

Replacement of Cylinder Head Gaskets

Types 220 and 220a

Special Tools:

Torque wrench 0–13 mkg (0–94 ft.lb.)	000 589 22 21
Torque wrench 0–6 mkg (0–43.5 ft.lb.)	000 589 27 21
Special Allen wrench, width over flats 8 mm (0.315"), length 300 mm (11.81"), for rocker arm brackets	187 589 04 07
Puller for camshaft sprocket	187 589 01 33
Special Allen wrench, width over flats 6 mm (0.24"), length 425 mm (16.73"), for cylinder head bolts M 8	187 589 03 07
Socket screw wrench insert, width over flats 10 mm (0.39"), length 140 mm (5.51"), for cylinder head	000 589 05 07
Chain alignment gauge	187 589 02 23
Socket screw wrench insert, width over flats 8 mm (0.315"), length 80 mm (3.15"), for rocker arm brackets	000 589 06 07
Socket wrench insert, opening 17 mm (0.67"), for rocker arm brackets, from	000 589 18 07
Special wrench, opening 14 mm (0.55"), for lower check nut on rocker arm	187 589 00 01
Wrench combination for upper check nut on rocker arm	187 589 01 09
Valve gauge bracket with tolerance gauge	136 589 00 23

Procedure:

Note: Remove cylinder head in cold condition only, otherwise it might deform.

1. Unscrew breather line at cylinder head cover as well as air filter with the two supports and cylinder head cover, and take these parts off.

Note: In Type 220 the radiator stay must be removed first.

2. Drain part of the cooling water. (Watch out for additives!) Remove the two hoses of the air conditioning system (in Type 220). Loosen all lines and connections at cylinder head, including exhaust manifold. Do not forget vent line from water pump to cylinder head (see Fig. M 3/80).

3. Loosen rocker arm bracket screws with wrench 187 589 04 07 and remove the brackets. Be careful to position the camshaft so that no load is placed on the camshaft and the respective rocker arms.

Note: We recommend to loosen the camshaft sprocket fastening screw before it is attempted to remove the rocker arm brackets.

4. Unscrew chain tensioner and take it out.

5. Turn out camshaft sprocket screw and take sprocket with chain off camshaft. If necessary, use puller 187 589 01 33 (see Fig. M 3/18). Place chain in sprocket housing. Take off adjusting washer; do not interchange the washer when reinstalling it.

Note: Watch out for key. If an offset key is provided, it must by all means be reinstalled. Mark the direction of offset on the camshaft to ensure that the key will be returned into its original position.

6. Loosen all cylinder head screws and turn them out. Do not forget the four hexagonal socket head screws M 8, opening 6 mm = 0.24" (a and b inside, c and d at the sprocket housing – Fig. M 20/6). Use special wrench 187 589 03 07. In the first few engines screw d is missing.
Take off cylinder head.

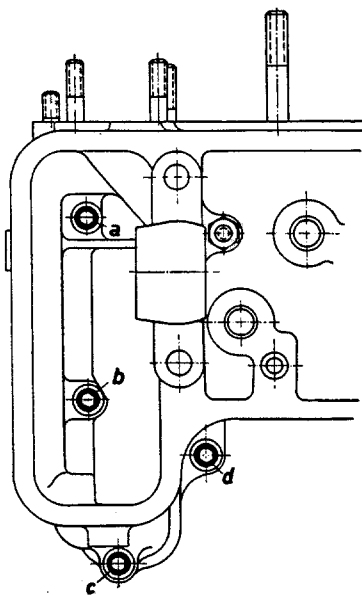


Fig. M 20/6

7. Remove all soot from the mating surfaces of cylinder crankcase and cylinder head and clean them carefully prior to reinstallation.

8. Mount cylinder head **without rocker arm brackets**. The following hints must be strictly observed:

- a) Install a new **valid** cylinder head gasket. Note that in the case of a high-compression cylinder head ($\varepsilon = 7.6$) the cutout in the cylinder head gasket for the combustion chamber is smaller than in the case of a low-compression cylinder head. Before installing the gasket, place it on the cylinder head; the gasket is correct when the shape of its cutout corresponds to the shape of the combustion chamber in the cylinder head.

- b) Apply graphite oil or "Auto-Kollag" to washers and contact surfaces of cylinder head bolts, before you install them.

- c) When tightening the cylinder head screws, be sure they can be turned sufficiently deep into the blind holes in the cylinder crankcase. If this is not the case, the screw may be tightened alright, but the cylinder head gasket will not be pressed on with the necessary force and is therefore liable to leak or to become defective.

Before turning in the cylinder head screws, make sure that:

1. the screw hole is perfectly clean,
2. the screw hole is free from oil pads, and
3. the screw can be turned in sufficiently deep.

Make the following check:

Turn screw in without washer as far as it will go. Check the distance between camshaft bearing or yoke and screw head; it must be at least 2–3 mm (0.08–0.12") smaller than height *a* of washer (Fig. M 20/8c).

