MAK

C

M551 - M552

Engine data

Stroke: 551 / 552	**550 / 520mm**	
Bore: 551 / 552	**450**	**mm**
Speed: 551	**300-450**	**rpm**
Speed: 552	**500**	**rpm**
Number of cylinders: 551	**6 / 8 / 9 / 12 / 16**	
Number of cylinders: 551	**6 / 8 / 9 / 12**	
Main bearing:		
Inside Ø	**350**	**mm**
Outside Ø	**370**	**mm**
Big end bearing:		
Inside Ø	**350**	**mm**
Outside Ø	**365**	**mm**
Valves (inlet)		
Length	**649**	**mm**
Shaft Ø	**25,50**	**mm**
Valve disk Ø	**136**	**mm**
Valves (exhaust)		
Length	**650**	**mm**
Shaft Ø	**30.50**	**mm**
Valve disk Ø	**136**	**mm**

Engine operating data

Temperatures		
Lub. oil, inlet	**50 - 55**	**°C**
Temperature rise:	**10 - 14**	**°C *1**
Fresh water circulation cooling		
Engine outlet:	**80 - 85**	**°C**
Temperature rise:	**7 - 10**	**°C *1**
Charge air, inlet:	**45 - 60**	**°C**
Pressures		
Lub. oil	**4.0 - 5.0**	**bar *2**
Fresh water circulation cooling:		
With min. 4mWs	**2.5 - 5.0**	**bar**
Nozzle cooling:	**1.5 - 3.0**	**bar**
Fuel pressure before injection pumps:		
MDO	**1.5 - 3.0**	**bar**
HFO	**4.0 - 5.0**	**bar**

***1 = at rated engine output**

***2 = at rated engine speed**

Cylinder head

M 551 - M552

The tightening torque for inserting the tie bolts is → **M = 900 ± 100 Nm**

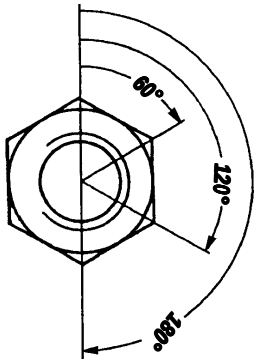
M 551

Cylinder head nuts - manual tightening

1. Pretighten nuts with → **M = 100 Nm**

then

2. tighten up to → **Dw = 180°**



Prerequisite for mechanical tightening is manual tightening of the nuts.

M 551 - M552

Cylinder head nuts - hydraulic tightening

Tightening with 8 hydraulic jacks: Go to → **P = 750 bar**
continuously and tighten round nuts with pin.

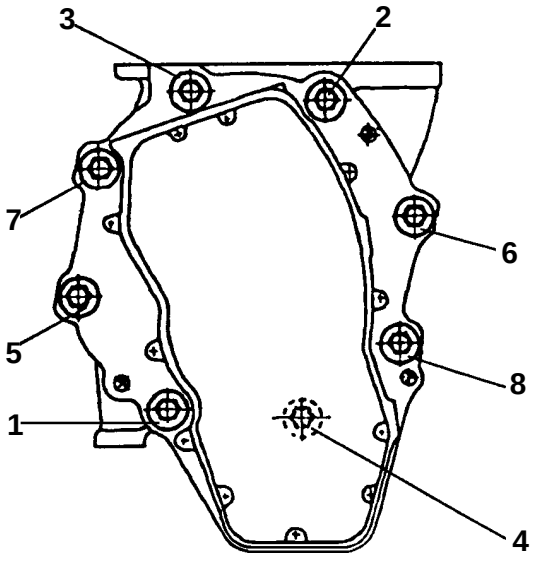
Prerequisite for hydraulic tightening is manual tightening of the nuts.

Tightening with 4 hydraulic jacks:

Tighten the cylinder head bolts **5 - 3 - 6 - 4** with → **P = 800 bar**
then tighten

the cylinder head bolts **1 - 7 - 2 - 8** with → **P = 750 bar**

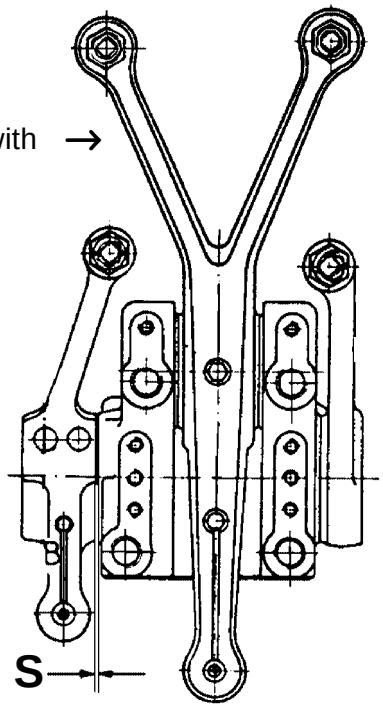
The cylinder head bolts 5 - 3 - 6 - 4 must be tightened with 800 bar in order to attain settling of the cylinder head. For loosening only 750 bar are required.



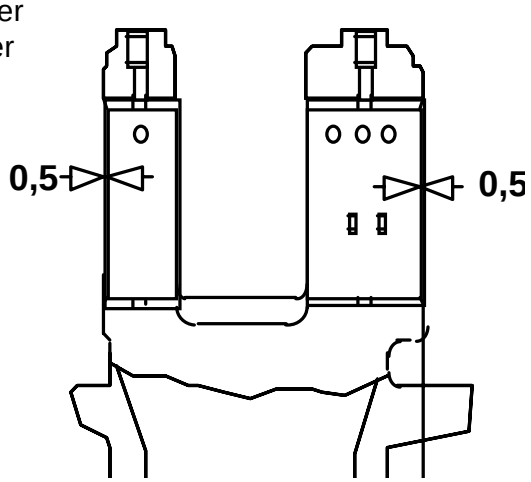
All round nuts must be tightened with the same slot number. If there is a difference of more than 1 bore width, all nuts must be loosened again and newly be tightened.

Cylinder head

M 551 - M552



Rocker arm bracket Tighten nuts for the taper pins with →	**M = 50**	**Nm**
Tighten fastening nuts with →	**M = 300**	**Nm**
Inlet valve rockers End clearance **„S“** →	**0.10 - 0.50**	**mm**
Valve rocker clearance, radial minimum clearance →	**0.05**	**mm**
maximum clearance →	**0.11**	**mm**
clearance limit →	**0.30**	**mm**
Valve rocker bearing Rocker arm bracket Both bushes shall recede by →	**0.50**	**mm**
Exhaust valve rocker Reference size after pressing in →	**85.08 ± 0.06**	**mm**



Bushes in the valve rocker bracket are inserted with joint face downwards, bushes in the exhaust valve rocker with joint face upwards. Grease the bushes before pressing them in.

Cylinder head

In-line engine

Valve clearance
up to eng. No. **55219**
inlet → **0.60 ± 0.10 mm**

exhaust → **0.80 ± 0.10 mm**

Attention exceptions:
On engines 55207 and 55208 the adjustment values are 0.40 and 1.10 mm (inlet / exhaust)

from eng. No. **55220 on and M552 engines**
inlet → **0.40 ± 0.10 mm**

exhaust → **1.10 ± 0.10 mm**

Valve clearance is identical with cold and warm engine.

Vee-engine

Valve clearance
up to eng. No. **60013**
inlet → **0.60 ± 0.10 mm**

exhaust → **0.80 ± 0.10 mm**

from eng. No. **60014 on and M552 engines**
inlet → **0.40 ± 0.10 mm**

exhaust → **1.10 ± 0.10 mm**

Attention exceptions:
On engines 60021 and 60022 the adjustment values are 0.60 and 0.80 mm (inlet / exhaust)
Valve clearance is identical with cold and warm engine.

In-line engine	Vee-engine

Frame for cylinder head
Tighten screws with → **M = 75 Nm**

Cylinder head

In-line engine	Vee-engine

Starting valve
Tighten nuts steadily with →

M = 80 Nm

Fuel injection valve
Tighten fastening nuts with →

M = 50 ± 5 Nm

The tightening torque for the nozzle cap is →

M = 250 Nm

Exhaust valves M551
Pretighten short tie bolts by hand with →

M = 100 Nm

than tighten alternately
in 2 steps up to →
(2 hexagons)

Dw = 120°

Pretighten tie bolts with sleeves by hand with →

M = 100 Nm

and mark them, then tighten alternately and steadily
in 4 steps up to →
(4 hexagons)

Dw = 240°

Exhaust valves M551 - M552
The tightening torque for inserting the tie bolts is →

M = 200 Nm

1. Tighten nuts with →
   to adapt the joint ring to the seat.
   Mark position of nut and loosen by 1 turn.

M = 100 Nm

2. Lengthen screws with →
   and tighen nuts by hand (abt. 100Nm)

P = 500 bar

3. Check pretightening, the nut shall have turned on by →
   that corresponds to 4 hexagons.

Dw = 240°

Cylinder head

If the hydraulic device is defective, tightening is possible with angle of rotation.

Pretighten nuts with → **M = 100 Nm**

then tighten alternately in 4 steps

up to → **Dw = 240°**

(4 hexagons)

In-line engine	Vee-engine

Valve guides

Exhaust

Nominal clearance → **0.19 - 0.26 mm**

Clearance limit → **0.40 mm**

Inlet

Nominal clearance → **0.12 - 0.19 mm**

Clearance limit → **0.40 mm**

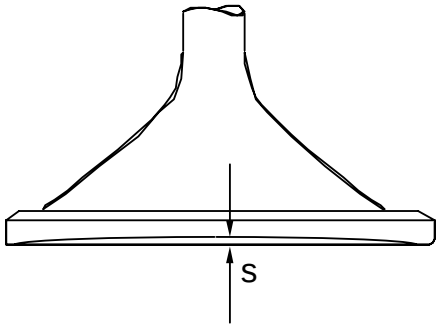
Measured in cross direction of engine.

In case of replacement of exhaust valve guides it must be ensured that the chamfer in the valve cage is 5 x 45°.

Valve stem

A valve stem is unusable in case of corrosive material wear of **2%** of the valve disk diameter and in case of high temperature corrosion **„S“** of **2 mm** on bottom side of valve disk.

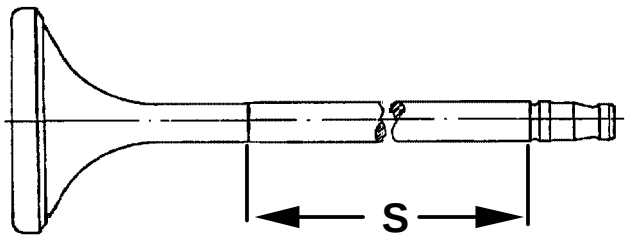
The eccentricity on the shaft must not exceed **0.04 mm.**



Straightness / eccentricity at shaft:

	Measuring distance „S“	
Eccentricity		
Inlet / exhaust	**440 mm**	**0.04 mm**

Supporting points for the measuring device are on the measuring track, **20 mm** from its end points**.**



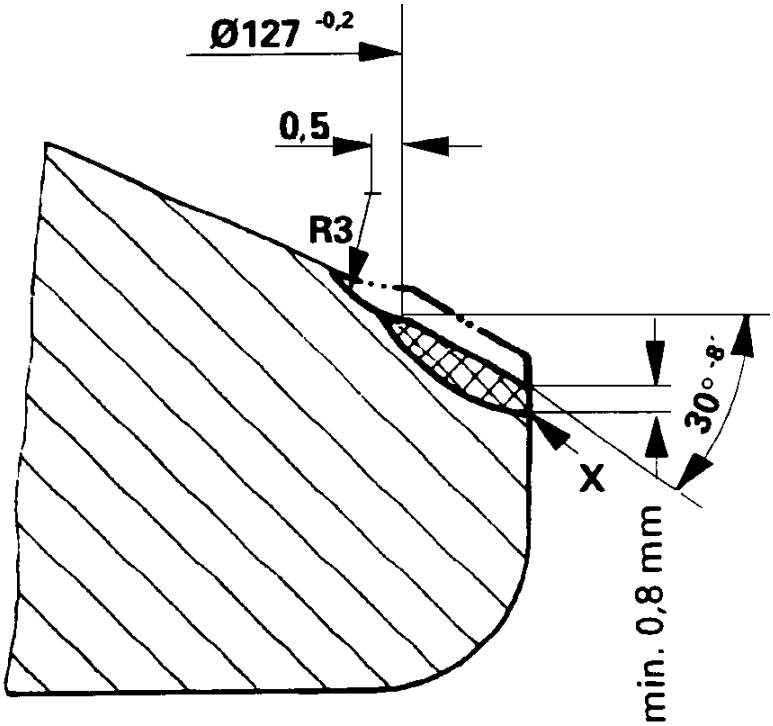
Cylinder head

Refinishing of the valve cone faces

Inlet valve cone

When refinishing the cone faces the dimension stated in the sketch must be observed.

If the valve cone is refinished the valve seat must be refinished, too.



Inlet valve seat rings, fitting

1. Supercool valve seat ring to **- 190 ° C** with liquid nitrogen and insert it in the cylinder head.
2. Press the valve seat ring on with the device **1.70.7-92.22.00-28** for a short time.

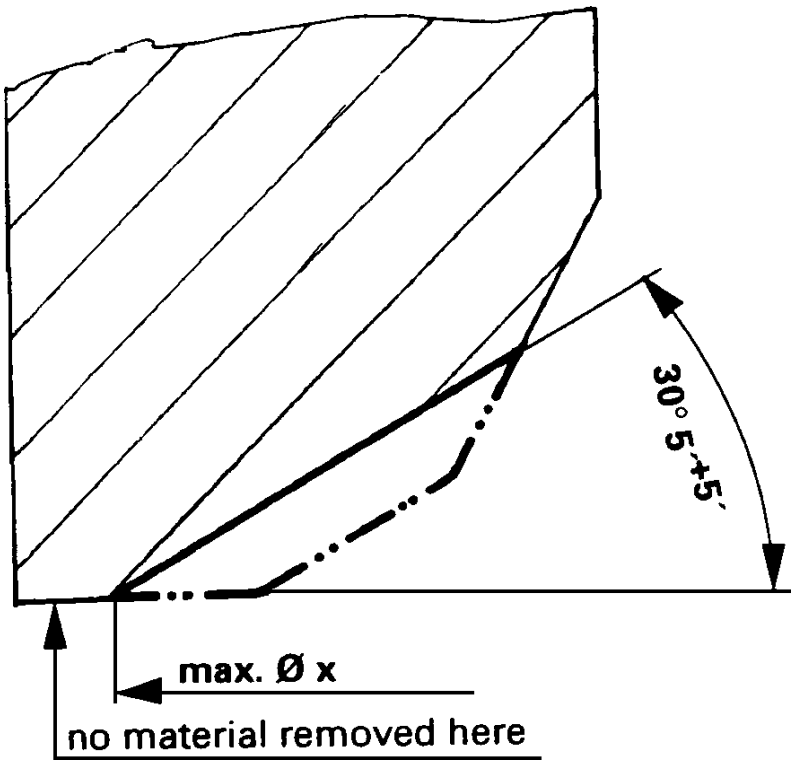
   Tighten nut of the pressure device with → **M = 150 Nm**

3. In cold shrunk state no clearance between valve seat ring and cyl. head is admissible.

The bore for the inlet valve seat ring is **Ø 147** ^{H6}
H6=147.00 - 147.025

When refinishing the valves the details stated in the sketch have to be observed.

Dimension **„X“** max. **Ø 142.50 mm**
Refinishing of the inlet and exhaust valve seat faces can be carried out by means of valve grinder or milling cutter.

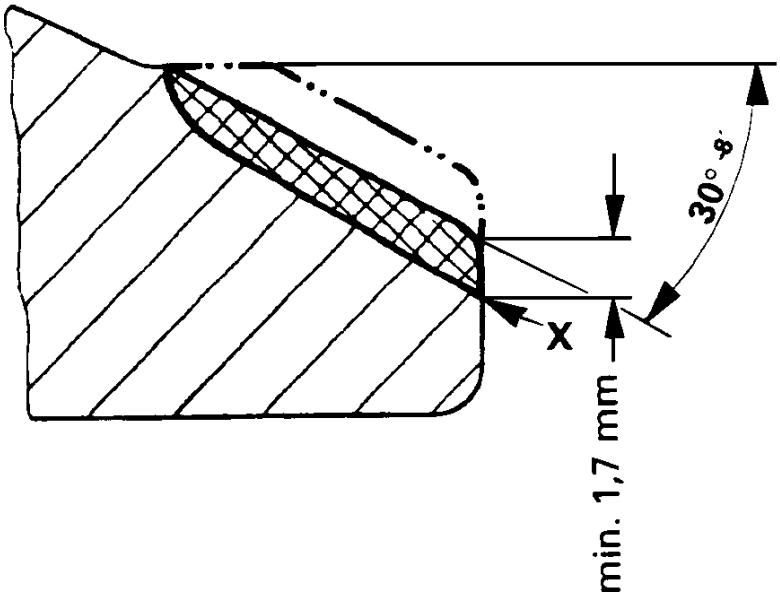


Cylinder head

Exhaust valve cone

Refinishing acc. to sketch, do not refinish the existing fillet.

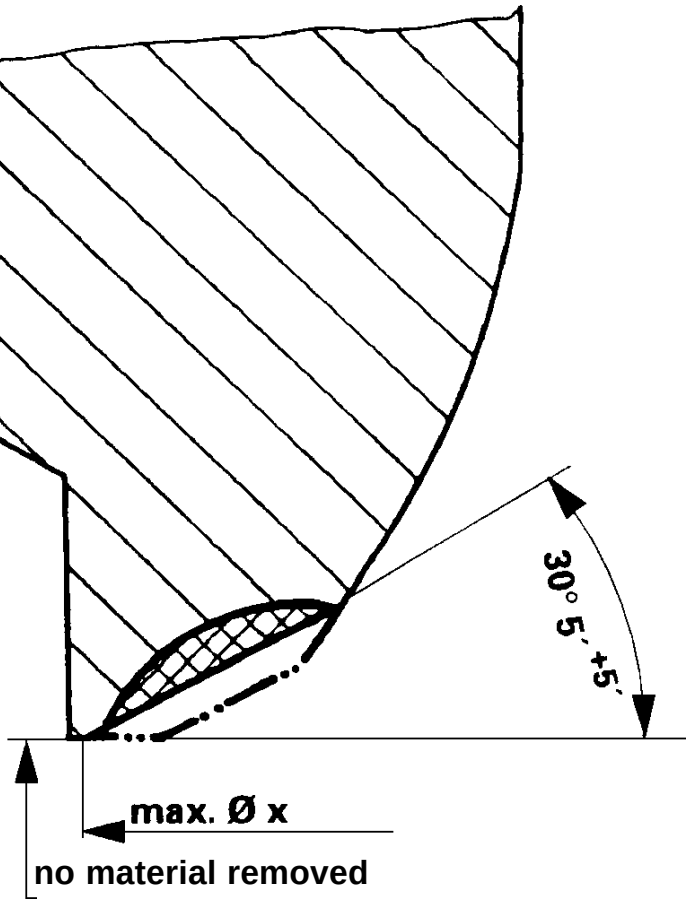
If the valve cone is refinished the valve seat must be refinished, too.



Exhaust cave seat

Refinishing acc. to sketch.

Dimension **„x“** maximum
Ø 142.50 mm



Cylinder head

Exhaust valve, fitting

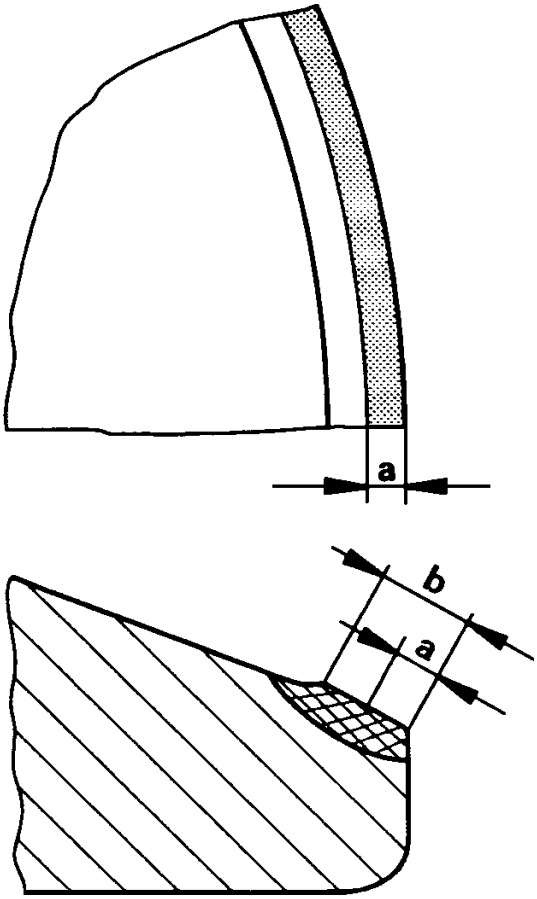
Before installation the joint ring between exhaust valve and cyl. head is to be glued to the housing seat with paste Dag S 5080. The housing bore in the cylinder head and the valve housing up to the o - ring groove are to be smeared lightly with paste Dag S 5080.
After inserting the valve guide in the exhaust valve housing in supercooled condition it shall have the

dimension **Ø** → **30.98** $^{+0.05}$ **mm**

Between valve guide and exhaust valve housing a clearance is **not** admissible. When fitting the exhaust valve spring pay attention that the narrow coils are at the bottom.

Grinding of inlet and exhaust valves

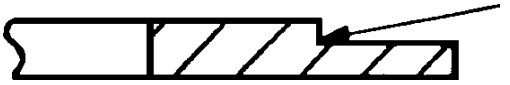
Apply small dots of the diamond paste Dp 30/10-15 my with a syringe to the seat surface of the new or remachined valve cone and distribute the paste equally. Thereafter the seat ring surface is to be sprayed with a thinner (F25) belonging to the diamond paste, for dilution and in order to increase the grip. Insert the oiled valve stem into the guide bush. Fasten the device to the valve head and grind the valve face and seat by hand applying a moderate pressure, rotating the device. The contact reflection **„a“** which is visible by the smooth grinding process shall be at least **30 %** of the seat width starting from the outside diameter. If the bearing characteristics described above are not reached, remachining of both sealing surfaces is necessary. After machining both seats have to be checked with a luminous magnifier. The fillet must not be refinished.
After machining round off the outside edge with a stone.



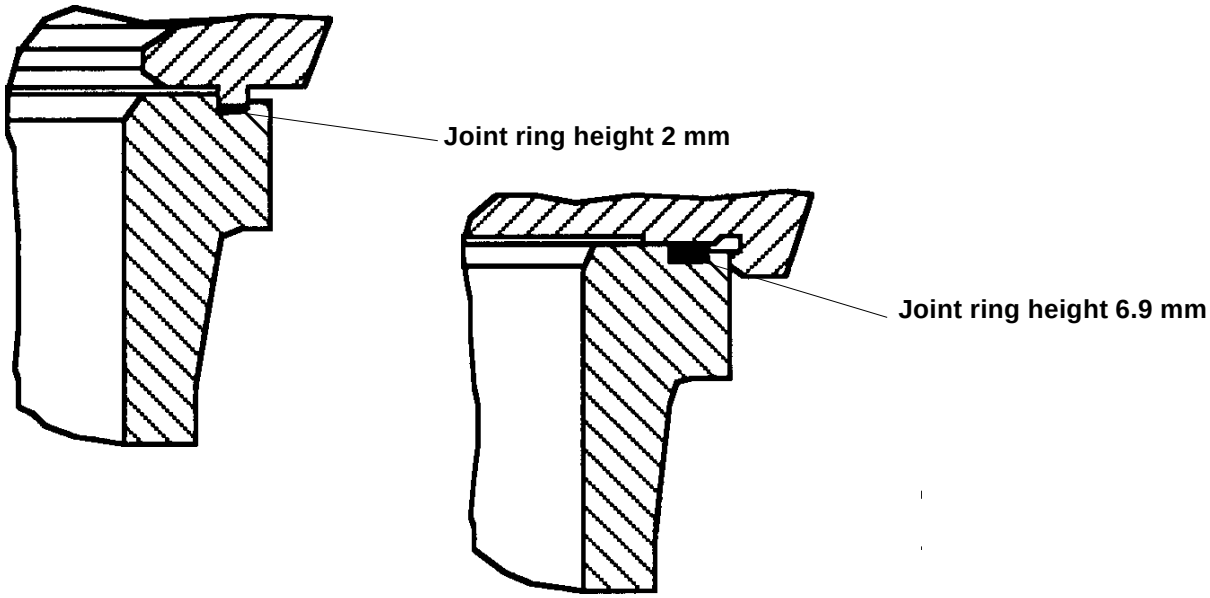
Cylinder head

Joint rings - Sealing surface

Take care of correct position of the joint ring to the liner.The old joint ring has a height of 2 mm, the new joint ring of 6.9 mm. The high joint ring can be used several times, if sealing surfaces are undamaged, but only together with cylinder heads of the modified type.***(See sketch)***



Recutting (slight grinding) of the landing surface is possible up to a maximum of 0.5 mm. Further recutting up to a maximum of 2 mm is only admissible, if the cyl. head bottom is recut at the same time.



