

CAUTION: *Timing chains positioned incorrectly*

- Too much wear on sprockets and timing chains
- Engine damage

→ Perform a visual inspection to check the position of the timing chains on the tensioning and guide rails.

Information

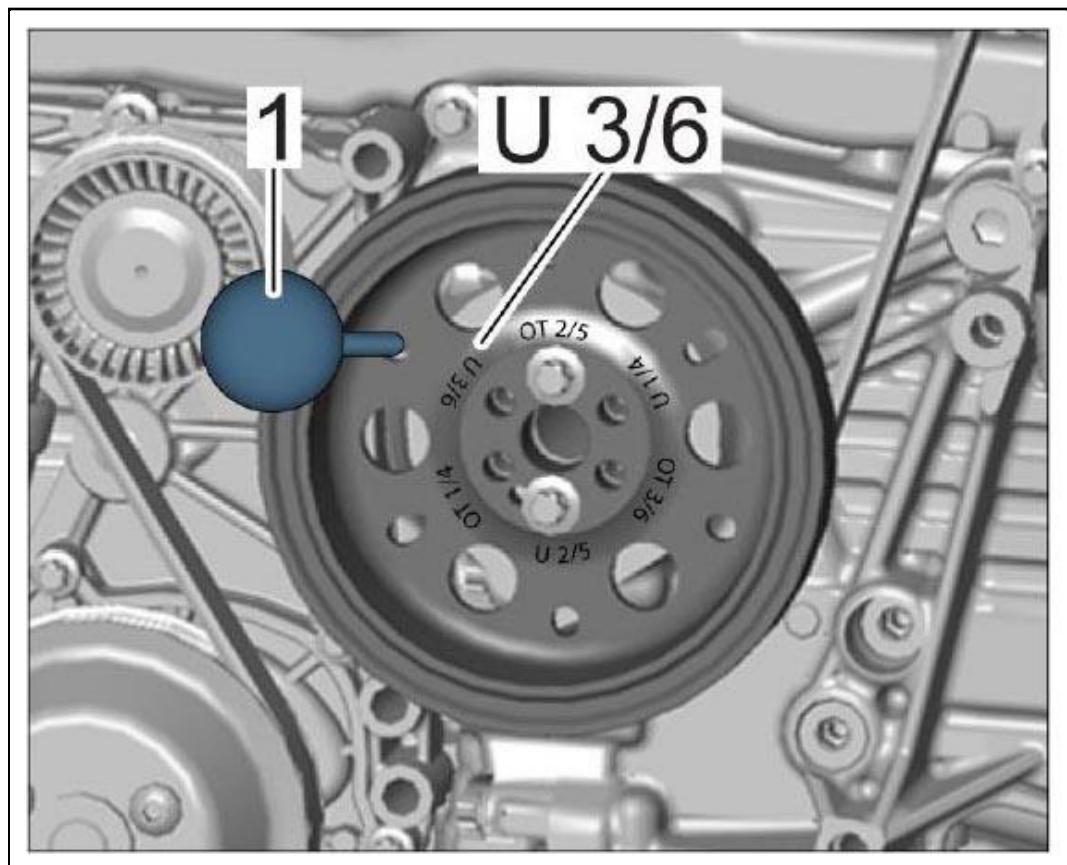
Before final tightening (torque angle) of the central screws, the special tool **staking tool 9772** must be removed.

1. Continue to turn the crankshaft **clockwise (direction of rotation of engine)** to 60° before TDC at the vibration damper.

1. 1.1. This position is marked **U 3/6** on the surface.

2. 1.2. Fix using a long **locating pin 9595/1 -1-**.