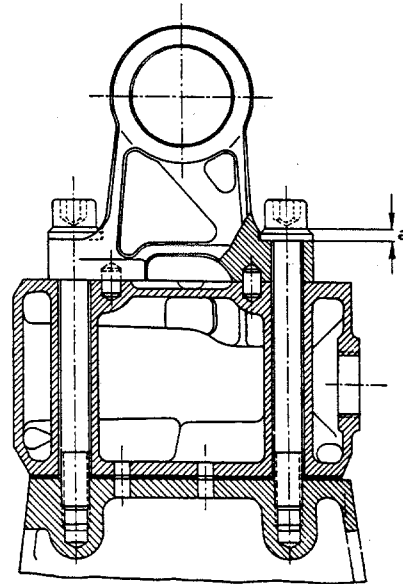


Fig. M 20/8c

Tightening of Cylinder Head Screws:

Tighten cylinder head screws in the order indicated below:

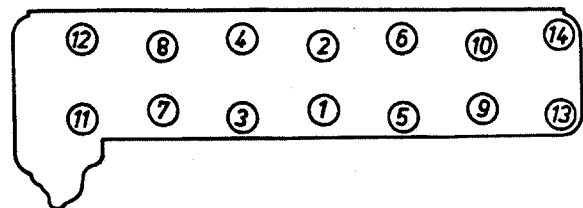


Fig. M 20/8

First pull: tighten all

screws to

4 mkg (29 ft.lb.)

Second pull:

6 mkg (43.5 ft.lb.)

Third pull:

8 mkg (58 ft.lb.)

Fourth pull: check all

screws for a torque of

8 mkg (58 ft.lb.)

Tighten the other screws (see Fig. M 20/6) with wrench 187 589 03 07.

Retightening the Cylinder Head Screws.

Proceed as follows:

Let engine warm up to a cooling water temperature of 80° C (175° F) under small load. After engine has run for about 5 minutes at this cooling water temperature, retighten cylinder head screws in the order indicated in Fig. M 20/8.

Tighten screws of cast iron cylinder head to 8 mkg (58 ft.lb.) and screws of light metal cylinder head to 9 mkg (65 ft.lb.).

Check cylinder head screws again after the road test, at the latest after 20 km (12.5 miles): 8 mkg (58 ft.lb.) in the case of a cast iron cylinder head, and 9 mkg (65 ft.lb.) in the case of a light metal cylinder head.

Do not place high loads on the engine during the road test.

After 500 km (310 miles) it is no longer required to retighten the cylinder head screws.

Note: In Type 220 first screws 8-G and then screws 10-K have been used. If an engine is provided with screws 8-G or screws 8-G as well as 10-K, tighten cylinder head screws to 7 mkg (50.5 ft.lb.) only and not to 8 mkg (58 ft.lb.).

Retighten screws after warming up the engine, and check after the road test as follows:

7 mkg (50.5 ft.lb.) in the case of a cast iron cylinder head, and

8 mkg (58 ft.lb.) in the case of a light metal cylinder head.

It is recommended to exchange screws 8-G for screws 10-K the next time you overhaul the engine or replace the cylinder head.

9. Check side play of camshaft.

After the cylinder head screws have been tightened, make sure that camshaft turns easily. If this is not the case, the camshaft may break.

10. Set first piston to TDC (see Operation No. M 3/cf. 64)..Push adjusting washer on cam-

shaft and turn camshaft with adjusting washer, until the marks on adjusting washer and first camshaft bearing coincide (Fig. M 20/10).

Note: If in addition the camshaft collar is provided with a notch and the camshaft bearing shows an arrow, these two marks must register. The arrow and the notch have only been provided on engines of the first series. When installing a new camshaft, refer to the marks on adjusting washer and camshaft bearing.

Before pushing on the adjusting washer, insert key into groove in camshaft. If an offset key has been installed, be sure to return it into original position.

It is recommended to check the valve settings after installation has been effected.

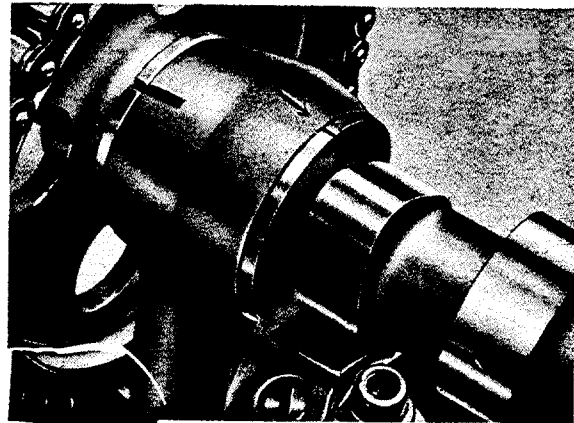


Fig. M 20/10

11. Before pressing on camshaft sprocket with chain, install sprocket on camshaft without chain and check alignment of sprockets with gauge 187 589 02 03 and a depth gauge or micrometer (see Figs. M 3/65 and 65a). The misalignment must not be more than 0.1 mm (0.004"). When making the check, push sprockets all the way back to eliminate the end play.

Note: The adjusting washers are available with the following thicknesses:

2.50, 2.75, 3.00, 3.25 and 3.50 mm
(0.1 0.11, 0.12, 0.13 and 0.14 in.)

12. Lift chain out of sprocket housing by means of a hook and place so over the sprocket that key and groove will coincide when sprocket is pressed on camshaft. Note that the left half of the chain must be taut. Then put on washer and snap ring and tighten by means of the hexagonal screws.
into bores in cylinder head. Make sure that the rings are snugly seated.
Install mounted rocker arm brackets and tighten to a torque of 3.75 mkg (27 ft.lb.). During installation the cams of the camshaft must by no means bear against the rocker arm brackets.
13. Fill chain tensioner in a container with engine oil and install it. Interpose a gasket. Fill oil pocket in cylinder head, which houses the chain tensioner, with engine oil; then vent tensioner again (see also Operation No. M 73a, cf. 3-5).
14. Insert fitting rings for rocker arm brackets
15. Adjust the valve play (see Operation No. M 26c).
16. Install all parts that have been removed.
17. Let engine run and check whether cylinder head leaks oil.