Exhaust gas manifold

Tighten screws to cyl. head with →

M = 200 Nm

Piston

Mahle
Piston 1.70.6-26.70.00-01 / -06 / -08 / -10 / -12 / -14 / -16
Piston var. -12 for M551 - Piston var. -16 for M552

The tightening torque for inserting the studs is → **M = 70 Nm**

The nuts are tightened with → **M = 120 Nm**
and loosened again, then check the tightening torque for inserting the studs and tighten nuts finally with → **M = 120 Nm**
Coat threads and contact surfaces with Molykote paste G -n.

Kolbenschmidt KS
Piston 1.70.7-26.70.00-02 / -05 / -11 / -13 / -15 / -17 / -18 - - mechanical tightening
Piston var. -11 and -17 for M551 - piston var. -15 for M552

The tightening torque for inserting the studs is → **M = 80 Nm**
(Do not insert with adhesive)

Tighten nuts crosswise twice with → **M = 150 Nm**
and loosen again, then check the tightening torque for inserting the studs.
Pretighten nuts with → **M = 20 Nm**
and tighten crosswise with → **Dw = 90°**

Check: With 150 Nm the nut must not turn further. ***(Var. -02 and -05)***
With 90 Nm the nut must not turn further. ***(Var. -11 up to -18)***
Coat threads and contact surfaces with Molykote paste G -n.

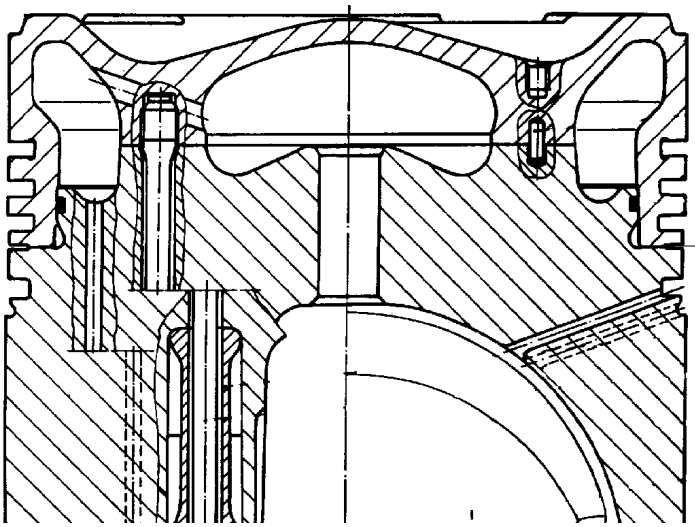
Piston 1.70.7-26.70.00-02 / -05 / -11 / -13 / -15 / -17 / -18 - - hydraulical tightening
Piston var. -11 and -17 for M551 - piston var. -15 for M552

The tightening torque for inserting the studs is → **M = 80 Nm**
(Do not insert with adhesive)

Tighten round nuts steadily with pin.
Lengthen studs with → **P = 119 bar**
and tighten round nuts with pin. Relieve hydraulic device, after a settling time of 3 min. bring hydraulic device to → **P = 119 bar**
again and retighten round nuts.

Piston

Clearance between piston crown and skirt
For the piston of Messrs. Kolbenschmidt the following clearances between crown and skirt must be observed: **Screws tightened: 0.25 mm Screws loosened: 0.31 mm**



Piston pin
The screws for the aluminium cover are tightened with → **M = 25 Nm**
Screws not longer than 14 mm.

Piston pin
nominal size → **Ø 189.99 mm**

Small end bush
Nominal size Ø → **190.24 mm**

Minimum clearance → **0.20 mm**

Maximum clearance → **0.27 mm**

Piston bosses
minimum clearance → **0.005 mm**

maximum clearance → **0.033 mm**

clearance limit → **0.06 mm**

Piston

End clearance piston boss distance - small end bush length

minimum clearance →	**0,50**	**mm**
maximum clearance →	**0,90**	**mm**
clearance limit →	**1,00**	**mm**

Piston rings - mounting

When fitting the piston, the piston rings must be arranged so that the ring butts are opposite in longitudinal direction of engine.
The mounting device (hose clamp) must move freely over the piston rings.
When inserting the piston rings in the ring grooves take care that the **„marking of the piston ring“** is pointing upwards.

If the taper-faced ring 0.00.6-35.42.00-72 and / or the bevelled-edge oil ring 0.00.6-35.41.00-87 are fitted on the piston, the hose clamp 1.70.7-92.20.00-10 must be used for mounting.
On pistons with chromium-plated ring grooves the groove must be recut and newly chromium-plated when the limt size is reached. Simple recutting with use of an oversize ring is not admissible.

Wear limits

Piston 1.70.6-26.60.01-01 / -02 - 1.70.6-26.60.01-06 - piston 1.70.6-26.70.00-02 / -03 / -08 / -11

Grooves	Grooves height	Ring height	Wear limit	Clearance limit
1	10,10 $^{+0,02}$	9,987 - 9,972	10,60	0,75
2	10,08 $^{+0,02}$	9,987 - 9,972	10,60	0,75
3	10,06 $^{+0,02}$	9,987 - 9,972	10,60	0,75
4	10,06 $^{+0,02}$	9,987 - 9,972	10,60	0,75
5	12,04 $^{+0,02}$	11,984 - 11,960	12,50	0,75
6	10,06 $^{+0,02}$	11,984 - 11,966	10,60	0,60

Piston

Piston 1.70.6-26.70.00-05 / -06 / -10 / -11 / -12 / -13 / -14 / -15 / -16 / -17 / -18

Grooves	Grooves height	Ring height	Wear limit	Clearance limit
1	10,16 $^{+0,02}$	9,87 $_{-0,022}$	10,36	0,50
2	10,16 $^{+0,02}$	9,87 $_{-0,022}$	10,60	0,75
3	10,06 $^{+0,02}$	9,81 $_{-0,022}$	10,60	0,75
4	10,06 $^{+0,02}$	9,984 $_{-0,034}$	10,60	0,75
5	12,06 $^{+0,02}$	11,984 $_{-0,034}$	12,50	0,60

Piston rings

Piston 1.70.6-26.60.01-02

Ringnut		ring
1 + 2	Fire ring, chromium-plated	0.00.6-35.41.00-61
3 - 5	Compression ring	0.00.6-35.41.00-18
6	Oil scraper ring	0.00.6-35.41.00-16
7	Rectangular ring	0.00.6-35.41.00-27

Piston 1.70.6-26.60.01-02

Ring groove		ring
1	Fire ring, chromium-plated	0.00.6-35.41.00-61
2 - 5	Rectangular ring	0.00.6-35.41.00-18
6	Oil scraper ring	0.00.6-35.41.00-16
7	Rectangular ring	0.00.6-35.41.00-27

Piston 1.70.6-26.60.01-06

Ring groove		ring
1 + 2	Fire ring, chromium-plated	0.00.6-35.41.00-61
3 + 4	Compression ring	0.00.6-35.42.00-02
5	Oil scraper ring	0.00.6-35.41.00-81.1

Piston 1.70.6-26.60.01-06

Ring groove		ring
1 + 2	Fire ring, chromium-plated	0.00.6-35.41.00-61
3	Compression ring chromium-plated	0.00.6-35.42.00-72
4	Bevelled-edge oil ring, chromium-plated	0.00.6-35.41.00-87
5	Oil scraper ring,chromium-plated	0.00.6-35.41.00-81.1

Piston

Piston 1.70.6-26.70.00-02 / -03 / -08 / -11 / -12 / -15 / -16 / -17

Ring groove		ring
1 + 2	Fire ring, chromium-plated	0.00.6-35.42.00-09
3	Compression ring, chromium-plated	0.00.6-35.42.00-72
4	Bevelled-edge oil ring, chromium-plated	0.00.6-35.41.00-87
5	Oil scraper ring, chromium-plated	0.00.6-35.41.00-81.1

Piston 1.70.6-26.70.00-05 / -06 / -10 / -11 / -12 / -15 / -16 / -17

Ring groove		ring
1	Fire ring, chromium-plated	0.00.6-35.42.00-69
2	Fire ring, chromium-plated	0.00.6-35.42.00-09
3	Compression ring, chromium-plated	0.00.6-35.42.00-72
4	Bevelled-edge oil ring, chromium-plated	0.00.6-35.41.00-87
5	Oil scraper ring, chromium-plated	0.00.6-35.41.00-81.1

Piston 1.70.6-26.70.00-02 / -03 / -08 / -11 / -12 / -15 / -16 / -17

Ring groove		ring
1 + 2	Fire ring, chromium-plated	0.00.6-35.42.00-09.1
3 + 4	Compression ring, chromium-plated	0.00.6-35.42.00-61.1
5	Oil scraper ring, chromium-plated	0.00.6-35.41.00-81.1

Piston 1.70.6-26.70.00-05 / -06 / -10 / -11 / -12 / -15 / -16 / -17

Ring groove		ring
1	Fire ring, chromium-platedt	0.00.6-35.42.00-69
2	Fire ring, chromium-plated	0.00.6-35.42.00-09
3 + 4	Compression ring, chromium-plated	0.00.6-35.42.00-61.1
5	Oil scraper ring, chromium-plated	0.00.6-35.41.00-81.1

Piston 1.70.6-26.70.00-13 / -18 / -14

Ring groove		ring
1	Fire ring, chromium-plated	0.00.6-35.42.00-69
2	Fire ring, chromium-plated	0.00.6-35.42.00-09
3	Compression ring, chromium-plated	0.00.6-35.42.00-72
4	Bevelled-edge oil ring, chromium-plated	0.00.6-35.41.00-87
5	Oil scraper ring, chromium-plated	0.00.6-35.41.00-81.1

Piston 1.70.6-26.70.00-13 / -18 / -14

Ring groove		ring
1	Fire ring, chromium-plated	0.00.6-35.42.00-69
2	Fire ring, chromium-plated	0.00.6-35.42.00-09
3 + 4	Compression ring, chromium-plated	0.00.6-35.42.00-61.1
5	Oil scraper ring, chromium-plated	0.00.6-35.41.00-81.1

Piston

Al - piston, double ring support
Gas oil operation
1.70.6-26.60.01-01 **M551**
Gas oil and heavy fuel operation
1.70.6-26.60.01-02 **M551**

Al - piston, double ring support
Gas oil and heavy fuel operation
1.70.6-26.60.01-06 **M551**

Built-up piston gas oil and heavy fuel operation ring grooves flame-hardened
1.70.6-26.70.00-02 / -03 / -08 / -11 **M551 - M552**

Built-up piston - heavy fuel operation 1. ring groove chromium-plated
1.70.6-26.70.00-05 / -06 / -10 / -11* / -12* / -15 / -16** / -17* *M551 ** M552**

Built-up piston - heavy fuel operation 1. ring groove chromium-plated
1.70.6-26.70.00-13 / -18 / -14 **M551 - M552**

Liner

Nominal size Ø (original size) →		**450.00 - 450.063**	**mm**
Wear limits			
Wear and tear value →		**0.75 - 0.90 ***	**mm**
Max. ovality →		**0.30**	**mm**
Wedge shape	Height →	**13.00**	**mm**
	Depth * * →	**0.05**	**mm**

Wedge-shaped indentation across the entire circumference, beginning at TDC 1st piston ring.

Canyon	Max. number →	**3**	
	Length →	**13.00**	**mm**
	Total width →	**6.00**	**mm**

Individual deep blow-through ducts in the area of the 1st piston ring (TDC)

Score	Number →	**3**	
	Length →	**250.00**	**mm**
	Depth →	**0.05**	**mm**

Hard vertical, linear friction marks.

Pocket	Number →	**3**	
	Length →	**120.00**	**mm**
	Width * * * →	**40.00**	**mm**
	Depth * * →	**0.03**	**mm**

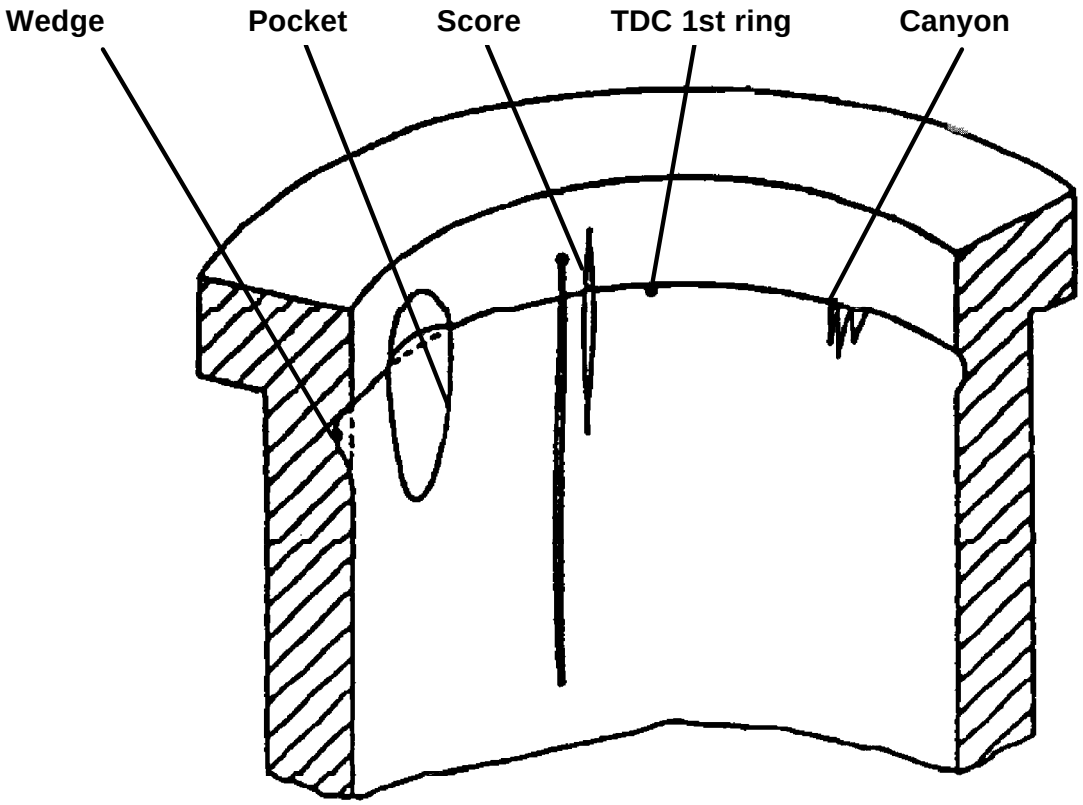
Liner

Areal, irregular indentations.

* ***Limit value for conically honed cylinder liner.***

** ***Radius ≥ 3 mm***

*** ***In circumferential direction.***



Dependent on the damage, refinishing (honing) is possible up to a maximum of **450.75 Ø mm** at the top edge resp. **450.60 Ø mm** at a distance of **106 mm** from the top edge and tapering to a maximum of **530 mm** from the top edge.

A conical gasket between liner and cylinder block must not be used twice, as its bearing surface has hardened and shows a permanent deformation.

If the sealing surfaces (liners / cylinder block) have been refinished: The liner should be inserted rather hogher than too deep.

Connecting rod

In-line engine M551

Big end bearing

Mechanical tightening: tighten nuts crosswise in several steps →

M	**=**	**1150**	**Nm**

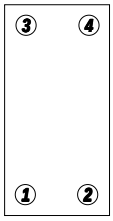
Hydraulical tightening: tighten nuts in steps as follows

1st step lengthen screws 1 + 4 with → and tighten nuts.

2nd lengthen screws 2 + 3 with → and tighten nuts.

3rd step lengthen screws 1 + 4 with → and tighten nuts.and tighten nuts.

4th step **(control step)** check nuts 2 + 3 with → ***(Molykote)***



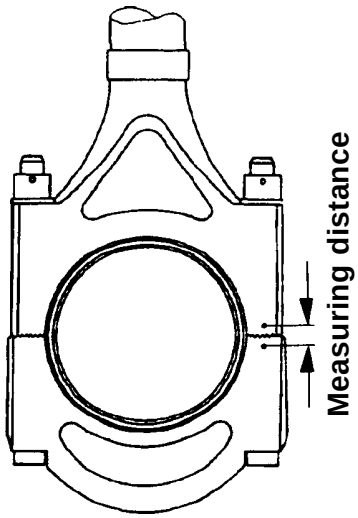
P	**=**	**350**	**bar**
P	**=**	**620**	**bar**
P	**=**	**620**	**bar**
P	**=**	**620**	**bar**

Check: After the last tightening step the tight support of the round nuts is to be checked by reducing the pressure by 50 bar. Loosening of the nuts with a pin must not be possible.

Prerequisite for mechanical and hydraulic tightening is manual tightening of the nuts.

Gap measurement

Pretighten both screws with 100 bar on the opposite side to the measuring bores **Ø 4mm.** Determine the measuring track between the two bores. Tighten the screws as prescribed and determine the measuring track once more. Ascertain the difference between first and second measurment.



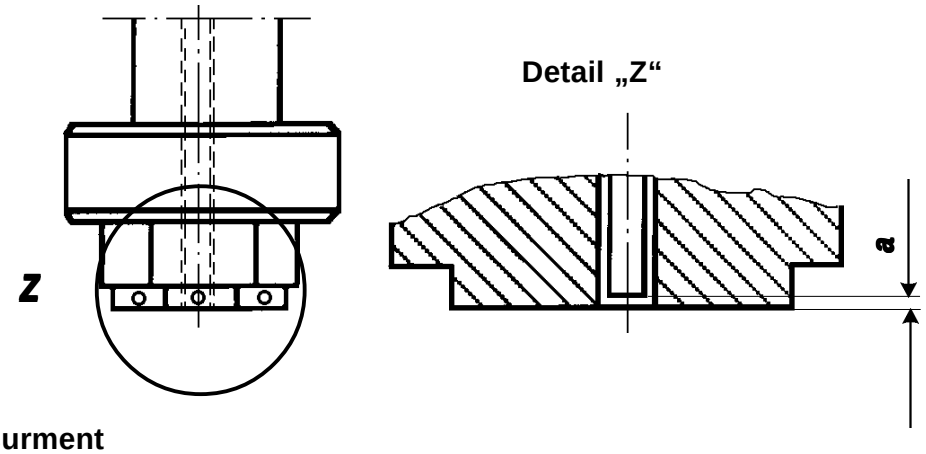
Gap →		**0.80 - 0.95**	**mm**
After longer operation not below →		**0.65**	**mm**
Bearing clearance original size →		**0.34**	**mm**
Limit value →		**0.40**	**mm**

Connecting rod

Vee-engine M551

Big end bearing
Lengthen bolts in several steps crosswise to dimension **„a“.**

1. Pretighten both sides up to dimension **„a“** →	**0.40** + 0.04 **mm**
2. Tighten both sides up to dimension **„a“** → ***(Molykote)***	**0.70** + 0.04 **mm**



Gap measurment
Tighten bolts as prescribed. Determine measuring track between the bores **Ø 4 mm.** Loosen both bolts on the side of the measuring track. Measure the distance between the bores **Ø 4 mm** once more and ascertain the difference.

Gap →	**0.92 - 1.10 mm**
After longer operation not below →	**0.92 mm**
Bearing clearance original size →	**0.34 mm**
Limit value →	**0.42 mm**
End clearance →	**0.20 - 0.45 mm**
Clearance limit →	**1.00 mm**

Connecting rod

Vee-engine M551

Bottom end of master rod

Pretighten bolts crosswise with →	**M = 100**	**Nm**
then pretighten in 2 steps up to →	**Dw = 31°**	
and tighten up to →	**Dw = 61°**	

(Molykote) Use angle gauge 1.70.7-91.80.00-03

Bottom end of link rod

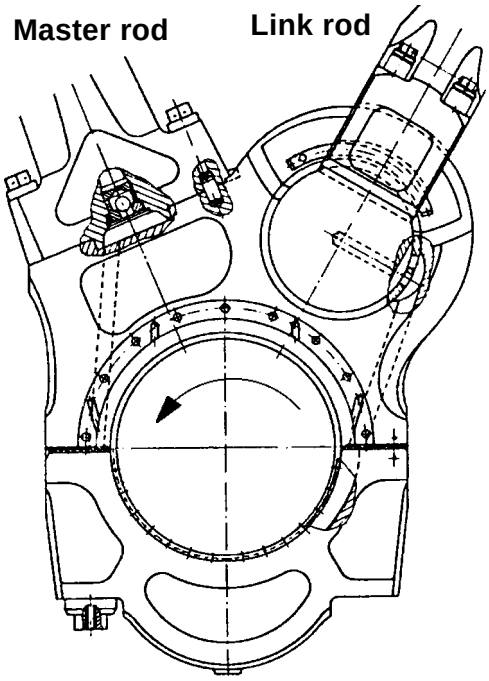
Pretighten bolts with →	**M = 50**	**Nm**
then tighten in 2 steps up to →	**Dw = 55°**	
and up to →	**Dw = 109°**	

(Molykote) Use angle gauge 1.70.7-91.80.01-06

Swivel pin bearing

end clearance →	**0.50 - 0.94**	**mm**
clearance limit →	**1.50**	**mm**

Take care during installation that the master rod is fitted in the direction of rotation, the link rod must follow.



Connecting rod

In-line engine M552

Big end bearing 1.70.7-26.01.00-50 / 53
Lightly coat threads and contact surfaces of the nuts with Molykote.

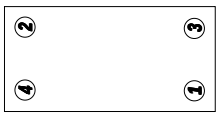
Pretighten nuts crosswise with → **M = 600 Nm**
Mark 0-mark of the angle gauge on the nuts.
Tighten nuts crosswise in pairs 1 - 2 / 3 - 4.
1st step up to → **Dw = 60°**

2nd step up to → **Dw = 100°**

Counternuts and lock washers not to be fitted any more.
The engines No. 57002 and 57003 are equipped with the var. -50, the engines No. 57008 / 57009 / 57010 / 57012 with the var. -53.

Big end bearing 1.70.7-26.01.00-55 / 58
Lightly coat threads and contact surfaces of the nuts with Molykote.

Pretighten nuts crosswise with → **M = 600 Nm**
Mark 0-mark of the angle gauge on the nuts.
Tighten nuts crosswise in pairs 1 - 2 / 3 - 4.
1st step up to → **Dw = 50°**



2nd step up to → **Dw = 90°**

The engines No. 57013 up to 57022 as well as 57025 and 57036 are equipped with the var.-55, the engines No. 57023 / 57024 / 57028 / 57032 - 57034 with the var.-58.

Big end bearing 1.70.7-26.01.00-56 / 61
Tighten bolts together in pairs 1 - 2 resp. 3 - 4.
1st step up to → **P = 270 bar**
2nd step up to → **P = 540 bar**

The engines No. 57035, 57037 up to 57039 as well as 57047 / 57048 and 57052 up to 57055 are equipped with the var.-56, the engines No. 57040 / 57041 / 57050 / 57051, 57056 up to 57073, / 57075 up to 57091 as well as 57093 / 57094 / 57096 with the var.-61.
Check: After the last tightening step the tight support of the round nuts is to be checked by reducing the pressure by 50 bar. It must not be possible any more to loosen the nuts with a pin.