Fig 33: Identifying U 3/6 Marking On Vibration Damper

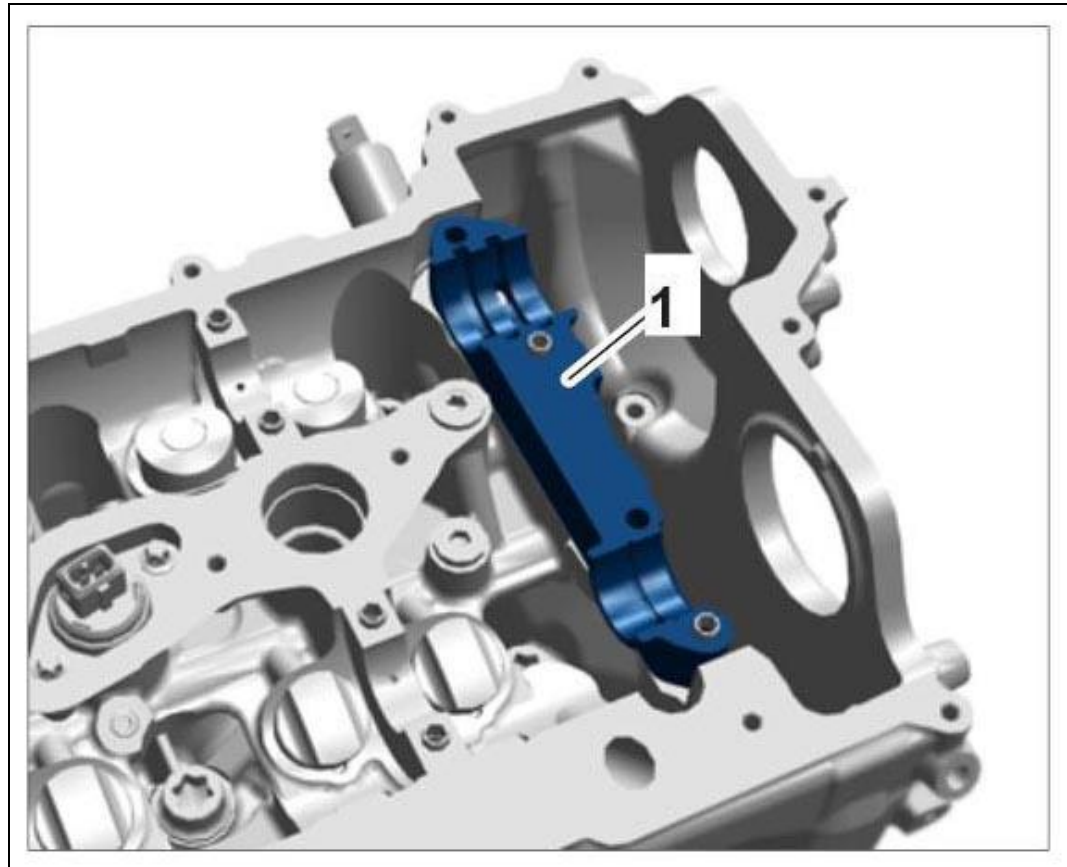


Courtesy of PORSCHE CARS NORTH AMERICA, INC.

2. Turn the engine on the assembly support until cylinder bank 1-3 is at the top.
3. Insert lower part of bearing saddle -1-. **Check matching number!**

1. 3.1. Check position of oil bores and position and fit the component over the dowel sleeves.

Fig 34: Identifying Lower Part Of Bearing Saddle On Cylinder Bank 1-3



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4. Oil the bearing surfaces of the camshafts with new engine oil. When rebuilding the engine, apply a light coating of Optimol Optipit grease (Part No. 000.043.204.17) on the bearings.

1. 4.1. Check that all hydraulic tappets are installed correctly.

5. Check that the new friction plate is fitted in the sprocket.

6. Fit outlet camshaft and sprocket.

1. 6.1. Tighten the central screw only slightly so that the sprocket can still turn.

2. 6.2. Lift the timing chain and position the camshaft and sprocket at the overlapping position of cylinder 1. The cams must then be facing outwards at an angle with respect to the cylinder head wall and the camshaft must lie loosely in the bearing positions.

3. 6.3. Another feature is the data matrix code marking on the reconditioned surface next to the dihedron. These markings must be facing the observer at overlapping position.

Information

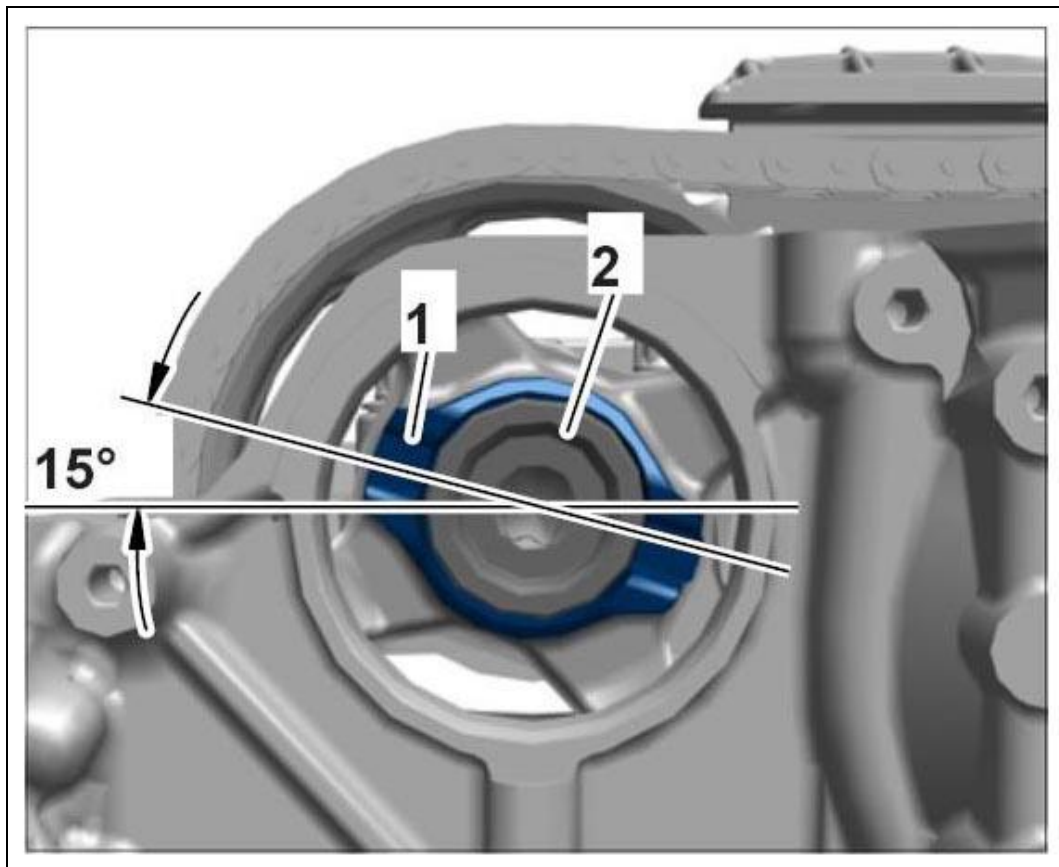
The outlet sprocket must be positioned correctly in order to build up the pressure of the high-

pressure pump correctly when starting the engine.

7. After fitting the outlet camshaft, the sprocket must be aligned with the driver for the high-pressure pump.

1. 7.1. **Cylinder head positioned vertically:** The sprocket must be positioned towards the top left using the deeper recess on the driver (13.5 mm) -1- at approx. 15 degrees with respect to the sealing face of the cylinder head.

Fig 35: Identifying Driver High-Pressure Pump Position (15°)



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8. Check that the new friction plate is fitted in the camshaft controller.

9. Insert intake camshaft.

1. 9.1. Lift the timing chain and engage and secure the camshaft controller. Guide the intake camshaft into the controller and set it to the overlapping position of cylinder 1. The cams must then be facing outwards at an angle with respect to the cylinder head wall and the camshaft must lie loosely in the bearing positions.

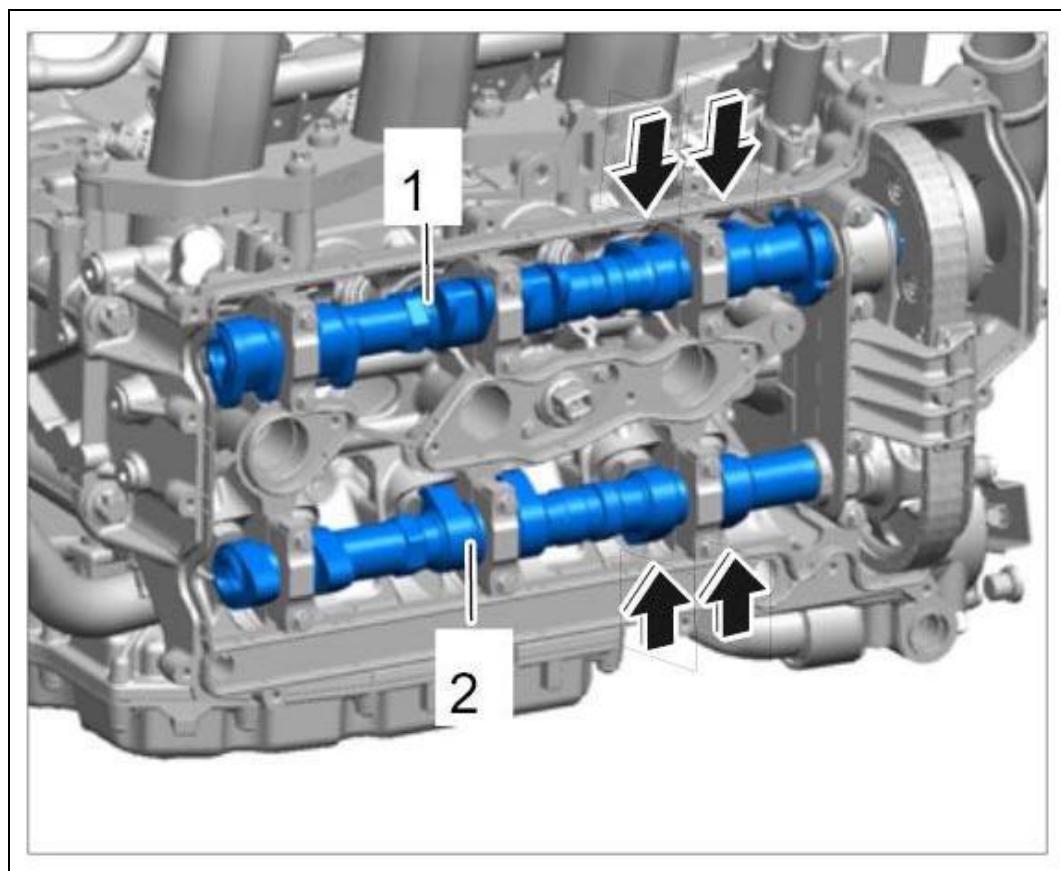
2. 9.2. The data matrix code marking on the camshaft must be facing the observer.