Connecting rod

Vee-engine M552

Big end bearing 1.70.7-26.01.00.54 / 62
Tighten bolts simultaneously in pairs 1 - 2 resp. 3 - 4

1st step up to →	**P = 270**	**bar**
2nd step up to →	**P = 540**	**bar**

The engines No. 62003 up to 62006 are equipped with the var.-54, the engines No. 62013 up to 62016 with the var.-62.
After the last tightening step check the tight support of the round nuts by reducing the pressure by 50 bar. Loosening by means of a pin must no longer be possible.

In-line engine M552

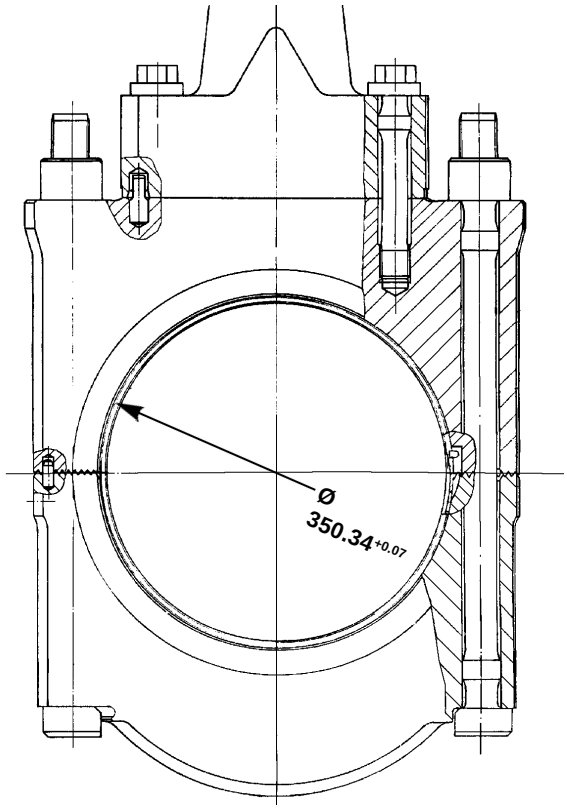
Vee-engine M552

Gap measurment
Tighten bolts are as prescribed. Loosen on one side and measure projecting length (gap between cover and crankpin bearing) by means of a slide gauge.

Gap →	**0.90 - 1.10**	**mm**
Limit value →	**0.70**	**mm**

Bearing clearance

Original size →	**0.34**	**mm**
Limit value →	**0.41**	**mm**

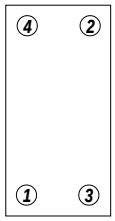


Connecting rod

In-line engine | **Vee-engine**

Bottom end of connecting rod 1.70.7-26.01.00-50 / 53
Lightly coat threads and contact surfaces of the bolts with Molykote.

Pretighten bolts with → **M = 100 Nm**
Mark 0-mark of the angle gauge on the bolts.
Tighten bolts crosswise in pairs 1-2 resp. 3-4
1st step up to → **Dw = 40°**

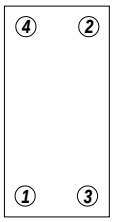


2nd step up to → **Dw = 75°**

Bottom end of connecting rod 1.70.7-26.01.00-54 / 55 / 56 / 58 / 61 /61
Lightly coat threads and contact surfaces of the bolts with Molykote.
Pretighten bolts.
1st step bolts 1 - 2 up to → **M = 100 Nm**

2nd step bolts 3 - 4 up to → **M = 100 Nm**

3rd step bolts 1 - 2 up to → ***(Check)*** **M = 100 Nm**
Mark 0-mark of the angle gauge on the bolts.
Tighten bolts.
1st step bolts 1 - 2 up to → **Dw = 50°**



2nd step bolts 3 - 4 up to → **Dw = 90°**

3rd step bolts 1 - 2 up to → **Dw = 90°**

Main bearing

In-line engine M551

1.73./74./79.7-12.00.00- 01 Mechanical tightening

Manual tightening of the nuts with wrench abt. 400 mm length, the counternuts have to be turned until they touch the bedplate. Tighten bolts in steps crosswise alternately.

1st step →	**M = 200 Nm**
2nd step →	**M = 500 Nm**
3rd step →	**M = 700 Nm**
4th step →	**M = 900 Nm**

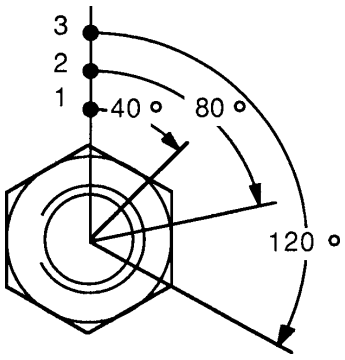
Molykote capp nut spanner size 41

1.73./74./79.7-12.00.00- 02 / 03 /04 Mechanical tightening

Tighten nuts crosswise until bearing cap gap on camshaft and exhaust gas side is **< 0,05 mm**, if necessary, tighten further until gap **< 0,05 mm.** Tighten nuts in steps alternately on exhaust gas and camshaft side.

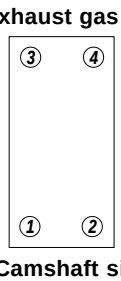
1st step →	**Dw = 40°**
2ns step →	**Dw = 80°**
3rd step →	**Dw = 120°**

Molykote capp nut, spanner size 41. Use angle gauge.



1.73./74./79.7-12.00.00- 06 / 07 Mechanical tightening

Pretighten bearing screws **3 and 4** to elongation dimension →	**Δl = 0.40 - 0.50 mm**
Tighten bearing screw **1** to length dimension →	**Δl = 0.55 - 0.65 mm**
Tighten bearing screw **2** to length dimension →	**Δl = 1.07 ± 0.05 mm**
Tighten bearing screw **1** to length dimension →	**Δl = 1.07 ± 0.05 mm**
Tighten bearing screws **3 and 4** to length dimension →	**Δl = 1.07 ± 0.05 mm**



Main bearing

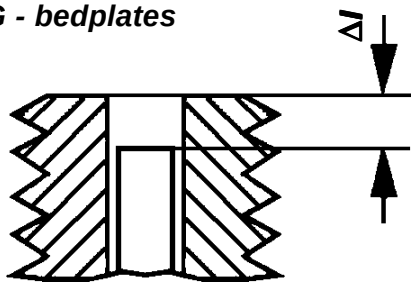
In-line engine M551

Check: Check all screws as to whether length dimension is →

Δl = 1.07 ± 0.05 mm

In case of deviation from the nominal value correct.

Molykote - hexagon nut spanner size 55 GG - bedplates



1.73./74./79.7-12.00.00-08 / 09 / 10 Hydraulic tightening

Tighten nuts steadily by hand.

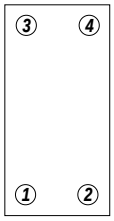
Lengthen screws **1 and 4** up to → and tighten nuts. **P = 350 bar**

Lengthen screws **2 and 3** up to → and tighten nuts. **P = 620 bar**

Lengthen screws **1 and 4** up to → and tighten nuts. **P = 620 bar**

Check: Length dimension → **Δl = 1,02 + 0,2 mm**

Molykote - Piston surface: 54,8 cm² var.-10 without elongation check.



1.73./74./79.7-12.00.00-12 Hydraulic tightening

Tighten nuts steadily by hand.

Lengthen screws **1 and 4** up to → and tighten nuts. **P = 350 bar**

Lengthen screws **2 and 3** up to → and tighten nuts. **P = 730 bar**

Lengthen screws **1 and 4** up to → and tighten nuts. **P = 730 bar**

Molykote - Piston surface: 54,8 cm²

GGG-bedplates series and replacement - Only valid for replacement: Bedplate with bolts with measuring pin. P = 730 bar corresponds to Δl = 1,25 + 0,05 mm (for checking)

Main bearing

In-line engine M551

Normal main bearing

Gap

normal →	**0.85 - 1.00**	**mm**
limit value →	**0.70**	**mm**
Bearing clearance →	**0.34 - 0.42**	**mm**

Located main bearing

Gap

normal →	**0.60 - 0.90**	**mm**
limit value →	**0.50**	**mm**
Bearing clearance →	**0.34 - 0.42**	**mm**
end clearance →	**0.40 - 0.54**	**mm**

Main bearing

Vee-engine M551

1.76./78.7-12.00.00-01
Tighten nuts alternately in steps crosswise.

1st step up to →	**M = 260 Nm**
2nd step up to →	**M = 520 Nm**
3rd step up to →	**M = 780 Nm**
4th step up to →	**M = 1050 Nm**
5th step up to →	**M = 1300 Nm**

Molykote

1.76./78.7-12.00.00-02
Tighten nuts alternately in steps crosswise.

1st step up to →	**Dw = 30°**
2nd step up to →	**Dw = 60°**
3rd step up to →	**Dw = 90°**

Molykote

1.76./78.7-12.00.00-03

Tighten nuts on A-side up to →	**M = 100 Nm**
Tighten nuts on B-side up to →	**M = 400 Nm**
Tighten nuts on A-side up to →	**M = 400 Nm**
Tighten nuts on B-side up to →	**M = 700 Nm**
Tighten nuts on A-side up to →	**M = 700 Nm**

Molykote
Check: On A side and B side the remaining gap must be **< 0,05 mm**. If the remainung gap exceeds this value, tighten nuts until the gap is **< 0,05 mm**.

Main bearing

Vee-engine M551

Mark 0°-mark of angle gauge on nuts. Tighten nuts further in 2 steps alternately on A side and B side until the mark on the nuts coincides with the 90°-mark on the angle gauge.

1st step up to → **Dw = 45°**

2nd step tighten further up to → **Dw = 90°**
Molykote

1.76. / 78. 7-12.00.00-04
Elimination of the shell projection by uniformly tightening the nuts crosswise.
Check: With feeler gauge. Mark 0°-mark of the angle gauge on the nuts. Tighten nuts in 3 steps crosswise.

1st step up to → **Dw = 30°**

2nd step tighten further up to → **Dw = 60°**

3rd step tighten further up to → **Dw = 90°**
Molykote

1.76. / 78. 7-12.00.00-06
Elimination of the shell projection by uniformly tightening the nuts crosswise.
Check: With feeler gauge. Mark 0°-mark of the angle gauge on the nuts. Tighten nuts in 3 steps crosswise

1st step up to → **Dw = 50°**

2nd step tighten further up to → **Dw = 100°**

3rd step tighten further up to → **Dw = 150°**
Molykote

Main bearing

Vee-engine M551

Normal main bearing

Gap

normal →	**0.85 - 1.00**	**mm**
limit value →	**0.70**	**mm**
Bearing clearance →	**0.34 - 0.45**	**mm**

Located main bearing

Gap

normal →	**0.40 - 0.54**	**mm**
limit value →	**0.30**	**mm**
Bearing clearance →	**0.34 - 0.45**	**mm**
end clearance →	**0.40 - 0.54**	**mm**

Main bearing

In-line engine M552

1.73. / 74. / 79. 7-12.00.00-50 / 56
Bearings 2 - 8 / 10 / 11

Tighten nuts crosswise continuouly up to → **M = 700 Nm**

Check if residual gaps on exhaust and camshaft side are smaller than 0.05 mm, incase of larger gap tighten nuts until gap is smaller than 0.05 mm.
Mark 0°-mark of the angle gauge on the nuts.
Tighten nuts crosswise in steps .

1st step up to → **Dw = 50°**

2nd step up to → **Dw = 100°**

3rd step up to → **Dw = 150°**

Bearing 1

Tighten nuts crosswise continuouly up to → **M = 700 Nm**

that corresponds
to a value of → **M = 19 Nm**
on the torque wrench when using box wrench 1.70.6-91.25.01-05 and power amplifier 0.00.6.15.21.00-06. Check if residual gaps on exhaust and camshaft side are smaller than 0.05 mm, incase of larger gap tighten nuts until gap is smaller than 0.05 mm. Then continue as on the other bearings.
Molykote

1.73. / 74. / 79. 7-12.00.00-60 / 62
Tighten nuts steadily by hand. Tighten nuts in steps.

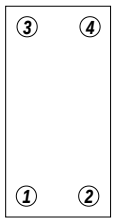
1st step, lengthen bolts 1and 4 up to → **P = 270 bar**

2nd step, lengthen bolts 2 and 3 up to → **P = 550 bar**

3rd step, lengthen bolts 1and 4 up to → **P = 820 bar**

4th step, lengthen bolts 2 and 3 up to → **P = 820 bar**

Piston surface 54,8 cm²

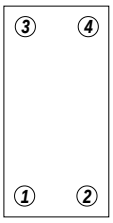


Main bearing

In-line engine M552

1.73. / 74. / 79. 7-12.00.00-64
Tighten nuts steadily by hand. Tighten nuts in steps.

1st step lengthen bolts 1 and 4 up to →	**P = 270**	**bar**
2nd step lengthen bolts 2 and 3 up to →	**P = 550**	**bar**
3rd step lengthen bolts 1 and 4 up to →	**P = 1000**	**bar**
4th step lengthen bolts 2 and 3 up to →	**P = 1000**	**bar**



Piston surface 54,8 cm²

Main bearing

In-line engine M552

Normal main bearing

Gap

Normal →	**0.80 - 1.00**	**mm**
Limit value →	**0.65**	**mm**
Bearing clearance →	**0.34 - 0.45**	**mm**

Located main bearing

Gap

Normal →	**0.40 - 0.54**	**mm**
Limit value →	**0.30**	**mm**
Bearing clearance →	**0.34 - 0.45**	**mm**
End clearance →	**0.40 - 0.54**	**mm**

Main bearing

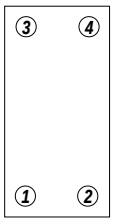
Vee-engine M552

1.76.7-12.00.00-51 / 59
Tighten nuts steadily by hand. Tighten nuts in steps.

1st step lengthen bolts 1 and 4 up to →		**P = 180 bar**
2nd step lengthen bolts 2 and 3 up to →		**P = 360 bar**
3rd step lengthen bolts 1 and 4 up to →		**P = 510 bar**
4th step lengthen bolts 2 and 3 up to →		**P = 510 bar**

Piston surface 78,5 cm²

1.76.7-12.00.00-60
Tighten nuts steadily by hand. Tighten nuts in steps.

1st step lengthen bolts 1 and 4 up to →		**P = 220 bar**
2nd step lengthen bolts 2 and 3 up to →		**P = 440 bar**
3rd step lengthen bolts 1 and 4 up to →		**P = 610 bar**
4th step lengthen bolts 2 and 3 up to →		**P = 610 bar**

Piston surface 78,5 cm² - GGG - bedplates

Main bearing

Vee-engine M552

Normal main bearing

Gap

Normal →	**1.10 - 1.30**	**mm**
Limit value →	**0.95**	**mm**
Bearing clearance →	**0.42 - 0.51**	**mm**

Located main bearing

Gap

Normal →	**0.80 - 0.99**	**mm**
Limit value →	**0.65**	**mm**
Bearing clearance →	**0.34 - 0.45**	**mm**
End clearance →	**0.40 - 0.55**	**mm**

Main bearing

M 551 | **M 552**

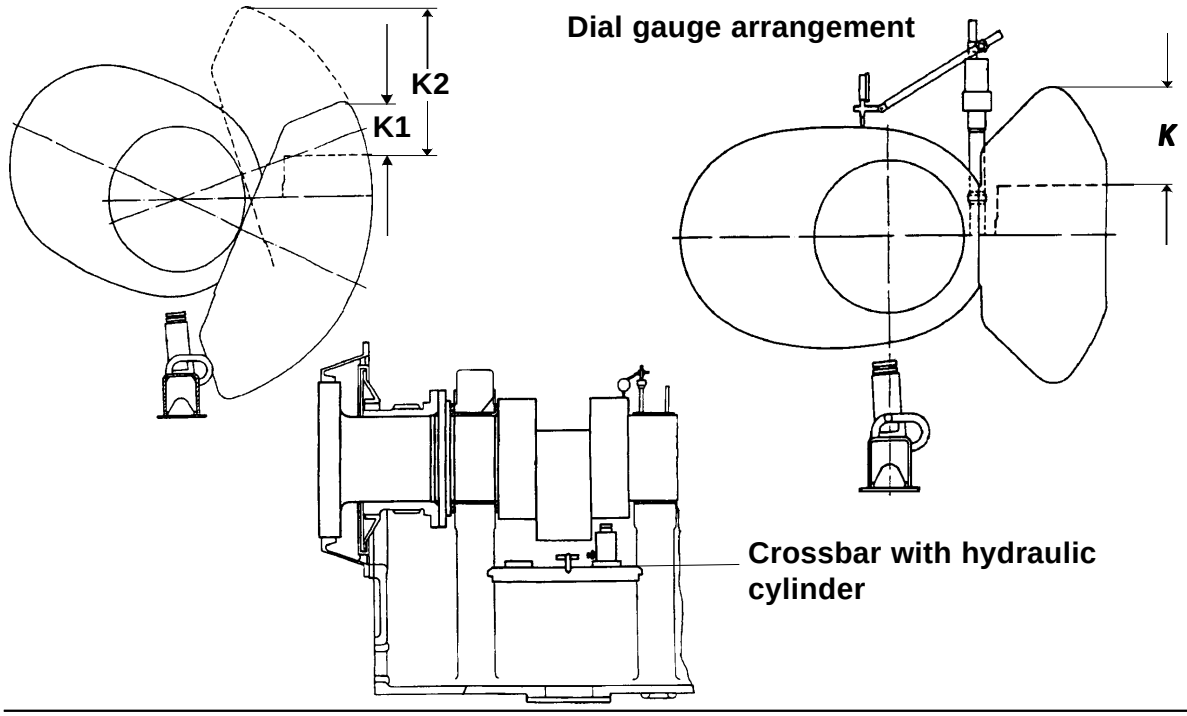
Fitting and removal of the bearing shells in case of bedplates made of Spheroidal graphite iron.

Removal

1st Loosen and remove bearing cap.
2nd Insert crossbar, only possible with ca **18°** under crankshaft center.
3rd Turn crankshaft into position **25°** over crankshaft center.
4th Lift crankshaft by **0.28 mm for M551 and 0.32 mm for M552** by means of hydraulic cylinder.
Check with dial gauge and magnetic stand.
5th Drive out the bottom bearing shell with beat and plug-in segments and hammer. Take care that the bearing shell is turned out in the correct direction.

Fitting

1st Fitting of the bottom bearing shell only with lifted crankshaft. **(0.28 mm for M551 and 0.32 mm for M552)**
2nd Oil the bottom bearing shell lightly, but uniformly on both sides, put it on the bearing journal and push it into the bearing pocket by hand as far as possible, then drive it in with the segments and hammer.
3rd Lower the crankshaft, remove hydraulic cylinder and crossbar. Oil bearing journal well, fit top bearing shell and tighten bearing cap acc. to specification.
Reference dimension „K“ = 205 mm; reference dimension „K1“ = 122 mm this corresponds to 25° ca-position.
Reference dimension „K2“ = 365 mm corresponds to 25° ca-position.



Main bearing

In-line engine M551

Before turning in the bottom bearing shell the inserting edge must be lightly chamfered with emery cloth. For the located main bearing the mounting device must be fitted with the side marked **„red“** pointing to the flywheel, for the normal main bearings the side marked **„green“** must point to the flywheel. If the engine is equipped with a temperature monitoring for the main bearings, before removal / installation of the bearing shell the temperature sensor must be removed.

In-line engine M552

For turning in the bearing shells on the normal and located main bearings the mounting device has to be tightened with the clamping bolts, on the additional normal main bearing which is fitted before the located main bearing the device is to be tightened with the bearing nuts.
The additional normal main bearing is installed from the exhaust gas side.

For the main bearings there are many different tightening variants which are stated in the drawings bedplate-mounting. There is no precise definition which tightening variant has to be applied. In case of doubt you **must** ask the competent official in charge of CK14.

Bedplates of Spheroidal graphite iron can be recognized by means of the drawing number cast in at the side, e.g. 1.73.**3**-12.10.00-.. for 6 cyl. engine

The **fourth** figure, the 3, means that the bedplate is made of Spheroidal graphite iron.

Counterweight

In-line engine M551

Mounting 1.73. / 74. / 79.7-25.20.00-01
Tighten tie bolt with → **M = 550 Nm**
Molykote
Tie bolt M27 x 2 x 232 mm, spanner size 36

Mounting 1.73. / 74. / 79.7-25.20.00-02
Pretighten tie bolt with → **M = 50 Nm**

Tighten tie bolt with → **Dw = 110°**
that corresponds to 2 hexagons. ***Molykote***
Tie bolt M247x 2 x 232 mm, spanner size 36

Mounting 1.73. / 74. / 79.7-25.20.00-03
Pretighten tie bolt with → **M = 100 Nm**

Tighten tie bolt with → **Dw = 180°**
that corresponds to 3 hexagons. ***Molykote***
Tie bolts M27 x 2 x 315 mm, spanner size 36

Vee-engine M551

Mounting 1.76. / 78. 7-25.20.00-01
Tighten tie bolt → **M = 1600 Nm**
Molykote
Tie bolt M39 x 3 x 368 mm, spanner size 46

Mounting 1.76. / 78. 7-25.20.00-02
Pretighten tie bolt with → **M = 300 Nm**

Tighten tie bolt with → **Dw = 60°**
Molykote
To adapt the locking plate continue tightening the bolts.
Tie bolt M39 x 3 x 368 mm, spanner size 46

Counterweight

In-line engine M552

Mounting 1.73. / 74. 79.7-25.20.00-50 / -51 / -52

Pretighten bolts continously with → **M = 150 Nm**

Apply 0° - mark of the angle gauge with chalk on the bolt head, then tighten bolts with → **Dw = 110°**

Molykote

Bolt M39 x 3 x 337 mm, spanner size 46

If necessary, tighten bolt further until coincidence with locking plate is reached.

Vee-engine M552

Mounting 1.76. 7-25.20.00-50

Pretighten bolts with → **M = 300 Nm**

Apply 0° - mark of the angle gauge with chalk on the bolt head, then tighten bolts in 2 steps.

1st step → **Dw = 60°**

2nd step → **Dw = 120° ± 15°**

Molykote

Tie bolt M 48 x 3 x 450 mm, spanner size 55

Mounting 1.76. 7-25.20.00-51

Pretighten bolts with → **M = 300 Nm**

Apply 0° - mark of the angle gauge with chalk on the bolt head, then tighten bolts in 2 steps.

1st step → **Dw = 68°**

2nd step → **Dw = 135° ± 7,5°**

Molykote

Tie bolt M 48 x 3 x 472 mm, spanner size 55

Counterweight

Mounting 1.76. 7-25.20.00-52

Pretighten screws with → **M = 300 Nm**

Apply 0° - mark of the angle gauge with chalk on the screw head,
then tighten screws in 2 steps.

1st step → **Dw = 75°**

2nd step → **Dw = 150°**

Molykote

Tie bolt M 48 x 3 x 472 mm, spanner size 55

Gear drive

In-line engine M551

Bedplate, Mounting 1.73. / 74. / 79 / 7-12.00.00-01 / -02
Gear wheel on crankshaft 1.70.7-25.30.00-01 / - 05
Tighten clamping bolts in steps crosswise alternately.

1st step →	**M = 150 Nm**
2nd step →	**M = 300 Nm**
3rd step →	**M = 400 Nm**

Molykote - Joint faces of the gear wheel must touch at one side, i. e. no gap! On the opposite side a minimum gap of 0.03 mm must remain with bolt completely tightened with M = 400 Nm..
Replacement for the gear wheel 1.70.7-25.30.00-01 is 1.70.7-25.30.00-05
The gear wheel 1.70.7-25.30.00-05 is mounted with 4 bolts M24 x 2 x 205 acc. to drawing No. and 4 capp nuts M24 x 2 SW 24 acc. to drawing No. The bolts are arrested with cylindrical pins 10 x 6 16 DIN.

Bedplate, Mounting 1.73. / 74. / 79 / 7-12.00.00-03 / -04 / -06 / - 07 / -08 / -09 / -10 / -12
Tighten clamping bolts in steps.

1st step up to →	**M = 280 Nm**
2nd step up to →	**M = 470 Nm**

Molykote
Tighten flange bolts in steps crosswise alternately.

1st step up to →	**M = 150 Nm**
2nd step up to →	**M = 250 Nm**

Molykote - 4 reamed bolts acc. to drawing No. and

Gear drive

Vee-engine M551

Bedplate, mountig 1.76. / 78.7-12.00.00-01
Tighten clamping bolts in steps alternately crosswise.