3. 9.3. Tighten the central screw only slightly by hand so that the camshaft controller can still turn.

10. Check cam position of cylinder 1 before fitting the bearing saddle and bearing covers. The cams must be facing outwards at an angle with respect to the cylinder head wall -arrows- .

1. 10.1. Check the position of the outlet sprocket again (position of driver for high-pressure pump).

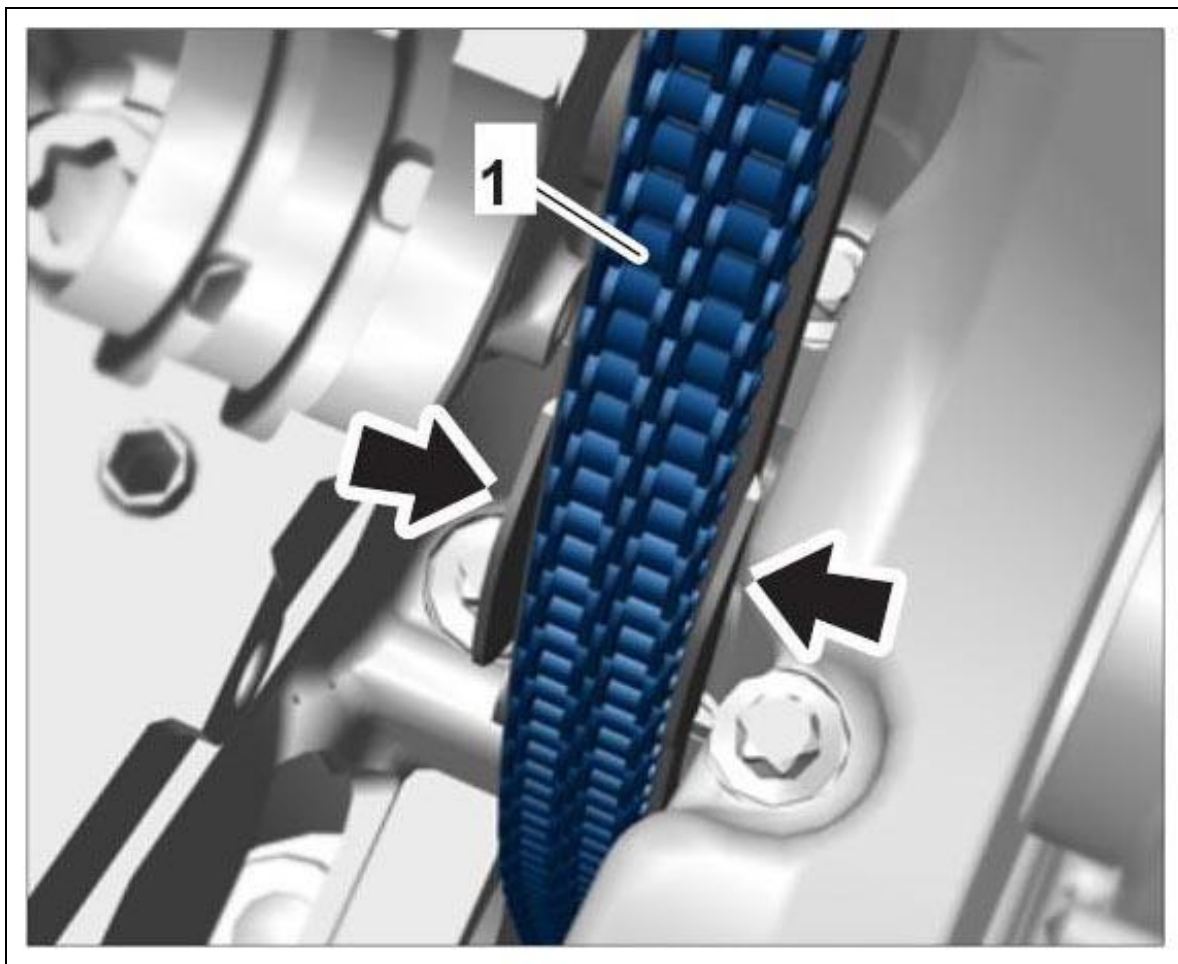
Fig 36: Locating Cam Position For Cylinder 1 (Overlap)



Courtesy of PORSCHE CARS NORTH AMERICA, INC.

11. Use a torch to check that the timing chains **-1-** are on the tensioning and guide rails between the guide pins **-arrows-** .

Fig 37: Locating Timing Chain In Tensioning And Guide Rails



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12. Oil the bearing surfaces of the camshafts with new engine oil. When rebuilding the engine, apply a light coating of Optimol Optipit grease (Part No. 000.043.204.17) on the bearings.

13. Fit bearing saddle and bearing covers.

1. 13.1. Fit bearing saddle and bearing covers and **check markings!**

2. 13.2. Fit four external Torx screws (M6 x 55) on the bearing saddle.

3. 13.3. Fit two external Torx screws (M6 x 37) on each of the bearing covers.

4. 13.4. Fit and tighten screws for the bearing covers and bearing saddle according to the specified tightening sequence (as for cylinder bank 4-6).

Tool recommendation: Electronic torque wrench, 2 - 100 Nm/1.5 - 74 ftlb. 9768

1. 13.4.1. **Initial tightening: 5 Nm (3.5 ftlb.)**

2. 13.4.2. **Subsequent tightening: 5 Nm (3.5 ftlb.)**

3. 13.4.3. **Final tightening torque angle: 50 degrees**

14. Check axial bearing clearance by pulling and pressing on the camshaft controller and sprocket.

1. 14.1. **There must be perceptible clearance because otherwise the shafts will have to be re-fitted!**

15. Screw in and tighten chain tensioner with a new seal.

Tightening torque 80 Nm (59 ftlb.)

Set the timing, cylinder bank 1-3: The timing for cylinder bank 1-3 is set in the same way as for cylinder bank 4-6.

16. The adjusting device is positioned on the reconditioned dihedron of the camshafts.

1. 16.1. Check the position of the intake and outlet side.

17. **Staking tool 9772** must be fitted on the cylinder head and camshafts.

1. 17.1. Secure on the cylinder head with four screws (M6 x 25 screws from cylinder head). Tighten screws slightly with your hand.

18. Tighten adjusting screw on the staking tool.

=> Tightening torque for adjusting screw: 10 Nm (7.5 ftlb.)

19. Turn the crankshaft **clockwise (direction of rotation of engine)** to the **TDC marking** of cylinders 1 and 4 at the vibration damper.

1. 19.1. This position is marked **TDC 1/4** on the vibration damper.