1st step →	**M = 200 Nm**
2nd step →	**M = 400 Nm**
3rd step →	**M = 500 Nm**

Molykote - Joint faces of the gear wheel must touch ai one side, i. e. no gap! On the opposite side a minimum gap of 0.03 mm must remain with bolts completely tightened with M = 500 Nm.
The gear wheel 1.70.7-25.30.00-02 is mounted with 4 bolts M27 x 2 x 178 acc. to drawing No. and 4 capp nuts M27 x 2 SW 30 acc. to drawing No. The bolts are arrested with cylindrical pins 10 x 6 16 DIN.

Bedplate, mounting 1.76. / 78. 7-12.00.00-02 / -03 / -04 / - 06
Tighten clamping bolts **M20** in steps.

1st step up to →	**M = 280 Nm**
2nd step up to →	**M = 470 Nm**
Tighten clamping bolts **M16** alternately crosswise with →	**M = 225 Nm**

Molykote
Tighten flange bolts alternately crosswise.

1st step up to →	**M = 150 Nm**
2nd step up to →	**M = 250 Nm**

Molykote - 4 reamed bolts acc. to drawing No. and
6 hexagon bolts acc. to drawing No.; 10 castellated nuts M24 x 2 DIN 979 and 10 split pins 5 x 50 DIN 94.
The gear wheel 1.70.7-25.30.00-07 is mounted with 2 reamed bolts M20 x 2 x 260 DIN 608 / 12.9 with castellated nut and 2 reamed bolts M16 x 125 DIN 609 / 12.9 with castellated nut and split pins 4 x 40 DIN 9.

Gear drive

In-line engine M552

Bedplate, mounting 1.73. / 74. / 79.7-12.00.00-50 / -52 / - 53 / - 54 / - 56 / -60 / -62

Tighten clamping bolts, reamed bolts and flange bolts with → **M = 250 Nm**

Molykote

4 reamed bolts M24 x 180 S DIN 609, 6 hexagon bolts M24 x 180 S DIN931, 10 nuts M24 DIN 931, 10 split pins 5 x 45 DIN 94

To the a. m. bedplates belongs the gear wheel 1.70.7-25.30.00-50 with 2 reamed bolts M20 x 2 x 105 DIN 609, 2 castellated nuts M20 x 2 DIN 935 and 2 split pins 4 x 36 DIN 94

Bedplate, mounting 1.73. / 74. / 79.7-12.00.00-63 / -64

Tighten reamed and flange bolts with → **M = 400 $^{+100}$ Nm**

Molykote

Reamed and flange bolts and washers acc. to drawing No., castellated nut M24 DIN 935

Tighten nuts for studs with → **M = 50 Nm**

Molykote

Studs acc. to drawing No., castellated nut M12 DIN 935, split pin 3,2 x 22 DIN 94

Vee-engine M552

Bedplate, mounting 1.76.7-12.00.00-51 / -59

Tighten clamping bolts **M20 x 2** in steps crosswise alternately.

1st step up to → **M = 150 Nm**

2nd step up to → **M = 250 Nm**

Tighten clamping bolts **M16** with → **M = 110 Nm**

Tighten flange bolts **M24 x 2** in steps crosswise alternately.

1st step up to → **M = 150 Nm**

2nd step up to → **M = 250 Nm**

Molykote

Bolts acc. to drawing No., castellated nut M24 x2 DIN 935, split pin 5 x 50 DIN 94

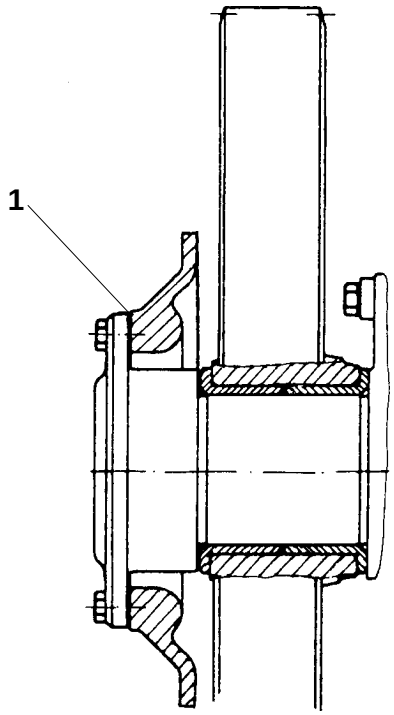
Gear drive

In-line engine M551

Vee-engine M551 - 552

Tighten screws for the bearing journal with → **M = 180 Nm**
Molykote
7 hexagon screws M20 x 2 x 75 SK DIN 960 with washers acc. to drawing No.

The thickness of the laminium shim **- 1 -** determines the clearance of → **0.20 mm**



In-line engine M552

Mounting for the bearing journal
Tighten bearing journal with 7 bolts with → **M = 230 Nm**
Molykote - screws M20 x 2 x 80 SK DIN 931

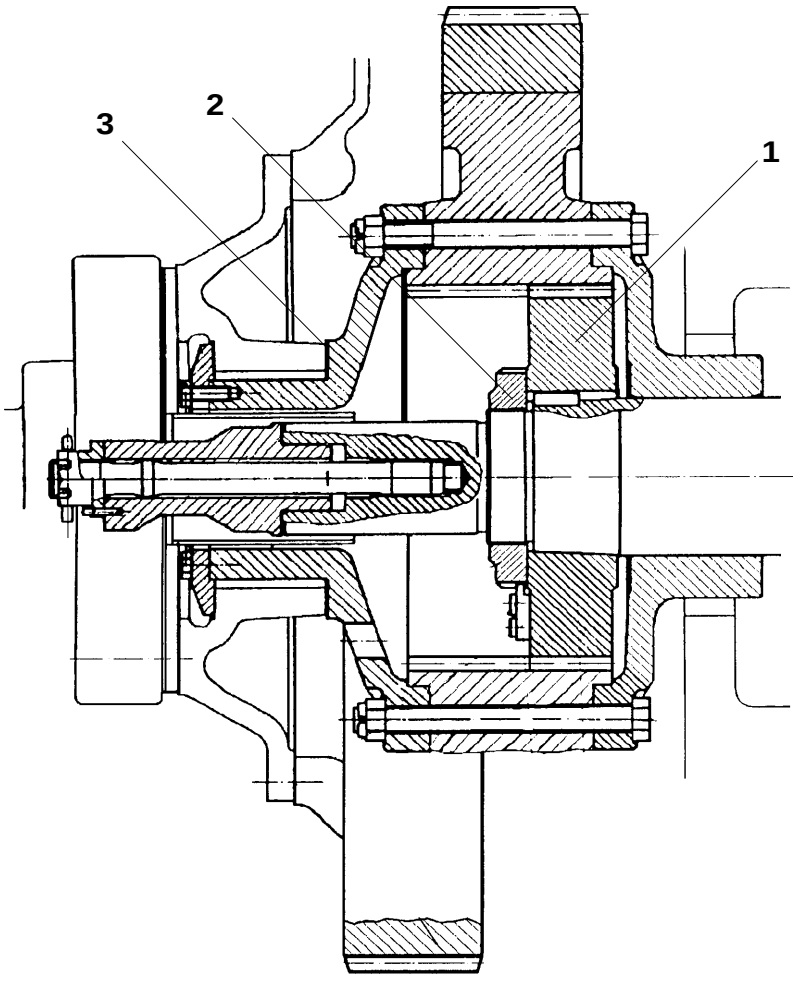
Tighten bearing journal with 11 tie bolts with → **M = 320 Nm**
or pretighten by hand,
then tighten with → **Dw = 60°**
Molykote
11 tie bolts acc. to drawing No., 2 pins 16 x 75 DIN 7977

Gear drive

Fitting

1. Spread cone of the coupling **- 1 -** with blue paste.
2. Insert fitted key in groove of camshaft and slip coupling **- 1 -** on the camshaft.
3. Coat grooved nut **- 2 -** with Molykote paste "G-Rapid" (thread / contact surface) and tighten with **M = 100 Nm**.
4. Mark position of coupling **- 1 -** and of grooved nut **- 2 -** on the camshaft.
5. Dismount coupling **- 1 -** and check blueing appearance .
   In case of deviations from the full-contact blueing appearance only a contact reflection displaced to the thick end is admissible.
6. Heat coupling **- 1 -** up to **100° C** and slip it on the camshaft.
7. Firmly tighten grooved nut **- 2 -** up to a valve displaced from the marking under point 4 by **240°.**
8. Check, if coupling **- 2 -** is shifted by **1.33 mm** compared to the marking acc. to sequence of operation point 4 .

Clearance at **- 3 -** → **0.20 - 0.40 mm**



Gear drive

In-line engine M551-552

Backlash

crankshaft gear - intermediate wheel →	**0.28 - 0.36**	**mm**
intermediate wheel - camshaft gear →	**0.20 - 0.28**	**mm**

Radial clearance

intermediate wheel - bearing journal →	**0.11 - 0.20**	**mm**
end clearance →	**0.18 - 0.20**	**mm**
maximum clearance →	**0.30**	**mm**

Vee-engine M551-552

Backlash

crankshaft gear - intermediate wheel →	**0.24 - 0,32**	**mm**
intermediate wheel - camshaft gear →	**0.20 - 0.29**	**mm**

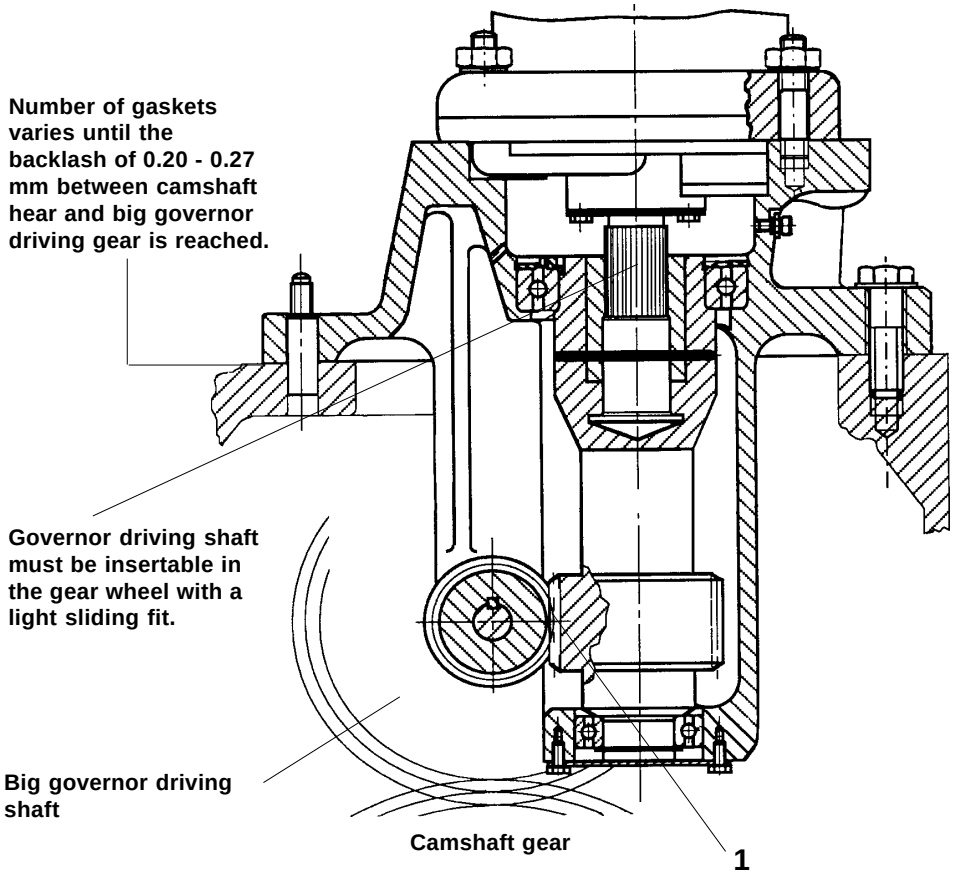
Radial clearance

intermediate wheel - bearing journal →	**0.11 - 0.20**	**mm**
end clearance →	**0.35 - 0.40**	**mm**
maximum clearance →	**0.45**	**mm**

End clearance can be adjusted resp. readjusted by means of laminated shims.

Gear drive

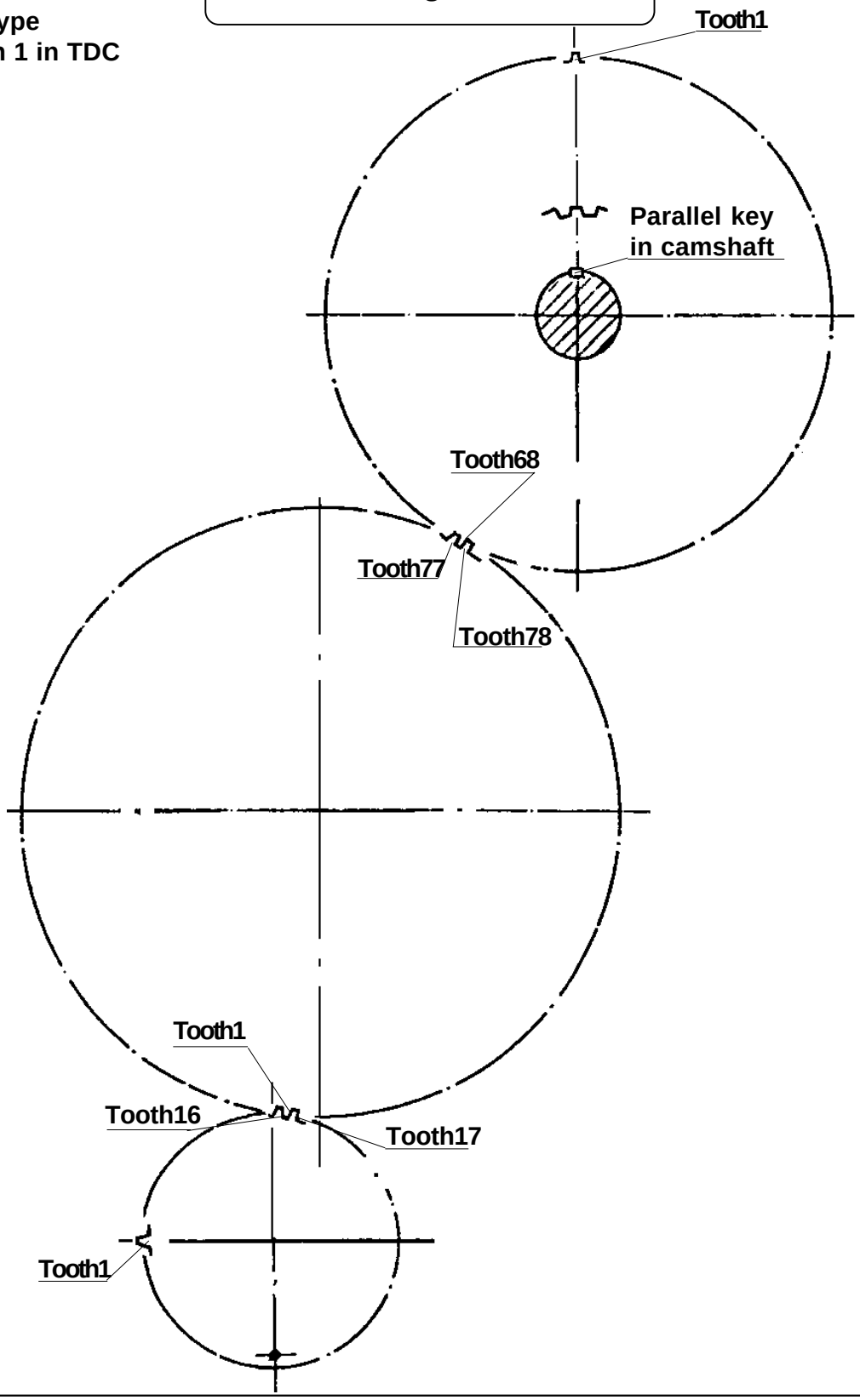
Camshaft gear - big governor driving gear →	**0.20 - 0.27**	**mm**
Backlash on **- 1 -** →	**0.12 - 0.20**	**mm**



Gear drive

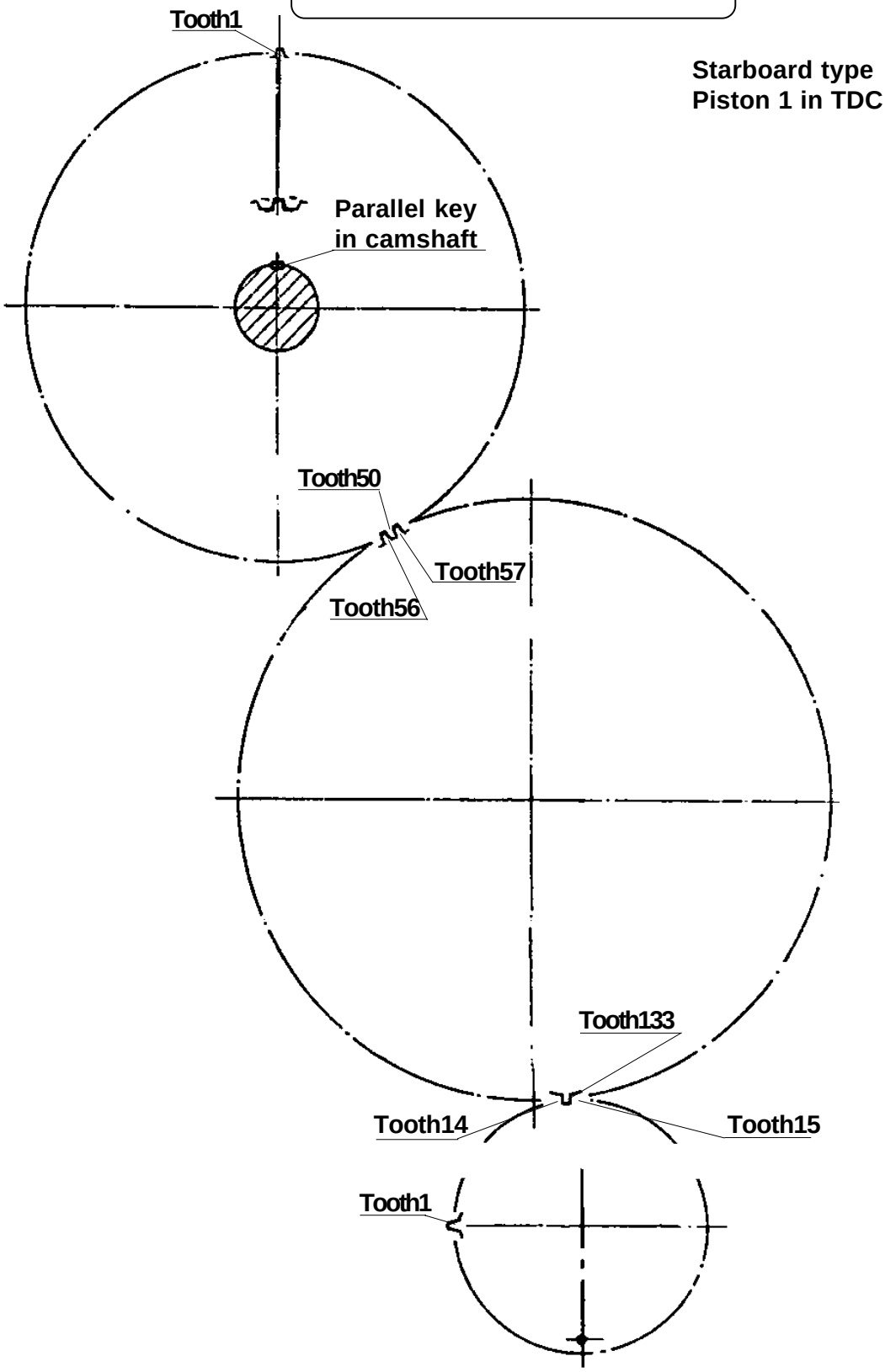
In-line engine M551

Port type
Piston 1 in TDC



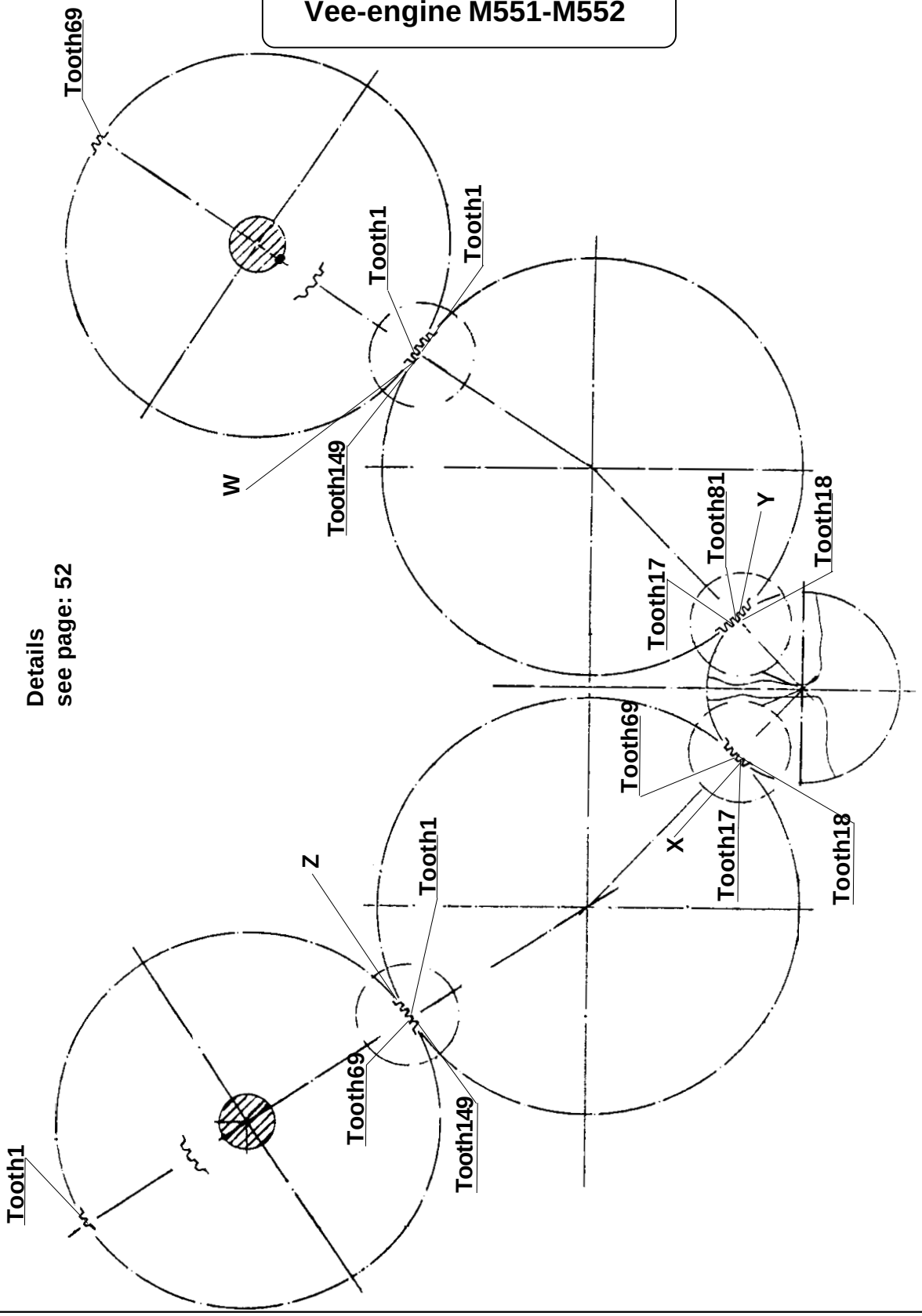
Gear drive

In-line engine M551



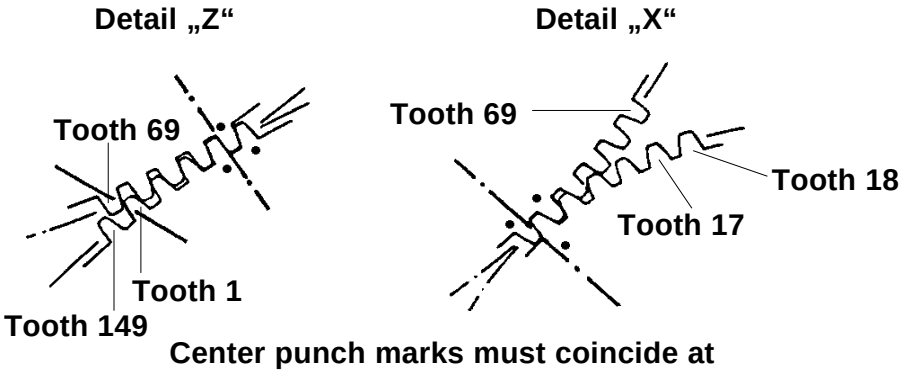
Gear drive

Vee-engine M551-M552

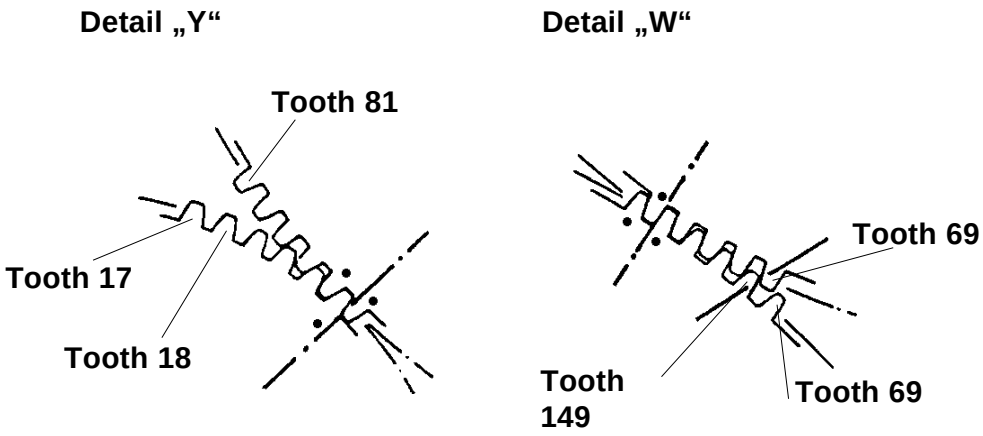


Gear drive

V - Motor M551-M552



Center punch marks must coincide at

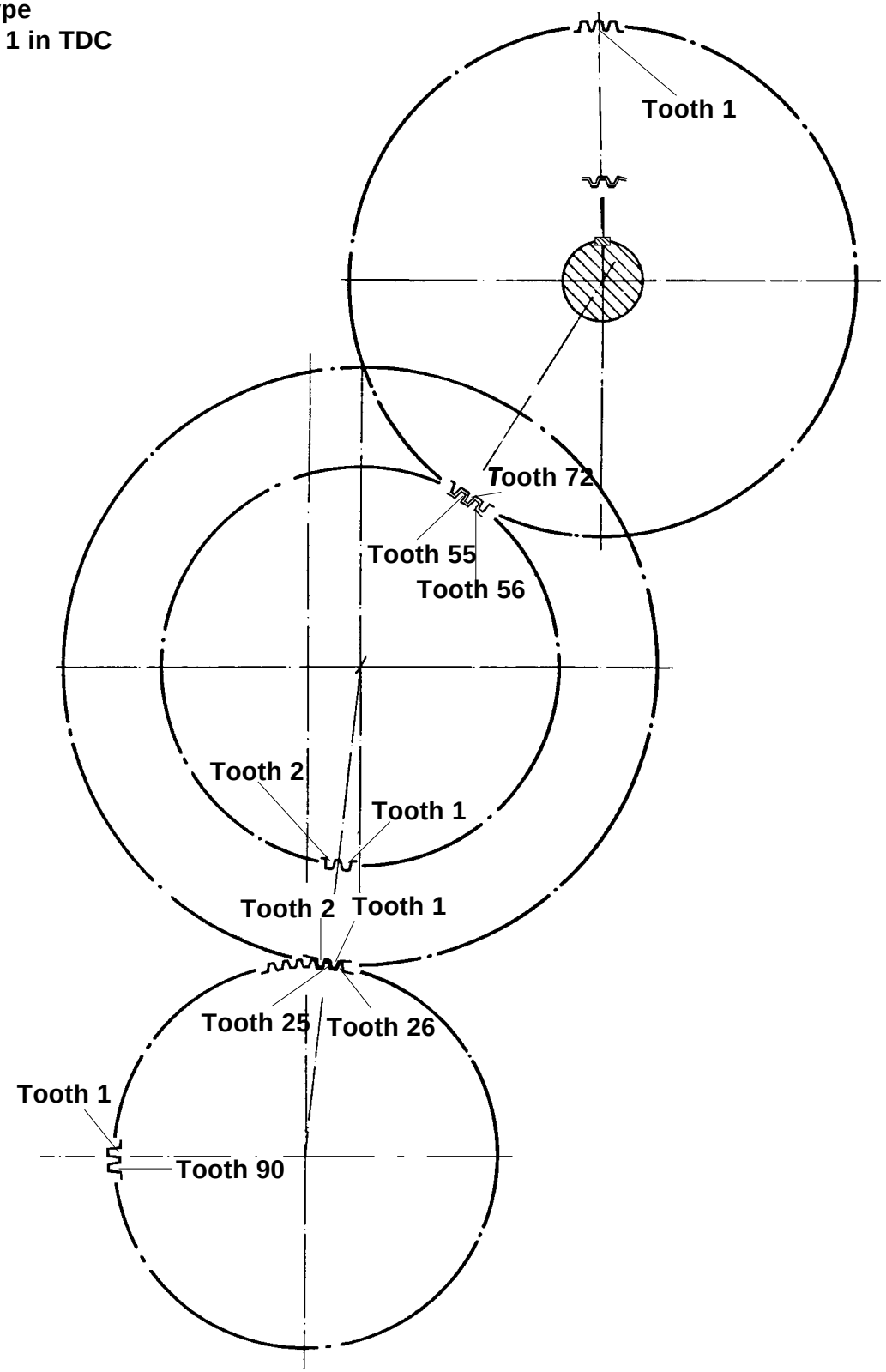


Center punch marks must coincide at piston B1 in TDC-position.

Gear drive

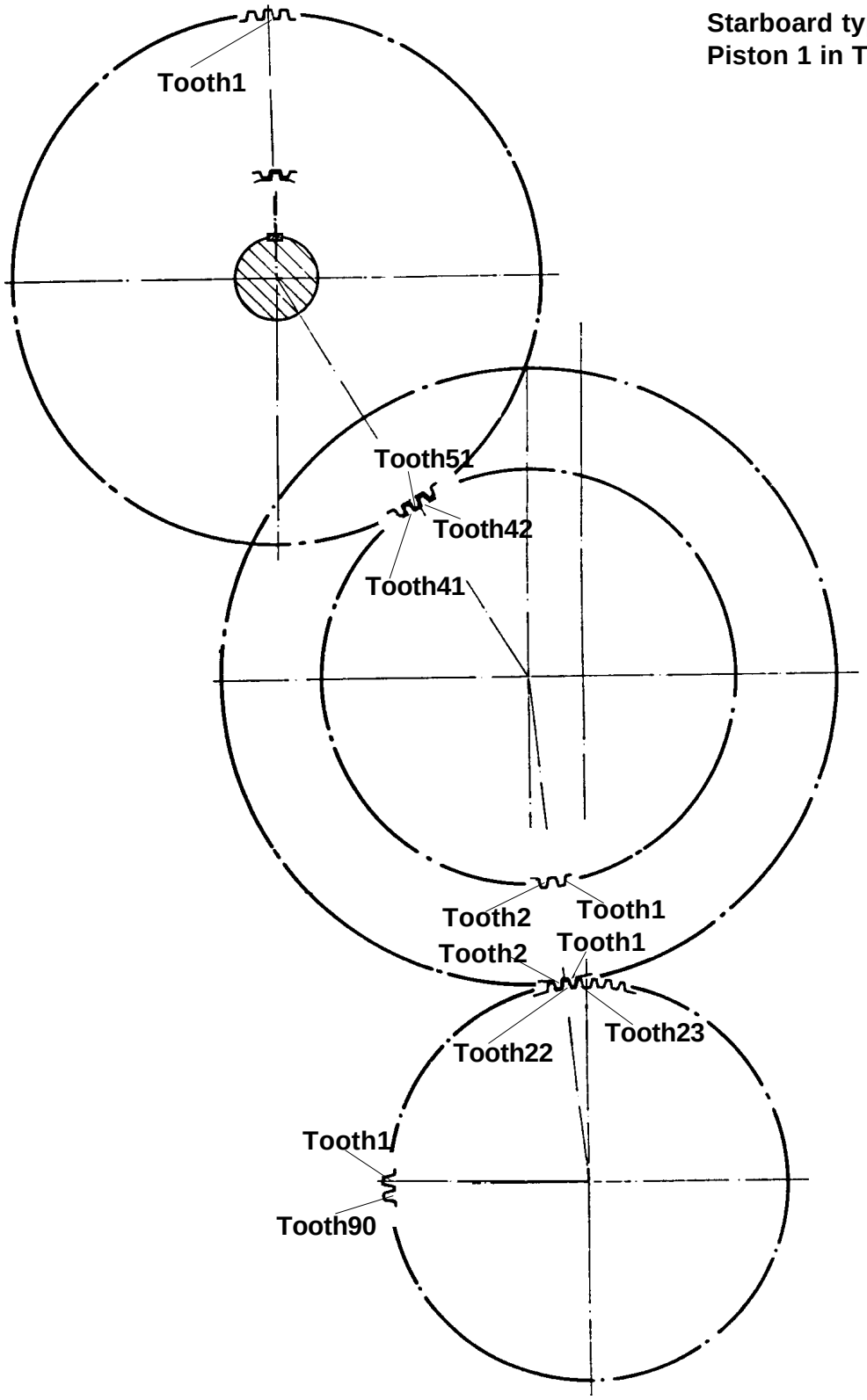
In-line engine M552

Port type
Piston 1 in TDC



Gear drive

In-line engine M552



Camshaft

In-line engine M551 - M552

Vee-engine M551 - M552

Camshaft bearing
Tighten nuts in 2 steps alternately up to → **M = 360 Nm**
Molykote

Gap
normal → **0.38 - 0.27 mm**

limit value → **0.20 mm**
For measuring the gap loosen nut on one side.

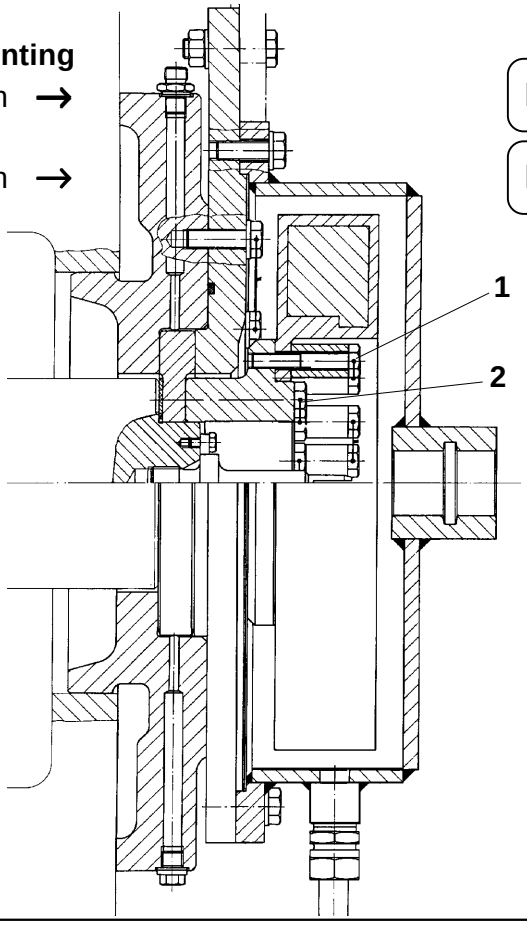
To guarantee perfect lub.oil supply make sure that the gap of the bearing shells is horizontal.

In-line engine

Vee-engine

Vibration damper mounting
Tighten screws **- 1 -** with → **M = 37.5 $^{+5}$ Nm**

Tighten screws **- 2 -** with → **M = 60 $^{+10}$ Nm**
Molykote



Camshaft

M551

Split fuel cams on cam holder for non-reversible and reversible engines.

Series design	stroke	split repair cam
1.70.7-32.30.01-02	35	1.70.7-32.35.00-01
1.70.7-32.30.01-03	37	1.70.7-32.35.00-07
1.70.7-32.30.01-05 / 11	37	1.70.7-32.35.00-07
1.70.7-32.30.01-06 / 11	37	1.70.7-32.35.00-07

1. Care for absolute cleanness.
2. Treaz the thread with Molykote G.
3. Screw in the screws from the dividing surface into the lower part up to the limit stop.
4. Slip on the upper part and carefully screw in the thread. Thread must grip during the first turn, otherwise fault in tightening.
5. Alternate screwing-in of both screws in small steps, otherwise faulty gripping.
6. After closing the dividing joint
   tighten the screws with → **M = 40 Nm**

   or with → **Dw = 90°**

7. If the hexagon shall hang over the back of the cam, the cam has to be redismantled.Screw has to be tightened up to the limit stop and then be turned back, three pitches of threads. After this proceed again acc. to instruction point No. 4;5 and 6.

Split fuel cam direct on camshaft without cam holder for non-reversible engines.

Series design	stroke	split repair cam
1.70.7-32.30.01-08	37	1.70.7-32.35.00-06

1. Treat thread and screw support with Molykote G.
2. Pretighten screws manually and tighten alternately in small steps with → **M = 370 Nm**

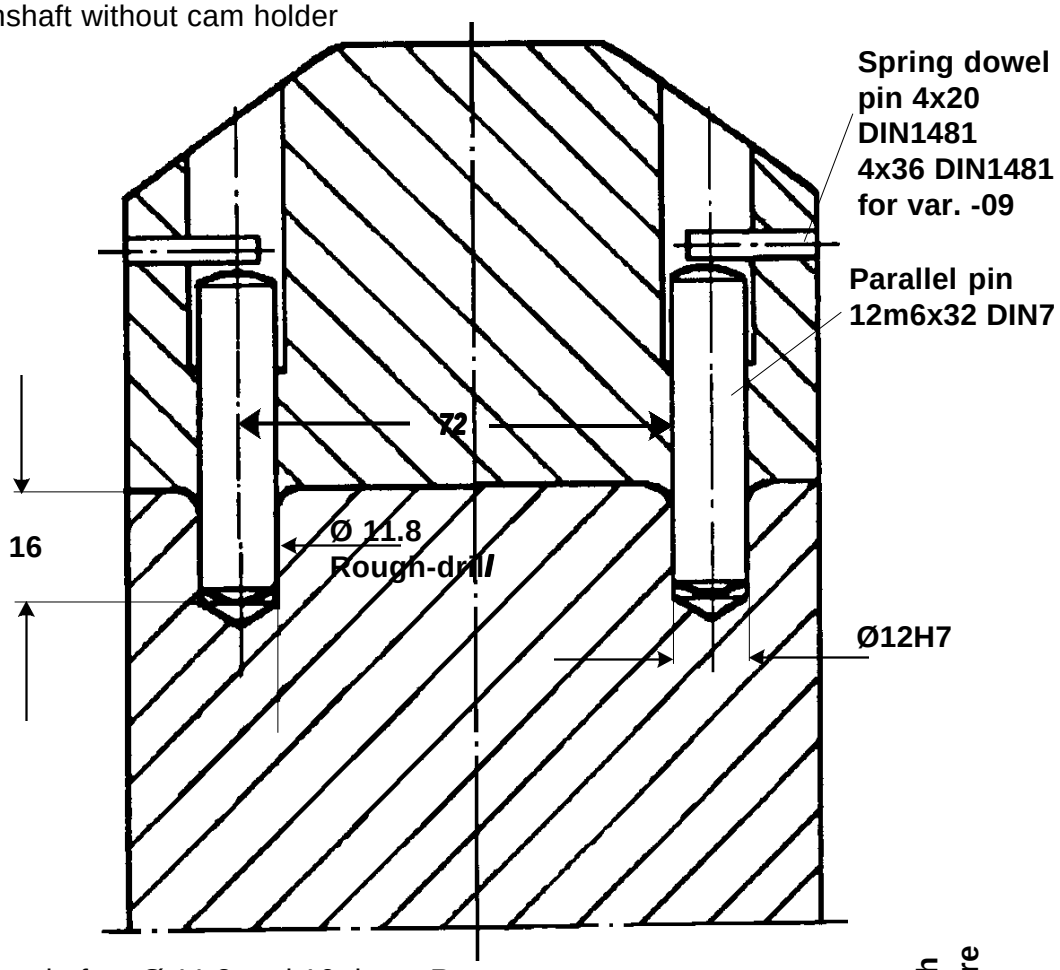
Camshaft

In-line engine M551 - M552

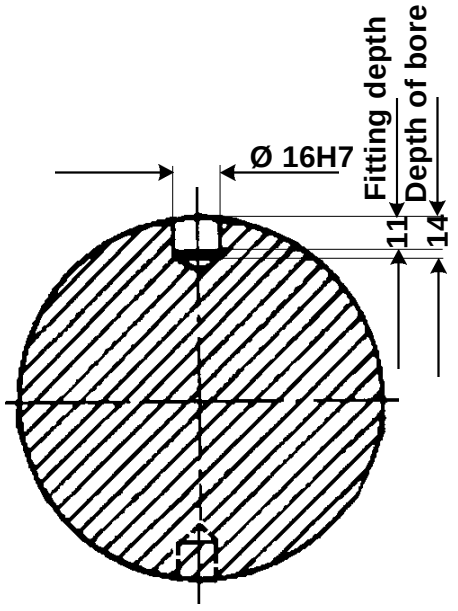
Vee-engine M551-M552

Mounting of fuel repair cams

Direct on camshaft without cam holder



Rough-drill camshaft to Ø 11.8 and 16 deep. Ream to Ø 12H7 together with cam. Round bore holes in the camshaft with R = 1.6. Mount cam, pin it and secure by means of spring dowel pin.



Mounting of inlet and exhaust repair cams

Camshaft

M551

Split exhaust cams for non-reversible engines.

Series design	stroke	split repair cam
1.70.7-32.22.01-02 / 12	33	1.70.7-32.23.00-24
1.70.7-32.22.01-06 / 11	33	1.70.7-32.23.00-23
1.70.7-32.22.01-07	33	1.70.7-32.23.00-21
1.70.7-32.22.01-08 / 12	33	1.70.7-32.23.00-24
1.70.7-32.22.01-13	33	1.70.7-32.23.00-25
1.70.7-32.22.01-14	33	1.70.7-32.23.00-26

Split exhaust cams for reversible engines.

Series design	stroke	split repair cam
1.70.7-32.20.01-01	33	1.70.7-32.23.00-04
1.70.7-32.20.01-02 / 12	33	1.70.7-32.23.00-07
1.70.7-32.20.01-04	32	1.70.7-32.23.00-06
1.70.7-32.20.01-05 / 07	33	1.70.7-32.23.00-01
1.70.7-32.20.01-06 / 11	33	1.70.7-32.23.00-03 / 08
1.70.7-32.20.01-07	33	1.70.7-32.23.00-01
1.70.7-32.20.01-08 / 12	33	1.70.7-32.23.00-07
1.70.7-32.20.01-09 / 11	33	1.70.7-32.23.00-08
1.70.7-32.20.01-10 / 12	33	1.70.7-32.23.00-07
1.70.7-32.20.01-14	33	1.70.7-32.23.00-09
1.70.7-32.20.01-15	33	1.70.7-32.23.00-10

Thread and screw support sparsely coat with Molykote paste.

Tightening torque → **M = 70 Nm**

Camshaft

M551

Split inlet cams for non-reversible engines.

Series design	stroke	split repair cam
1.70.7-32.12.01-03 / 10*	23	1.70.7-32.13.00-03
1.70.7-32.12.01-06 / 10	23	1.70.7-32.13.00-03
1.70.7-32.12.01-07 / 11*	23	1.70.7-32.13.00-22
1.70.7-32.12.01-08 / 10	23	1.70.7-32.13.00-03
1.70.7-32.12.01-13	23	1.70.7-32.13.00-23
1.70.7-32.12.01-14	23	1.70.7-32.13.00-24

* Replacement conditioned, consultation with CK14 is necessary.

Split inlet cams for reversible engines.

Series design	stroke	split repair cam
1.70.7-32.10.01-01 / 09	23	1.70.7-32.13.00-02
1.70.7-32.10.01-02 / 12	23	1.70.7-32.13.00-04
1.70.7-32.10.01-03 / 12	23	1.70.7-32.13.00-04
1.70.7-32.10.01-04	23	1.70.7-32.13.00-02
1.70.7-32.10.01-07 / 12	23	1.70.7-32.13.00-04
1.70.7-32.10.01-08 / 12	23	1.70.7-32.13.00-04
1.70.7-32.10.01-09 / 13	23	1.70.7-32.13.00-05
1.70.7-32.10.01-10 / 12	23	1.70.7-32.13.00-04
1.70.7-32.10.01-11 / 13	23	1.70.7-32.13.00-05
1.70.7-32.10.01-14	23	1.70.7-32.13.00-06
1.70.7-32.10.01-15	23	1.70.7-32.13.00-07

Thread and screw support sparsely coat with Molykote paste.

Tightening torque → **M = 70 Nm**

Camshaft

M552

Split fuel cams direct on camshaft without cam holder for non-reversible engines.

Series design	stroke	split repair cam
1.70.7-32.30.01-07 / 08	37	1.70.7-32.35.00-06
1.70.7-32.30.01-10	37	1.70.7-32.35.00-08

1. Treat thread and screw support with Molykote G.
2. Prestress screws ed manually and tighten alternately in small steps with →

M = 370 Nm

Split fuel cam on cam holder for reversible engines.

Series design	stroke	split repair cam
1.70.7-32.30.01-05 / 11	37	1.70.7-32.35.00-07
1.70.7-32.30.01-06 / 11	37	1.70.7-32.35.00-07

1. Care for absolute cleanness.
2. Treat the thread with Molykote G.
3. Screw in the screws from the dividing surface into the lower part up to the limit stop.
4. Slip on the upper part and carefully screw in the thread. Thread must grip during the first turn, otherwise fault in tightening.
5. Alternate screwing-in of both screws in small steps, otherwise faulty gripping.
6. After closing the dividing joint tighten the screws with →

M = 40 Nm

or with →

Dw = 90°

7. If the hexagon protrudes beyond the cam scope, the cam has to be redismantled, screw has to be tightened up to limit stop and then be turned back by three pitches of threads. After this proceed again acc. to instruction point No. 4;5 and 6.

Camshaft

M552

Split exhaust cams for non-reversible engines.

Series design	stroke	split repair cam
1.70.7-32.22.01-02 / 12	33	1.70.7-32.23.00-24
1.70.7-32.22.01-06 / 11	33	1.70.7-32.23.00-23
1.70.7-32.22.01-08 / 12	33	1.70.7-32.23.00-24
1.70.7-32.22.01-09 / 11	33	1.70.7-32.23.00-23
1.70.7-32.22.01-10 / 12	33	1.70.7-32.23.00-24
1.70.7-32.22.01-13	33	1.70.7-32.23.00-25
1.70.7-32.22.01-14	33	1.70.7-32.23.00-26

Split exhaust cams for reversible engines.

Series design	stroke	split repair cam
1.70.7-32.20.01-02 / 12	33	1.70.7-32.23.00-07
1.70.7-32.20.01-06 / 11	33	1.70.7-32.23.00-03 / 08
1.70.7-32.20.01-08 / 12	33	1.70.7-32.23.00-07
1.70.7-32.20.01-09 / 11	33	1.70.7-32.23.00-08
1.70.7-32.20.01-10 / 12	33	1.70.7-32.23.00-07
1.70.7-32.20.01-14	33	1.70.7-32.23.00-09

Thread and screw support sparsely coat with Molykote paste
.

Tightening torque → **M = 70 Nm**

Camshaft

M552

Split inlet cams for non-reversible engines.