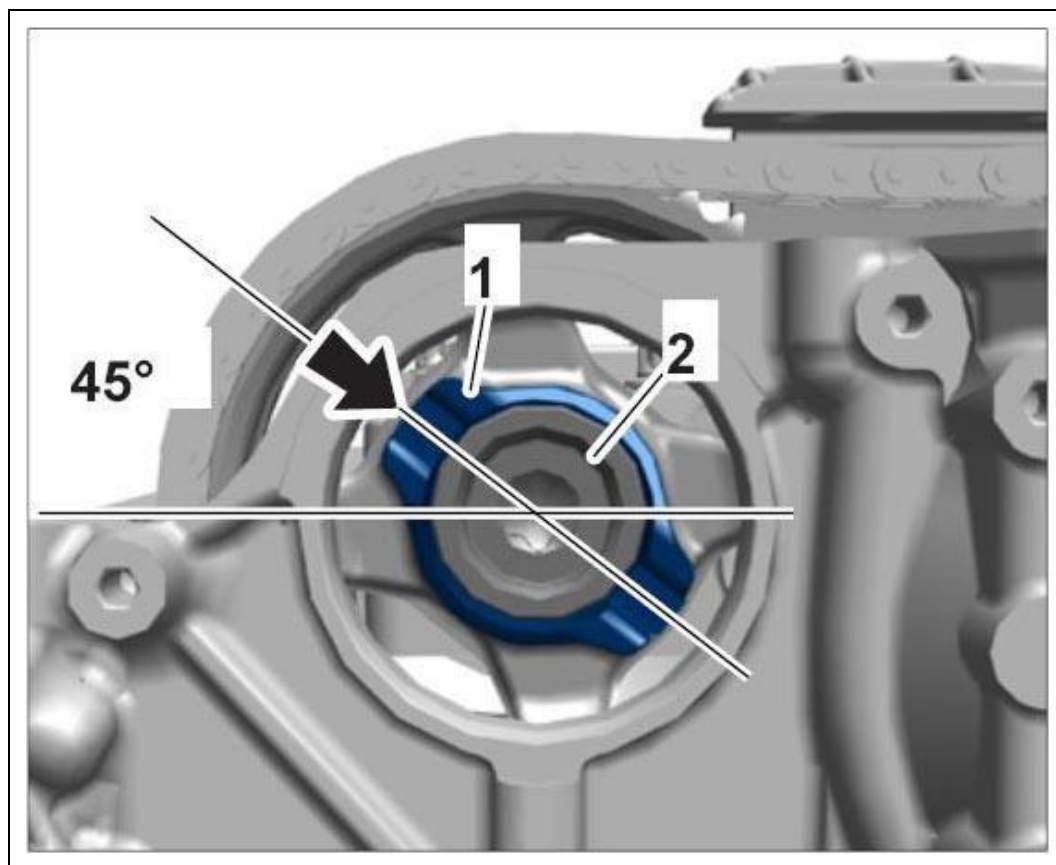
2. 19.2. Fix using a long **locating pin 9595/1** .

20. Check position of the outlet sprocket.

1. 20.1. The sprocket must now be positioned towards the top left with the deeper recess on the driver (13.5 mm) **-1-** at approx. 45 degrees with respect to the sealing face of the cylinder head.

2. 20.2. If this is not the case, the outlet camshaft must be re-aligned with the sprocket.

Fig 38: Locating End Position Of Driver High-Pressure Pump (45°)



Courtesy of PORSCHE CARS NORTH AMERICA, INC.

21. Pre-tighten central screws for the sprocket and camshaft controller.

1. 21.1. Tighten central screw on sprocket initially and counter with **holding wrench 9775** while doing this.

Tightening torque 5 Nm (3.5 ftlb.)

2. 21.2. Tighten central screw on camshaft controller initially, countering with a long open-ended wrench (a/f 32) at the driver.

Initial tightening 5 Nm (3.5 ftlb.)

22. **Staking tool 9772** must now be removed.

1. 22.1. Loosen the adjusting screw. A creaking noise is completely normal due to the tension in the tool.
2. 22.2. Unscrew fastening screw on the cylinder head and remove the tool.

23. Tighten central screws on the sprocket and camshaft controller to the prescribed final torque using a torque angle wrench.

1. 23.1. Tighten central screw on sprocket and counter with a **holding wrench 9775** while doing this.

Torque angle 65°

2. 23.2. Tighten central screw on camshaft controller, countering with a long open-ended wrench (a/f 32).

Torque angle 90°

24. Then check the position of the camshafts on both sides again (pay attention to overlapping position).

1. 24.1. It must be possible to screw in the adjusting screw by hand at the **staking tool 9772**.
2. 24.2. Remove the tool and complete the engine.

Subsequent Work

1. Fit cover for crankcase ventilation line.
2. Install high-pressure pump. → INSTALLING HIGH-PRESSURE PUMP
3. Install vacuum pump. → INSTALLING VACUUM PUMP
4. Install cylinder head cover. → Installing Cylinder Head Cover
5. Install spark plugs. → INSTALLING SPARK PLUGS
6. Install turbocharger. → INSTALLING TURBOCHARGER
7. Install engine carrier. → INSTALLING ENGINE CARRIER
8. Install engine. → INSTALLING ENGINE