Series design	stroke	split repair cam
1.70.7-32.12.01-08 / 10	23	1.70.7-32.13.00-03
1.70.7-32.12.01-13	23	1.70.7-32.13.00-23
1.70.7-32.12.01-14	23	1.70.7-32.13.00-24

Split inlet cams for reversible engines.

Series design	stroke	split repair cam
1.70.7-32.10.01-02 / 12	23	1.70.7-32.13.00-04
1.70.7-32.10.01-03 / 12	23	1.70.7-32.13.00-04
1.70.7-32.10.01-04	23	1.70.7-32.13.00-02
1.70.7-32.10.01-07 / 12	23	1.70.7-32.13.00-04
1.70.7-32.10.01-08 / 12	23	1.70.7-32.13.00-04
1.70.7-32.10.01-09 / 13	23	1.70.7-32.13.00-05
1.70.7-32.10.01-10 / 12	23	1.70.7-32.13.00-04
1.70.7-32.10.01-11 / 13	23	1.70.7-32.13.00-05
1.70.7-32.10.01-14	23	1.70.7-32.13.00-06

Thread and screw support sparsely coat with Molykote paste.

Tightening torque → **M = 70 Nm**

Starting air distributor

Starting cam

The tightening torque for inserting the tie bolt is → **M = 200 Nm**

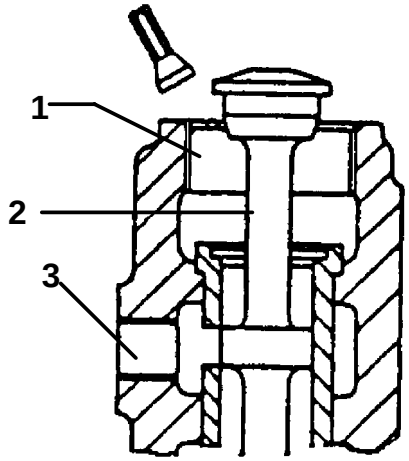
Pretighten castellated nut with → **M = 200 Nm**

and tighten with → **Dw = 60°**

Possibly tighten up to the next split pin hole.

Setting

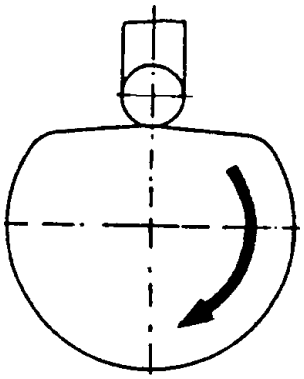
Turn **cyl.1** into position **„8“** after TDC. Direct light beam from top into the bore **- 1 -** and observe control piston **- 2 -** through bore **- 3 -.** Turn starting cam in the opposite direction to the rotation of camshaft until the light gap is still just visible. Now the starting cam has reached the position **„starting valve opens“.**



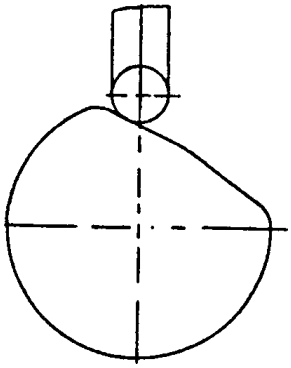
Starting valve timing:

Starting air control piston opens	8° after TDC.
Starting air control piston closes	138° after TDC.

Position at start of setting



Position „Starting valve opens“



Lower valve and fuel injection pump drive

In-line engine | **Vee-engine**

Tighten screws **- 1 -** with → **M = 130 Nm**

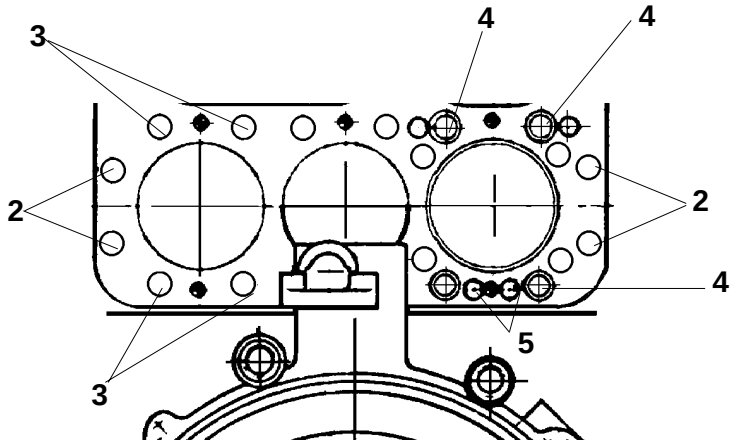
Hexagon screws M16 x 110 SK DIN 931 secured with wire.
2 pcs. / cyl.
Screws are inside the camshaft housing

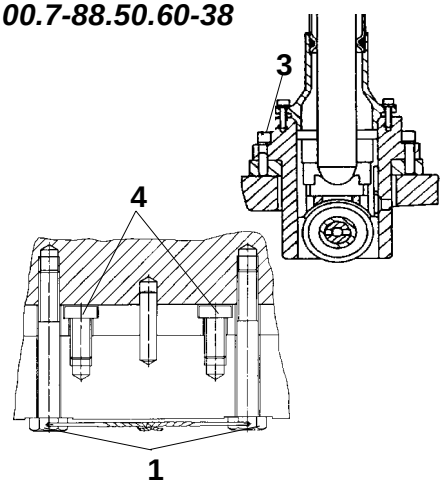
Tighten screws **- 2 -** with → **M = 130 Nm**
Socket head cap screws M16 x 45 DIN 912 - 8.8 - A3C - with spring washer. 4 pcs. / cyl.

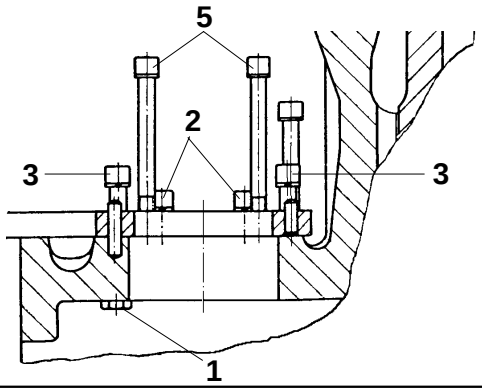
Tighten screws **- 3 -** with → **M = 115 Nm**
Socket head cap screws M16 x 70 DIN 912 - 8.8 - A3C
8 pcs. / cyl.

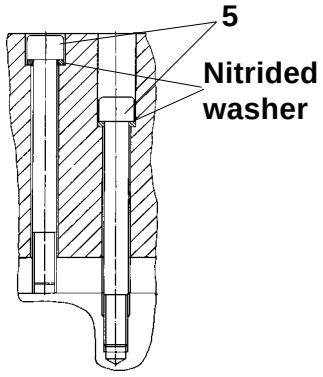
Tighten screws **- 4 -** with → **M = 130 Nm**
Socket head cap screws M16 x 30 DIN 7984 8.87 - A3C
4 pcs. / cyl.

Tighten screws **- 5 -** with → **M = 130 Nm**
Socket head cap screws M16 x 150 DIN 912 8.8 - A3C
6 pcs. / cyl. with nitrided washer acc. to drawing No. 1.00.7-88.50.60-38









Fuel injection pumps

In-line engine | **Vee-engine**

For fixing the injection pumps different tightening torques are applicable. The variants with the fillister-head screws and spring washers are to be tightened with the torque of table for DIN-screws. ***Fillister-head screw M16 x 60 DIN 912 with spring washer 16 DIN 7980 or washerØ 30 x Ø 17, height 4 mm nitrided.***

Tightening torque for tie bolts with spacer sleeve → **M = 130 Nm**

Tie bolt M16 x 105, SW 24 - Spacer sleeve Ø30 x Ø17 height 43 mm

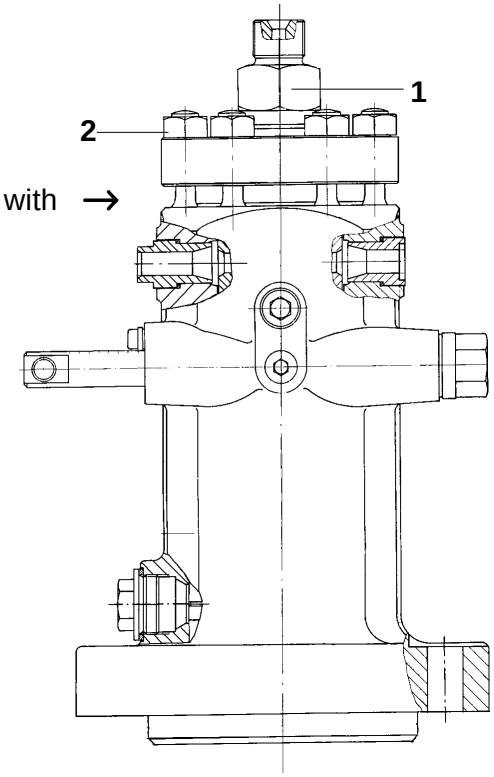
Tightening torque for tie bolts with tension sleeve → **M = 190 Nm**

corresponding to → **Dw = 30°**
after manual tightening.

Tie bolt M20 x 101, SW 30 - tension sleeve Ø35 x Ø21, height 35 mm

Fuel injection pump PEO-G 011 a y

Tighten connecting socket **- 1 -** with → **M = 450 $^{+50}$ Nm**



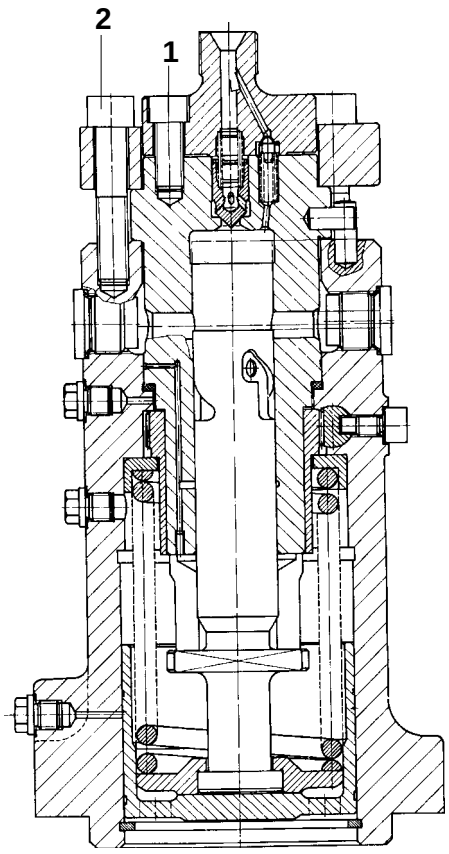
Tighten flange nuts **- 2 -** with → **M = 100 $^{+20}$ Nm**

Fuel injection pumps

Fuel injection pumps PEO-G 040 and PEO-G040 b

Tighten screws **- 1 -** with → **M = 100 Nm**

Tighten screws **- 2 -** with → **M = 120 Nm**



Fuel injection pumps

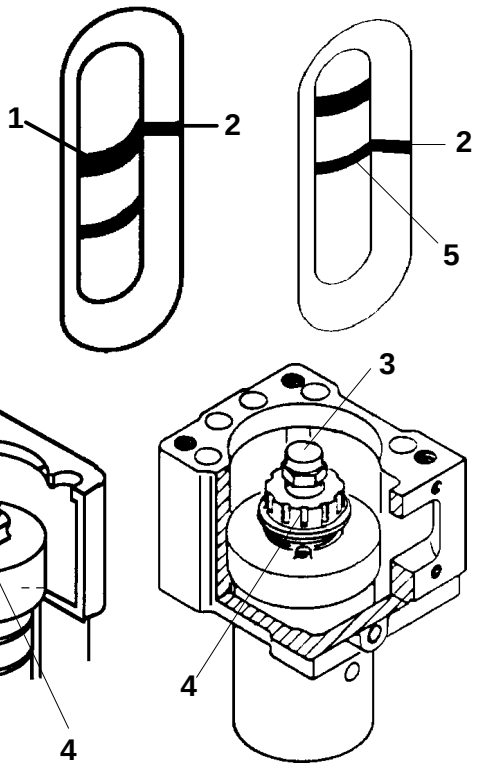
In-line engine

Vee-engine

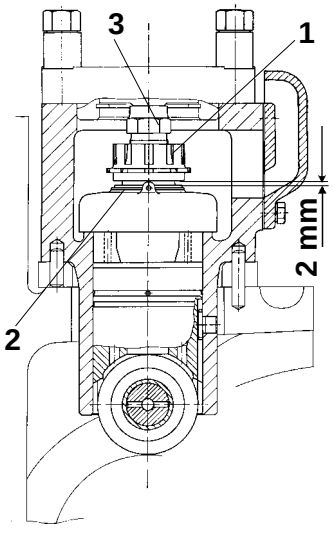
Basic setting

Basic setting for cams with toothing

1. In position of the roller resting on the base circle of cam coincidence of line marks **1 - 2** must be visible in the window of the fuel injection pump.
2. If there is no coincidence of line marks **1 - 2**, it can be attained by thrust bolt adjustment **- 3 -** . After adjustment it is important to take care that the locking screws **- 4 -** are firmly tightened.
3. Commencement of delivery: Turn engine into direction of rotation until coincidence of line marks **2 - 5** is reached. In case of minordeviations of abt. **1°** from the acceptance test record readjustment by means of the thrust bolt is admissible. Howewer, you must take care that you stay within line mark **- 1 -**. If you do not stay within line mark **- 1 -**, readjustment of the cam is necessary. Point 1 must then be repeated.



Setting drive with lock nut for fuel injection pump 1.70.7-35.80.00-13 / - 14



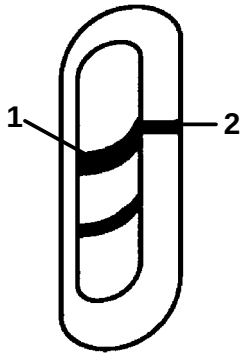
1. Screw lock nut **- 1 -** on plunger **- 2 -** leaving a clearance of **2 mm.**
2. Screw thrust bolt **- 3 -** into lock nut and, if necessary, screw lock nut upwards until the threads of thrust bolt coincide with the threads of the plunger, paying attention to dimension **2** $^{+6}$**.**
3. Adjust pump by turning the thrust bolt, see basic setting.
4. Clamp thrust bolt by turning the lock nut with hook wrench, holding the thrust bolt tight at the same time.

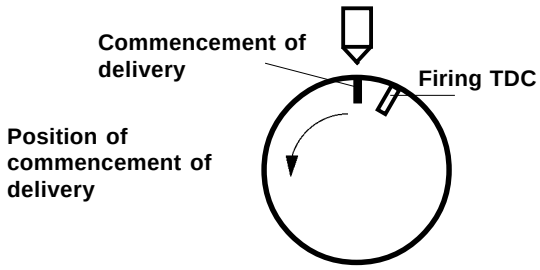
Fuel injection pumps

In-line engine | **Vee-engine**

Basic setting for cams with oil hydraulic mounting

1. Turn the concerned cylinder into firing TDC.
2. See commencement of delivery from the acceptance test record, enter the relevant arc on the measuring groove of the flywheel and mark commencement of delivery.
3. Turn engine until the commencement mark is below the dead centre indicator.
4. Take care that the line mark **- 1 -** on the spring cup coincides with line mark **- 2 -** on the pump casing by adjusting by withlifting device.
5. Mark position of the fuel cam in radial and axial direction.
6. Mount hydraulic tool and increase pressure until the cam is floating.
7. Turn cam against the roller and secure it in this position, then relieve the hydraulic tool.





Flanged shaft mounting without power take-off

In-line engine M551

Mounting 1.70.7-63.45.00-12 /14 MAN-sleeve spring damper
6 / 8 M551

Tighten castellated nut with → **M = 250 Nm**

Molykote
5 reamed bolts M24 x 2 x 265 Ø 27 ^{H7} and 5 threaded bolts M24 x 2 x 265
20 castellated nuts M24 x 2 DIN 935

Mounting 1.70.7-63.45.00-18 Geislinger damper and additional weight
8 M551

Pretighten castellated nuts with → **M = 150 Nm**

and tighten with → **Dw = 30°**

Tighten up to the next split pin hole.

Coat thread and contact surface of the nut on flange shaft side with Molykote.
Thread and contact surface of nut on crankshaft side remain dry.
10 reamed bolts M24 x 2 x 265 Ø 27 ^{H7}
20 castellated nuts M24 x 2 DIN935

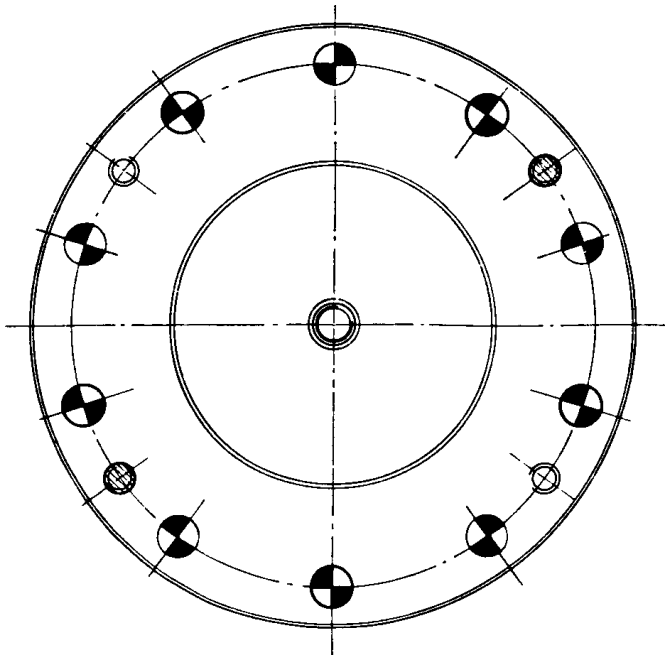
Tighten fixing screws with → **M = 310 Nm**

Molykote
2 fillister-head screws M20 x 80 DIN 912

Tighten nuts for the additional weight with → **M = 304 Nm**

Seal nuts with Loctite 0242 or an equivalent.

Arrangement of reamed bolts



Flanged shaft mounting without power take-off

Mounting 1.70.7-63.45.00-21 sleeve spring damper
6 M551

Pretighten castellated nuts with → **M = 150 Nm**

and tighten with → **Dw = 30°**

Tighten up to the next split pin hole.

Coat thread and contact surface of the nut on flange shaft side with Molykote.
Thread and contact surface of nut on crankshaft side remain dry.
5 reamed bolts M24 x 2 x 265 Ø 27 ^{H7} and 5 threaded bolts M24 x 2 x 265
20 Castellated nuts M24 x 2 DIN935

Tighten fixing screws with → **M = 310 Nm**

Molykote
4 fillister-head screws M20 x 2 x 130 DIN 912

Mounting 1.70.7-63.45.00-22 Holset damper
8 M551

Assemble thrust ring, spacer and vibration damper before mounting them at the crankshaft.

Tighten castellated nuts with → **M = 1150 Nm**

Molykote
8 threaded bolts M36 x 3 x 200 ; 16 castellated nuts M36 x 3 DIN 935

Tighten castellated nuts with → **M = 350 Nm**

Molykote
10 threaded bolts M24 x 2 x 265 ; 20 castellated nuts M24 x 2 DIN 935

Mounting 1.70.7-63.45.00-23 sleeve spring damper
8 M551

Pretighten castellated nuts with → **M = 150 Nm**

and tighten with → **Dw = 30°**

Tighten up to the next split pin hole.

Coat thread and contact surface of the nut on flange shaft side with Molykote.
Thread and contact surface of nut on crankshaft side remain dry.
10 reamed bolts M24 x 2 x 265 Ø 27 ^{H7}
20 castellated nuts M24 x 2 DIN935

Tighten fixing screws with → **M = 310 Nm**

Molykote
2 fillister-head screws M20 x 2 x 130 DIN 912

Flanged shaft mounting without power take-off

In-line engine M552

Mounting 1.70.7-63.45.00-50 - M552 with vibration damper
Mounting 1.70.7-63.45.00-51 - 6 M552 with vibration damper
Mounting 1.70.7-63.45.00-52 - M552 without vibration damper

Tighten castellated nuts with → **M = 450 Nm**

15 threaded bolts M30 x 2 x 275, 30 castellated nuts M30 x 2 DIN 935

Mounting 1.70.7-63.45.00-53 6 - 8 M552 with Holset damper
Mounting 1.70.7-63.45.00-54 6 - 8 - 9 M552 without vibration damper with distance ring

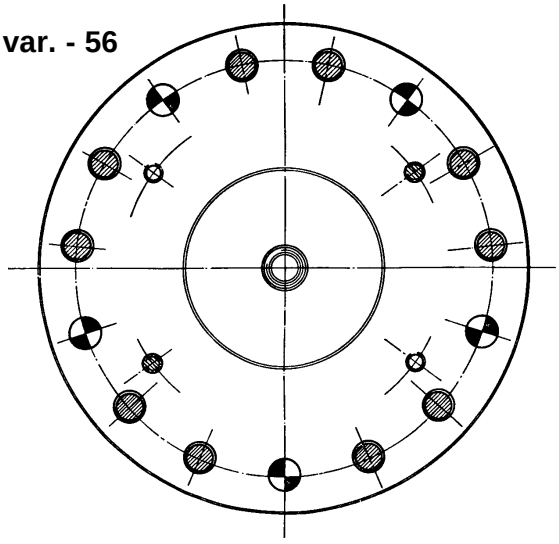
Tighten castellated nuts with → **M = 550 Nm**
Molykote
- 53 = 15 threaded bolts M30 x 2 x 291, 30 castellated nuts M30 x 2 DIN 935
- 54 = 5 threaded bolts M30 x 2 x 291, 30 castellated nuts M30 x 2 DIN 935

Mounting 1.70.7-63.45.00-56 6 - 8 M552 with MAN sleeve spring damper
Mounting 1.70.7-63.45.00-57 9 M552 with Geislinger damper

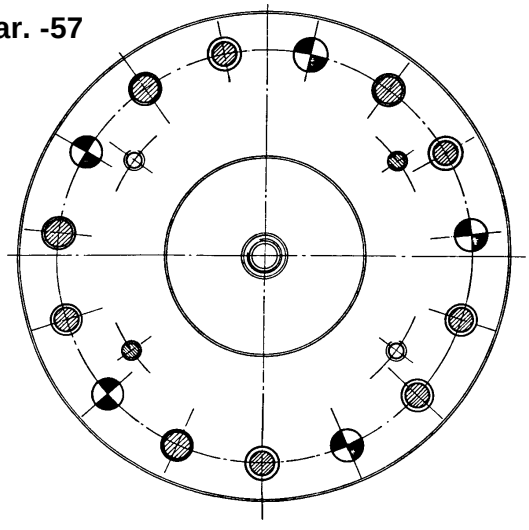
Tighten castellated nuts with → **M = 550 Nm**
Molykote
10 threaded bolts M30 x 2 x 291, 20 castellated nuts M30 x 2 DIN 935
5 reamed bolts M30 x 2 x 291 Ø 33 ^{H7}, 10 castellated nuts M30 x 2 DIN 935
The threads for the thrust bolts in the damper must not coincide with the tapholes in the crankshaft flange.

Arrangements of reamed and through bolts.

var. - 56



var. -57



Flanged shaft mounting without power take-off

Mounting 1.70.7-63.45.00-58 8 M552 with Geislinger damper and additional weight

Tighten castellated nuts → **M = 550 Nm**

Molykote

10 threaded bolts M30 x 2 x 291, 20 castellated nuts M30 x 2 DIN 935

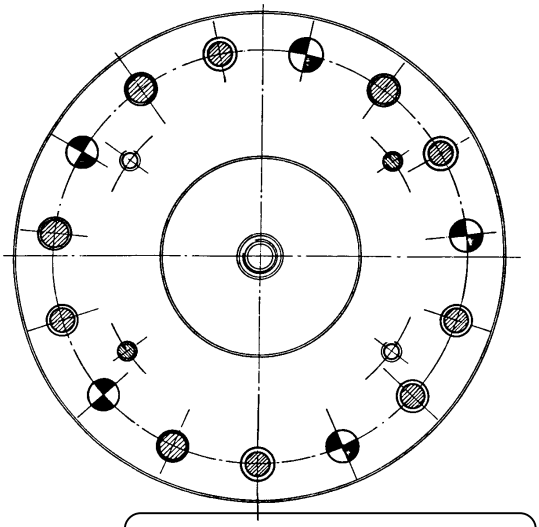
5 reamed bolts M30 x 2 x 291 Ø 33 ^{H7}, 10 castellated nuts M30 x 2 DIN 935

The threads for the thrust bolts in the damper must not coincide with the tapholes in the crankshaft flange.

Tighten nuts for the additional weight with → **M = 304 Nm**

Seal nuts with Loctite 0242 or an equivalent.

Arrangement of reamed and through bolts



Mounting 1.70.7-63.45.00-59 M552 with sleeve spring damper

Tighten castellated nuts → **M = 550 Nm**

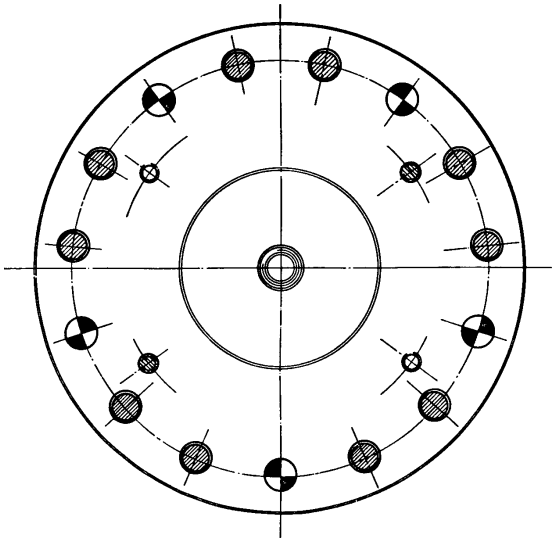
Molykote

10 threaded bolts M30 x 2 x 291, 20 castellated nuts M30 x 2 DIN 935

5 reamed bolts M30 x 2 x 291 Ø 33 ^{H7}, 10 castellated nuts M30 x 2 DIN 935

The threads for the thrust bolts in the damper must not coincide with the tapholes in the crankshaft flange.

Arrangement of reamed and through bolts



Flanged shaft mounting without power take-off

Mounting 1.70.7-63.45.00-60 with sleeve spring damper M552

Pretighten castellated nuts with → **M = 450 Nm**

and tighten with → **Dw = 30°**

Tighten up to the next split pin hole. ***Molykote***
15 reamed bolts M30 x 2 x 265 Ø 33 ^{H7} and 5 threaded bolts M33 x 2 x 265
30 castellated nuts M30 x 2 DIN935

V-engine M551 - M552

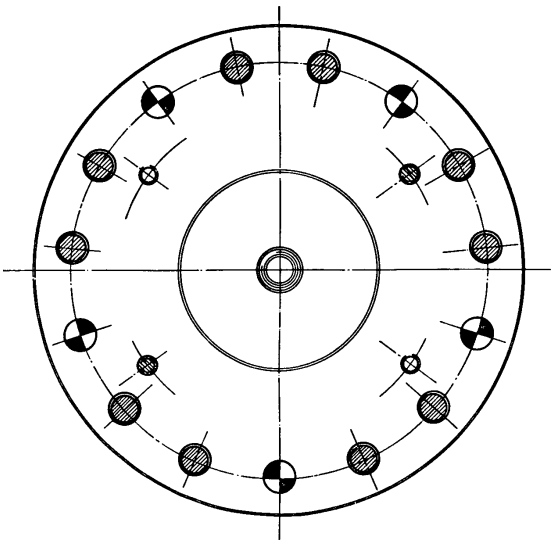
Mounting 1.70.7-63.45.00-11 with vibration damper 12M 551 / 552

Tighten castellated nuts with → **M = 550 Nm**
Molykote
15 threaded bolts M30 x 2 x 291, 30 castellated nuts M30 x 2 DIN 935

Mounting 1.70.7-63.45.00-17 with vibration damper 12M 551 / 552

Tighten castellated nuts with → **M = 200 Nm**
Molykote
10 threaded bolts M30 x 2 x 291, 5 reamed bolts M30 x 2 x 291 Ø 33 ^{H7} and
30 castellated nuts M30 x 2 DIN 935

Arrangement of reamed and through bolts



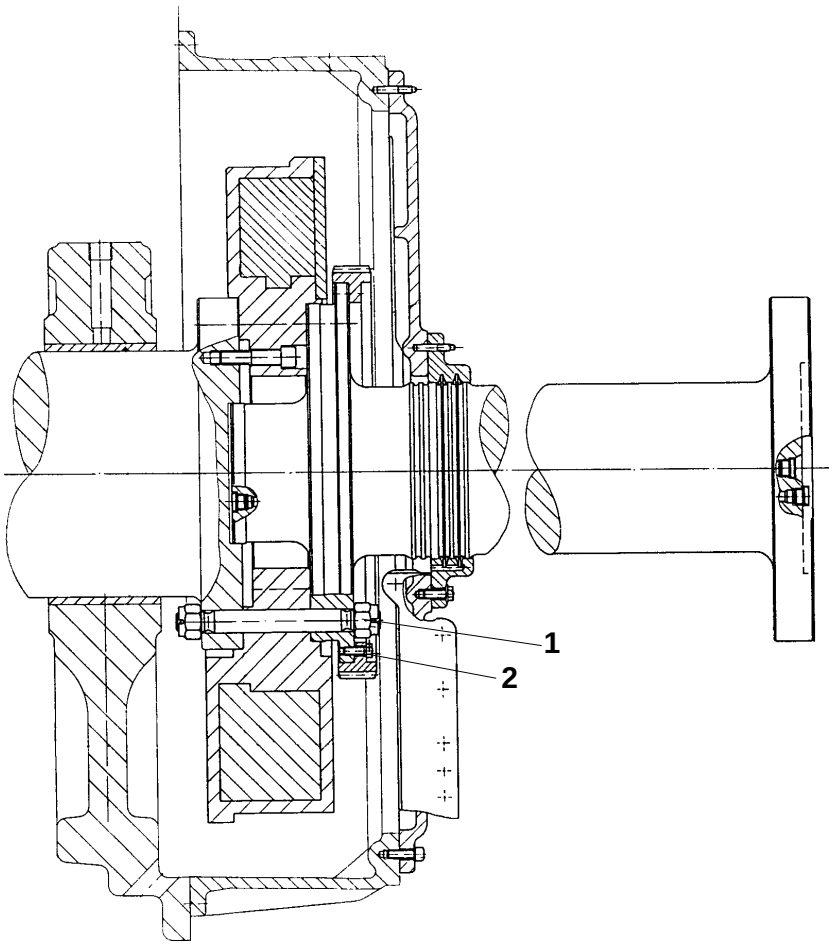
Flanged shaft mounting with power take-off

In-line engine M551 - M552

Vee-engine M551 - M552

Tighten castellated nuts **- 1 -** with → **M = 800 Nm**
Molykote
Reamed bolts M30 x 2 x 291 - castellated nuts M30 x 2 DIN 935

Tighten hexagon screws **- 2 -** for fixing the gear wheel for the lubrication oil pump with → **M = 40 Nm**
Molykote
Hexagon screws M12 x 35 SK DIN 933



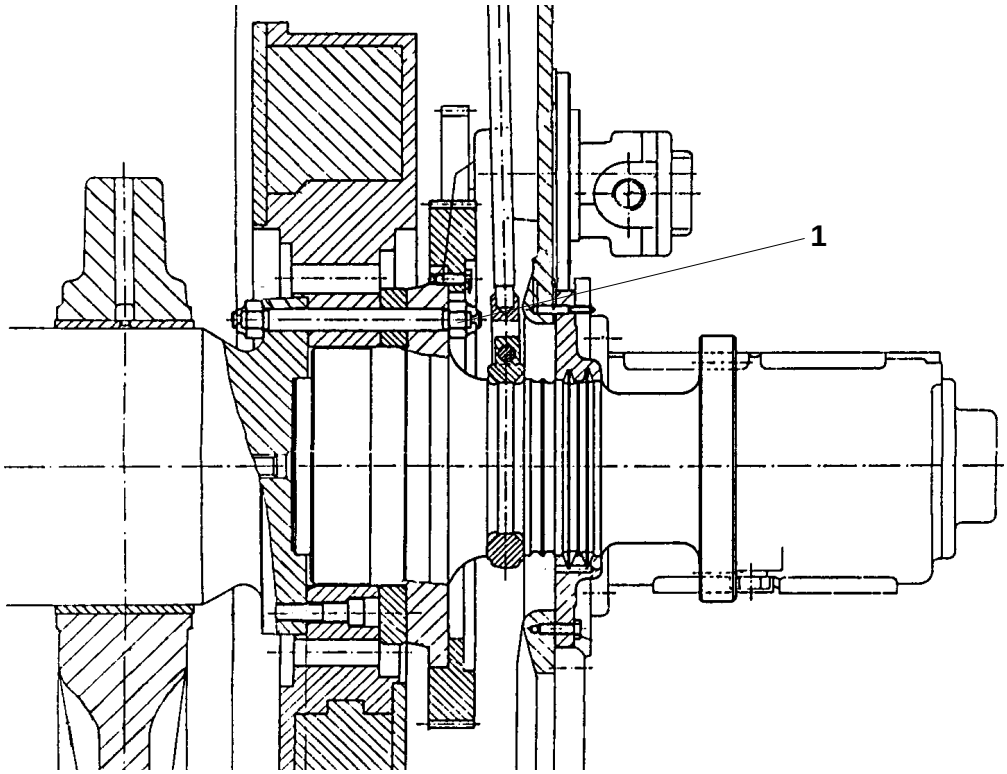
Flanged shaft mounting with power take-off

Tighten castellated nuts **- 1 -** with →

M = 250	Nm

Molykote

Reamed bolts M24 x 2 x 265 - castellated nuts M24 x 2 DIN 935



Lub. oil pump mounting

Backlash →

0.20 - 0.30	mm

Flywheel mounting

In-line engine M551

Mounting 1.70.7-73.10.00-01 and 1.70.7-73.19.00-20
Tighten castellated nuts with → **M = 2800 Nm**
Oil
For 1.70.7-73.10.00-0110 reamed bolts M42x3x405 mm
For 1.70.7-73.19.00-0110 reamed bolts M42x3x312 mm

Mounting 1.70.7-73.10.00-14 / 15
Tighten castellated nuts with → **M = 1850 Nm**
Molykote
For 1.70.7-73.10.00-145 reamed bolts M42x3x405 mm
5 through bolts M39x3x412 mm
For 1.70.7-73.10.00-155 reamed bolts M42x3x312 mm
5 through bolts M39x3x306 mm
var. -14 mounting for intermediate shaft - var. -15 mounting for coupling

Vee-engine M551

Mounting 1.70.7-73.10.00-02
Tighten castellated nuts with → **M = 2800 Nm**
Oil
10 reamed bolts M42x3x405 mm

Mounting 1.70.7-73.10.00-11
Tighten castellated nuts with → **M = 2700 Nm**
Oil - for generator mounting
10 reamed bolts M42x3x355 mm

Mounting 1.70.7-73.19.00-12
Tighten castellated nuts with → **M = 2000 Nm**
Molykote
10 reamed bolts M42x3x280 mm

Flywheel mounting

In-line engine M552

Mounting 1.70.7-73.10.00-04 and 1.70.7-73.19.00-13 / -14 / - 15 / -17 / -19 / -21

Tighten castellated nuts with → **M = 2800 Nm**

Oil
For 1.70.7-73.10.00-0410 reamed bolts M42x3x405 mm
For 1.70.7-73.19.00-1310 reamed bolts M42x3x195 mm
For 1.70.7-73.19.00-1410 reamed bolts M42x3x248 mm
For 1.70.7-73.19.00-1510 reamed bolts M42x3x258 mm
For 1.70.7-73.19.00-17 / -19 10 reamed bolts M42x3x282 mm
For 1.70.7-73.19.00-2110 reamed bolts M42x3x355 mm, also with 1850 Nm - Molykote

Mounting 1.70.7-73.10.00-06

Tighten castellated nuts with → **M = 2700 Nm**

Oil - for generator mounting
10 reamed bolts M42x3x395 mm

Mounting 1.70.7-73.10.00-12 / -13

Tighten castellated nuts with → **M = 1850 Nm**

Molykote
For 1.70.7-73.10.00-125 reamed bolts M42x3x355 mm
5 through bolts M39x3x358 mm
For 1.70.7-73.10.00-135 reamed bolts M42x3x282mm
5 through bolts M39x3x278 mm
var. -12 mounting for intermediate shaft - var. -13 mounting for coupling

Vee-engine M552

Mounting 1.70.7-73.10.00-05 / -07

Tighten castellated nuts with → **M = 6000 Nm**

Oil - var. -07 = for generator mounting
For 1.70.7-73.10.00-05 10 reamed bolts M56x4x460 mm
For 1.70.7-73.10.00-07 10 reamed bolts M56x4x421 mm

Mounting 1.70.7-73.19.00-18

Tighten castellated nuts with → **M = 4000 Nm**

Molykote
10 reamed bolts M56x4x341 mm

Turbocharger mounting

In-line engine M551-M552

Vee-engine M551-M552

Fixing turbocharger - turbocharger bracket

Tighten screws with → **M = 360 Nm**

Molykote

Tightening torque is valid for the turbochargers: VTR321 - VTR400 - VTR401 - VTR501 - NA455

Screws for mounting:

VTR 321: ***4 pieces M20x55 DIN933 - 12.9 with spring washer***
4 pieces M20x2x50 DIN960 - 12.9 with spring washer
VTR 400: ***8 pieces M20x2x50 DIN961 - 12.9 with spring washer***
VTR 401: ***8 pieces M20x50 DIN933 - 12.9 with spring washer***
VTR 501: ***8 pieces M20x65 DIN931 - 12.9 with spring washer***
NA 455: ***8 pieces M20x50 DIN933 - 12.9 with spring washer***

Tighten srews with → **M = 400 Nm**

Molykote

Tightening torque is valid for the turbocharger: NA455

Screws for mounting: 8 pieces M20x80SK DIN931 - 10.9 with tension sleeves E31x30 DIN2510

Tighten screws with → **M = 800 Nm**

Molykote

Tightening torque is valid for the turbocharger: VTR454

Screws for mounting: 4 pieces tension bolts M30x164 SW46

Turbocharger VTR454 for 8 M552

Pretighten screws with → **M = 50 Nm**

and tighten with → **Dw = 55° ± 5°**

Molykote

4 pieces tension bolts M24x2x99 with tension sleeves acc. to drawing No.

Mounting turbocharger bracket to cylinder block

Tighten screws with → **M = 180 Nm**

corresponding to manual tightening plus → **Dw = 65° + 5°**

Tension bolts M20x2x125 SW30

Tighten screws with → **M = 600 Nm**

corresponding to manual tightening plus → **Dw = 30° + 5°**

Tension bolts M30x135 SW46

Turbocharger mounting

Support between turbocharger bracket and cylinder block

Tighten screws with →
Molykote
Tension bolts M16x80 SW 24

M = 120 Nm

Tighten screws with →
Molykote
Tension bolts M20x88 SW 30

M = 200 Nm

Connecting screws

In-line engine M551 - M552

Cylinderblock - intermediate frame
Tighten screws with →

M = 700 - 900 Nm

Screws M30 x 2 x 150 DIN 912

Intermediate frame - bedplate
Tighten screws with →

M = 700 - 900 Nm

Screws M30 x 2 x 150 DIN 912

Vee-engine M551 - M552

Cylinder block - intermediate frame
Tighten screws with →

M = 700 - 900 Nm

Screws M30 x 2 x 150 DIN 912

Intermediate frame - bedplate
Tighten screws with →

M = 1200 Nm

Screws M30 x 2 x 150 DIN 912

Hexagon screws M36 x 1 80 DIN 931 (only M552)

Align intermediate frame on bedplate and bore and ream it together.

Bedplate - intermediate frame - cylinderblock
Before fitting the bedplate must be placed stresss-free and absolutely horizontally, bending must be strictly avoided.
The intermediate frame is aligned flush with the laterally milled pump side face of the bedplate.

The cylinder blocks are aligned to the camshaft and flywheel sides.

The joint faces of the bedplate and of the bearing pockets may be recut up to max. 1.00 mm.

Tie rod

In-line engine M551

Tie rods 1.70.7-16.20.00-01 / -09

1st step → **P = 210 bar**

2nd step → **P = 421 bar**

3rd step → **P = 631 bar**

Old bedplate GG25 var. - 09 is replacement for - 01, possible ist also - 13 with tightening device 95 cm²

6 cyl. engine	Tightening sequence	8 cyl. engine
+ + + + + + + 1 2 3 4 5 6 7 + + + + + + +	1st step	+ + + + + + + + + 1 2 3 4 5 6 7 8 9 + + + + + + + + +
+ + + + + + + 14 13 12 11 10 9 8 + + + + + + +	2nd step	+ + + + + + + + + 18 17 16 15 14 13 12 11 10 + + + + + + + + +
+ + + + + + + 15 16 17 18 19 20 21 + + + + + + +	3rd step	+ + + + + + + + + 19 20 21 22 23 24 25 26 27 + + + + + + + + +

No. 1 ; 14 ; 15 ; 18 ; 19 is the fly wheel side

Thread for tightening device: M45 x 3 external thread
Thread for tie rod nuts: M64 x 4
The var - 01 has hexagon nuts, the var. - 09 has round nuts

After inserting the tie rods tighten steadily upper nut by hand.
Mount hydraulic device and tighten nut with pin firmly up to the support.

Tie rod

In-line engine M551

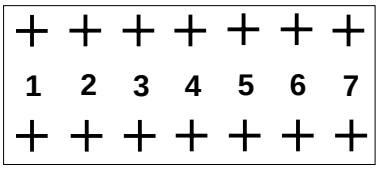
Tie rods 1.70.7-16.20.00-11 / 13 / 14

1st step → **P = 210 bar**

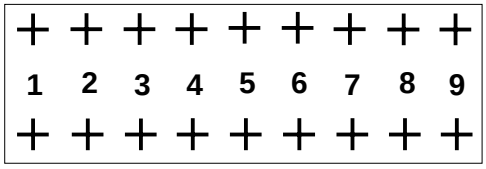
2nd step → **P = 421 bar**

3rd step → **P = 631 bar**

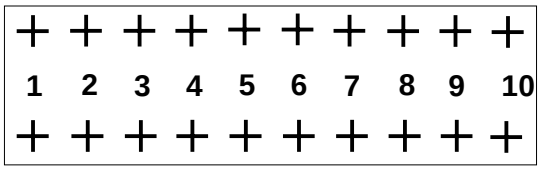
Var. - 11 / - 13 old bedplate, var. - 14 new bedplate
Tightening device 95 cm²
Tightening sequence:
6 cyl. engine
1st step: 1 + 2 3 + 4 5 + 6
2nd step: 7 + (6) 5 + 4 3 + 2
3rd step: 1 + (2) 3 + 4 5 + 6 (6) + 7



8 cyl. engine
1st step: 1 + 2 3 + 4 5 + 6 7 + 8
2nd step: 9 + (8) 7 + 6 5 + 4 3 + 2
3rd step: 1 + (2) 3 + 4 5 + 6 7 + 8 (8) + 9



9 cyl. engine
1st step: 1 + 2 3 + 4 5 + 6 7 + 8
2nd step: 10 + 9 8 + 7 6 + 5 4 + 3
3rd step: 1 + 2 3 + 4 5 + 6 7 + 8 9 + 10



No. 1 is the flywheel side
Var. -11 / - 13: thread for tightening device M45 x 3 external thread, thread for tie rod nuts: M64 x 4
Var. - 14: thread for tightening device M56 x 4 external thread, thread for tie rod nuts M64 x 4

Tie rod 1.70.7-16.20.00-12

1st step → **P = 263 bar**

2nd step → **P = 526 bar**

3rd step → **P = 631 bar**

Tightening device 95 cm²
Thread for tightening device M39 x 3 internal thread, thread for tie rod nuts M64 x 4
Tightening sequence see above.

Tie rod

Vee-engine M551

Tie rods for bedplate - intermediate frame 1.70.7-16.20.00-02 / -03

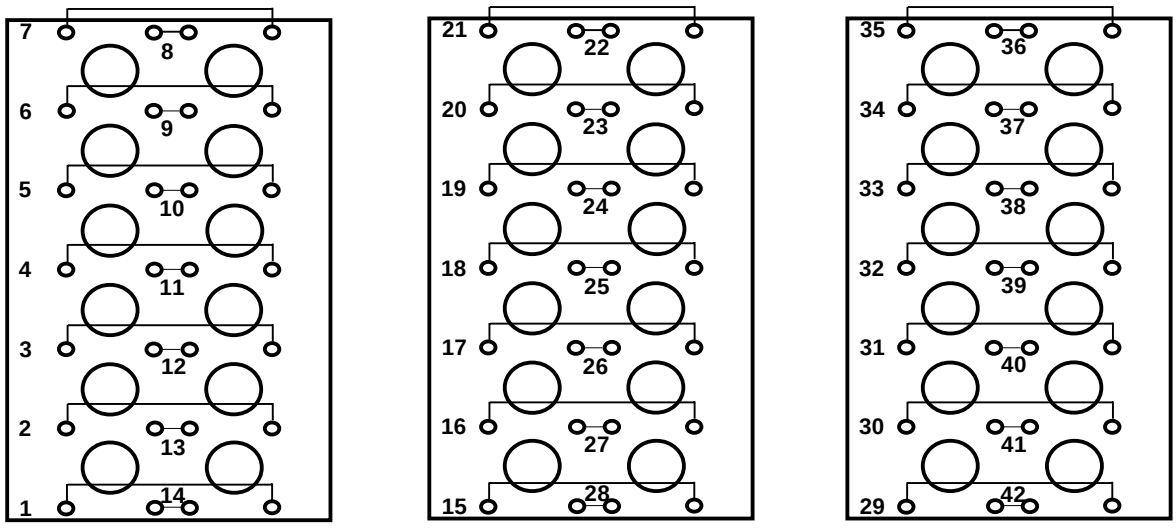
1st step →	**P = 90 bar**
2nd step →	**P = 180 bar**
3rd step →	**P = 250 bar**

1.70.7.16.20.00-05 / -06

1st step →	**P = 115 bar**
2nd step →	**P = 225 bar**
3rd step →	**P = 300 bar**

var. - 05 is replacement for - 02, var. - 06 is replacement for - 03
Thread for tightening device: M36 x 3 internal thread, thread for tie rod nuts: M56 x 4
After inserting the tie rods tighten steadily upper nut by hand.
Mount hydraulic device and tighten nut with pin firmly up to the support.

Tightening sequence for 12 cyl. engines

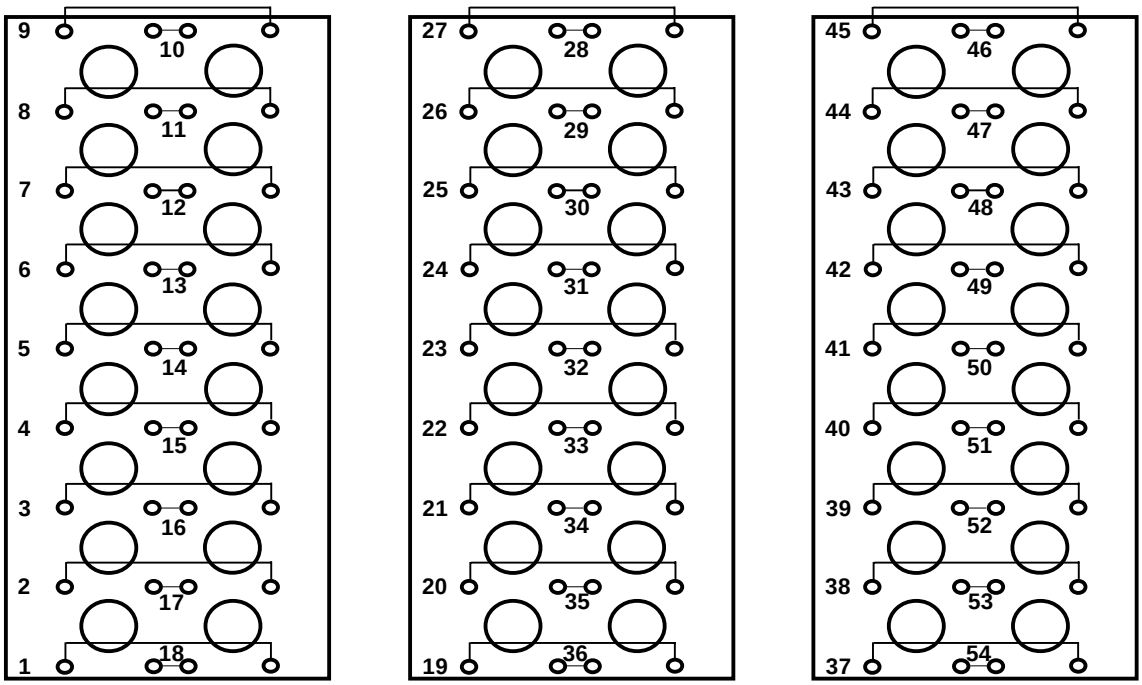


Flywheel side

Tie rod

Vee-engine M551

Tightening sequence for 16 cyl. engines



Flywheel side

Tie rods for intermediate frame - cylinder block 1.70.7-16.20.00-04

1st step →	**P = 90 bar**
2nd step →	**P = 180 bar**
3rd step →	**P = 250 bar**

1.70.7-16.20.00-07

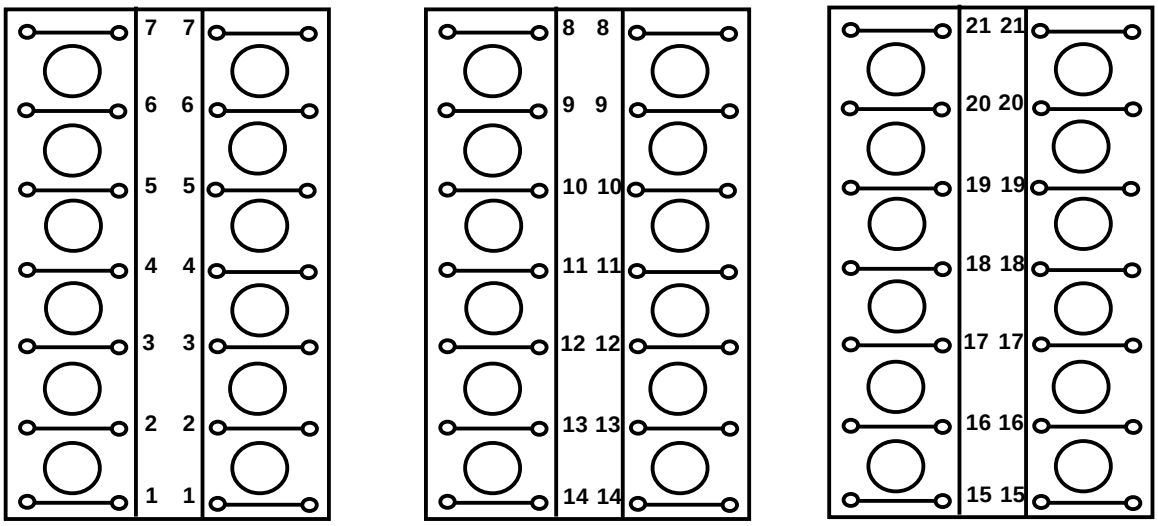
1st step →	**P = 115 bar**
2nd step →	**P = 225 bar**
3rd step →	**P = 300 bar**

Var. -07 is replacement for - 04 thread for tightening device: M36 x 3 internal thread, thread for tie rod nuts M56 x 4

Tie rod

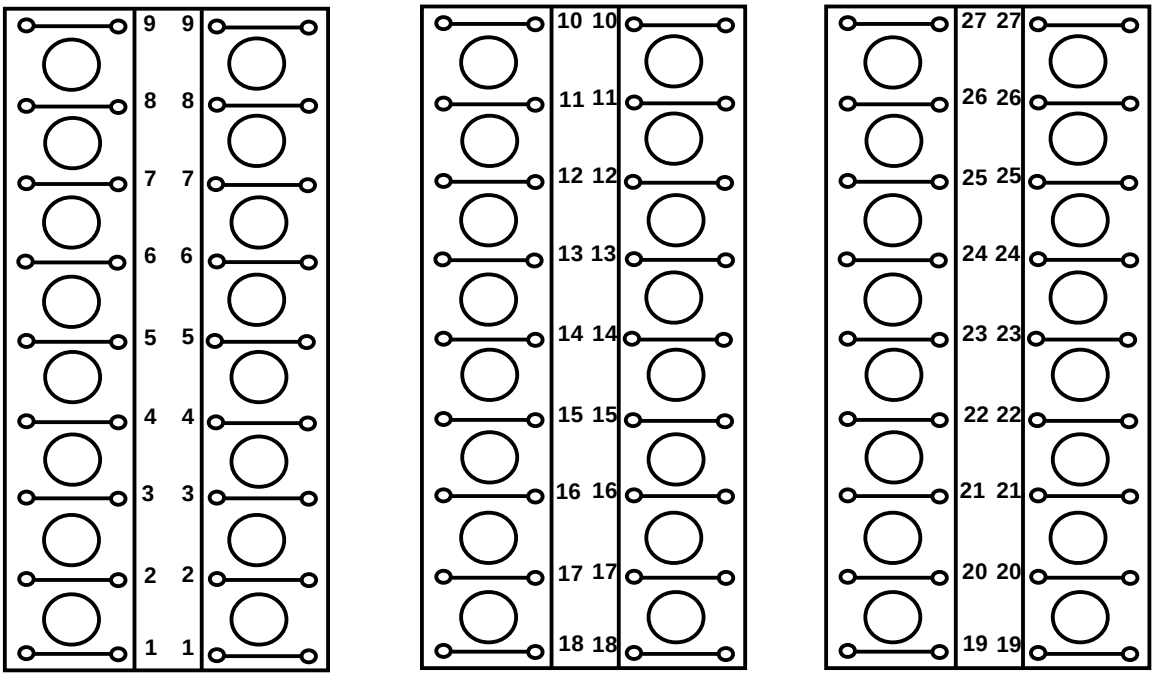
Vee-engine M551

Tightening sequence for 12 cyl. engines



Flywheel side

Tightening sequence for 16 cyl. engines



Flywheel side

Tie rod

In-line engine M552

Tie rods 1.70.7-16.20.00-08 / -10

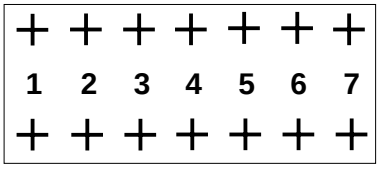
1st step → **P = 270 bar**

2nd step → **P = 530 bar**

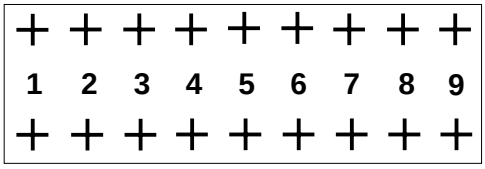
3rd step → **P = 640 bar**

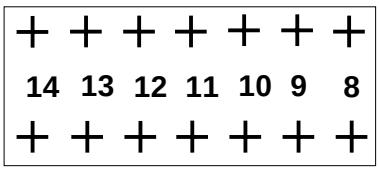
Old bedplate GG 25 ; var. - 15 is replacement for - 08, var. - 12 is replacement for - 10. Thread for tightening device M56 x 4 external thread, thread for the tie rod nuts M64 x 4

6 cyl. engine **Tightening sequence** **8 cyl. engine**

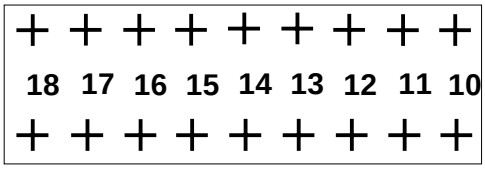


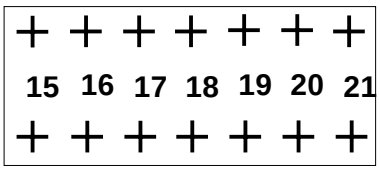
1st step



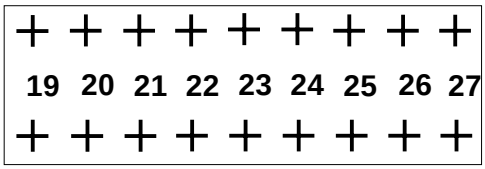


2nd step



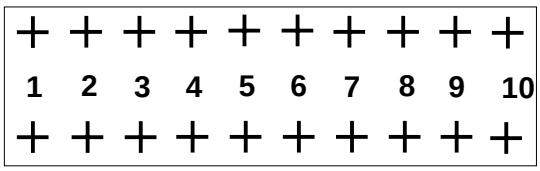


3rd step

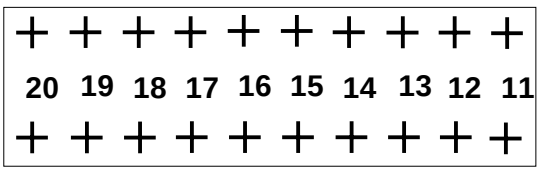


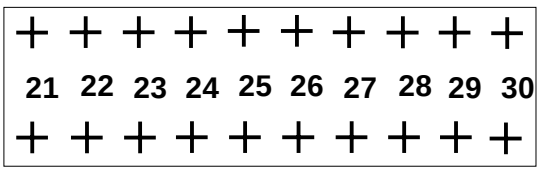
9 cyl. engine

1st step



2nd step **3rd step**





On all sketches No. 1 ; 14 ; 15 ; 18 ; 19 ; 20 ; 21 is the flywheel side.

Tie rod

In-line engine M552

Tie rods 1.70.7-16.20.00-12 / - 15

1st step → **P = 263 bar**

2nd step → **P = 526 bar**

3rd step → **P = 631 bar**

Var. -10 / -12 = GGG 50 bedplates Pz = 125 bar,
Var. -15 = GGG 50 bedplates Pz = 135 bar
Tightening device 95 cm²
Var. -12 thread for tightening device: M39 x 3 internal thread, thread for tie rod nuts: M64 x 4
Var. -15 thread for tightening device: M56 x 4 external thread, thread for tie rod nuts: M64 x 4

Tie rod 1.70.7-16.20.00-16

1st step → **P = 263 bar**

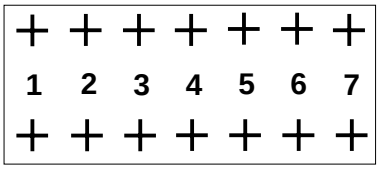
2nd step → **P = 526 bar**

3rd step → **P = 715 bar**

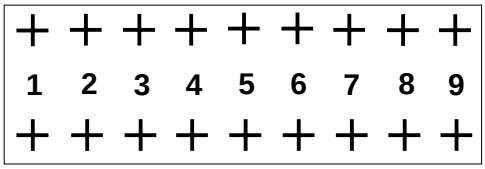
Var. - 16 = GGG 50 bedplate ecological design.
Tightening device 95 cm²
Var. -16 thread for tightening device: M56 x 4 external thread, thread for tie rod nuts: M64 x 4

Tightening sequence:

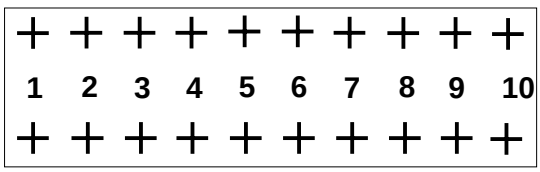
6 cyl. engine
1st step: 1 + 2 3 + 4 5 + 6
2nd step: 7 + (6) 5 + 4 3 + 2
3rd step: 1 + (2) 3 + 4 5 + 6 (6) + 7



8 cyl. engine
1st step: 1 + 2 3 + 4 5 + 6 7 + 8
2nd step: 9 + (8) 7 + 6 5 + 4 3 + 2
3rd step: 1 + (2) 3 + 4 5 + 6 7 + 8 (8) + 9



9 cyl. engine
1st step: 1 + 2 3 + 4 5 + 6 7 + 8
2nd step: 10 + 9 8 + 7 6 + 5 4 + 3
3rd step: 1 + 2 3 + 4 5 + 6 7 + 8 9 + 10



No. 1 is the flywheel side

Tie rod

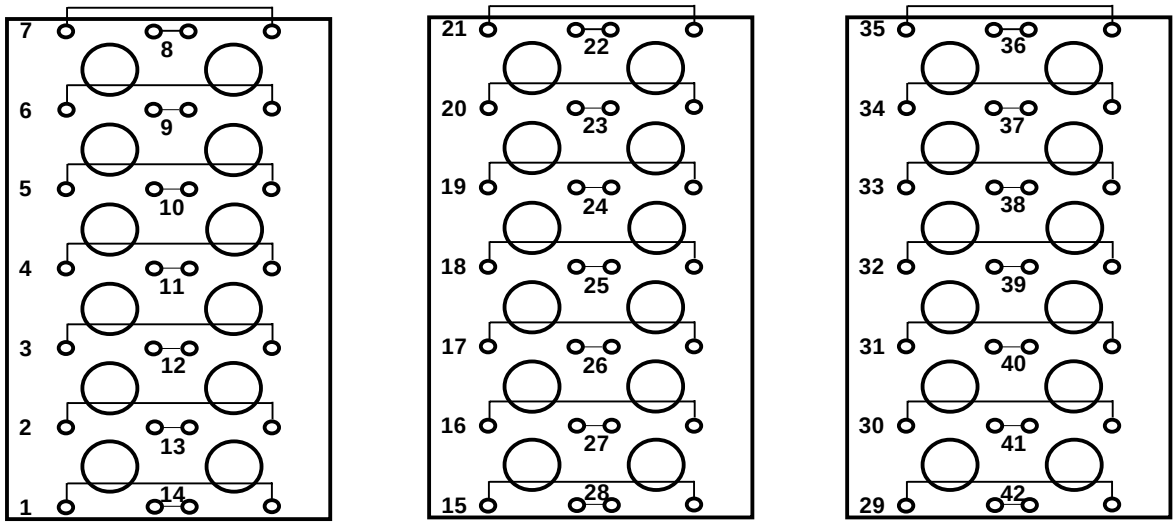
Vee-engine M552

Tie rods for bedplate - intermediate frame 1.70.7-16.20.00-50 / -51

1st step →	**P = 330 bar**
2nd step →	**P = 650 bar**
3rd step →	**P = 920 bar**

Tightening torque 95 cm ²
Thread for tightening torque: M56 x 4 external thread, thread for tie rod nuts: M64 x 4

Tightening sequence



Flywheel side

Tie rod for intermediate frame - cylinder block 1.76.7-16.20.00-01

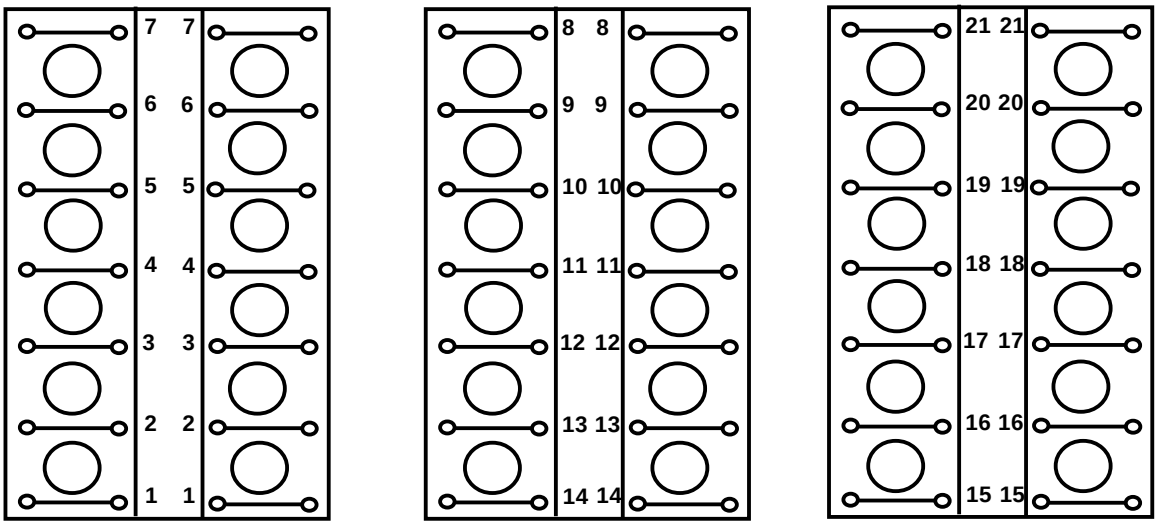
1st step →	**P = 240 bar**
2nd step →	**P = 470 bar**
3rd step →	**P = 640 bar**

Tightening device 95 cm ²
Thread for tightening device: M56 x 4, thread for tie rod nuts: M 64 x 4

Tie rod

Vee-engine M552

Tightening sequence intermediate frame - cylinder block



Flywheel side

After inserting the tie rods tighten steadily upper nut by hand.
Mount hydraulic device and tighten nut with pin firmly up to the support.

The tightening instructions for tie rod contain different variants. In case of doubt please contact the official in charge from CK14 for clarification (state the engine number).

Overall table - tie rod

	- 01	- 02	- 03	- 04	- 05	- 06	- 07	- 08	- 09	- 10	- 11	- 12	- 13	- 14	- 15	- 16	- 50	- 51	- 01*
M 551R	●								●		●	●	●	●					
M 551V		●	●	●	●	●	●												
M 552R								●		●		●			●	●			
M 552V																	●	●	●
- 05		●																	
- 06			●																
- 07				●															
- 09	●																		
- 12										●									
- 13											●								
- 13 B	●								●										

Explanation
Horizontal row: Tie rod variants 1.70.7-16.20.00-
- 01* = 1.76.7-16.20.00-01, 13 B = Conditional installation, consultation of After - Sales Service necessary.

Vertical row: Engine types and tie rod variants (replacement) e. g. var. - 05 replacement for var. - 02
Are bedplates replaced by GGG 50 - bedplates, the spare variants are to be inserted.

Firing sequences

In-line engine M551- M552

6 Zyl. clockwise rotation	1 - 3 - 5 - 6 - 4 - 2	
anticlockwise rotation	1 - 2 - 4 - 6 - 5 - 3	
8 Zyl. clockwise rotation	1 - 4 - 7 - 6 - 8 - 5 - 2 - 3	
anticlockwise rotation	1 - 3 - 2 - 5 - 8 - 6 - 7 - 4	
9 Zyl. clockwise rotation	1 - 5 - 9 - 6 - 8 - 7 - 3 - 2 - 4	**M551**
anticlockwise rotation	1 - 4 - 2 - 3 - 7 - 8 - 6 - 9 - 5	
9 Zyl. clockwise rotation	1 - 2 - 4 - 6 - 8 - 9 - 7 - 5 - 3	**M552**
anticlockwise rotation	1 - 3 - 5 - 7 - 9 - 8 - 6 - 4 - 2	

Vee-engine M551 - M552

Long - interval firing

12 Zyl. clockwise rotation	B1 - A3 - B4 - A5 - B2 - A1 - B6 - A4 - B3 - A2 - B5 - A6
12 Zyl. anticlockwise rotation	A1 - B2 - A5 - B4 - A3 - B1 - A6 - B5 - A2 - B3 - A4 - B6
16 Zyl. clockwise rotation	B1 - A5 - B4 - A2 - B7 - A3 - B6 - A1 - B8 - A4 - B5 - A7 - B2 - A6 - B3 - A8
16 Zyl. anticlockwise rotation	A1 - B6 - A3 - B7 - A2 - B4 - A5 - B1 - A8 - B3 - A6 - B2 - A7 - B5 - A4 - B8

Short - interval firing

12 Zyl. clockwise rotation	B1 - A4 - B4 - A2 - B2 - A6 - B6 - A3 - B3 - A5 - B5 - A1
12 Zyl. anticlockwise rotation	A1 - B5 - A5 - B3 - A3 - B6 - A6 - B2 - A2 - B4 - A4 - B1
16 Zyl. clockwise rotation	A8 - B8 - A5 - B5 - A2 - B2 - A3 - B3 - A1 - B1 - A4 - B4 - A7 - B7 - A6 - B6
16 Zyl. anticlockwise rotation	B1 - A1 - B3 - A3 - B2 - A2 - B5 - A5 - B8 - A8 - B6 - A6 - B7 - A7 - B4 - A4

Designation	Length mm	Breadth mm	Height mm	Weight kg
Bedplate, compl.				
6 M551	4400	1600	1209	6650
6 M552	4550	1600	960	9270
8 M551	5700	1600	1209	8700
8 M552	5850	1600	960	10850
9 M551	6350	1600	1209	9800
9 M522	6500	1600	960	11800
12 M551	4440	2100	1450	13100
12 M552	5830	2100	1125	15780
16 M551	5740	2100	1450	16750
Crankshaft without counterweights			**Radius**	
6 M551	4670		275	5000
6 M552	4820		260	6315
8 M551	5970		275	6600
8 M552	6120		260	8025
9 M551	6620		275	7250
9 M552	6770		260	8860
12 M551	4710		267	5910
12 M552	6106		260	7300
16 M551	6010		267	8200
Gear wheel on crankshaft				
6 - 8 - 9 M551		275	495	90
6 - 8 - 9 M552		100	630	120
12 - 16 M551 / 552		220	620	125

Designation	Length mm	Breadth mm	Height mm	Weight kg
Intermediate frame				
6 M551 / 552	**4140**	**1280**	**820**	**4900**
8 M551 / 552	**5440**	**1280**	**820**	**6500**
9 M551 / 552	**6090**	**1280**	**820**	**7300**
12 M551	**4140**	**2044**	**1288**	**11300**
12 M552	**5260**	**2044**	**1288**	**14000**
16 M551	**5440**	**2044**	**1288**	**15000**
Cylinder block, compl. with liners and studs				
6 M551	**4140**	**1070**	**1786**	**11575**
6 M552	**4140**	**1070**	**1786**	**11825**
8 M551	**5440**	**1070**	**1786**	**15231**
8 M552	**5440**	**1070**	**1786**	**15750**
9 M551	**6090**	**1070**	**1786**	**17110**
9 M552	**6090**	**1070**	**1786**	**17110**
12 M551 (2 pcs./engine)	**4140**	**1070**	**1786**	**11575**
16 M551 (2 pcs./engine)	**5440**	**1070**	**1786**	**15231**
12 M552 (2 pcs./engine)	**5260**	**1070**	**1705**	**15075**
Camshaft				
6 M551 reversible	**4925**		**130**	**460**
6 M552 reversible	**4925**		**130**	**460**
6 M551 non-reversible	**4510**		**130**	**450**
6 M552 non-reversible	**4510**		**130**	**450**
8 M551 reversible	**6225**		**130**	**600**
8 M551 non- reversible	**5810**		**130**	**590**
9 M551 reversible	**6875**		**130**	**675**

Designation	Length mm	Breadth mm	Height mm	Weight kg
Camshaft				
9 M551 non-reversible	**6460**		**130**	**659**
12 M551 reversible	**4925**		**130**	**460**
12 M551 non-reversible	**4510**		**130**	**450**
12 M552 reversible	**4925**		**130**	**460**
12 M552 non-reversible	**4510**		**130**	**450**
16 M551 reversible	**6225**		**130**	**600**
16 M551 non-reversible	**5810**		**130**	**590**
Reversing gear				
M551 - M522	**611**	**410**	**480**	**157**
Injection pump				
M551 - M552	**199**	**184**	**365**	**30**
Piston				
M551, built-up		**Ø 450**	**795**	**203**
Alu		**Ø 450**	**795**	**180**
Piston with connecting rod				
M551	**1986**	**465**		**553**
M552	**2030**	**516**		**664 - 684**
M551 V-type, built-up				
Master rod	**1545**	**Ø 450**		**494**
Link rod	**1468**	**Ø 450**		**436**
M551 V-type, Alu				
Master rod	**1545**	**Ø 450**		**471**
Link rod	**1468**	**Ø 450**		**413**
End casing				
6 - 8 - 9 M551	**350**	**1260**	**1300**	**310**
12 - 16 M551	**355**	**1380**	**1505**	**383**

Designation	Length mm	Breadth mm	Height mm	Weight kg
Lubricating oil twin pump				
6 M551 (WD 4)	**535**	**240**	**285**	**89**
6 - 8 - 9 M551 / 552 (WD 5)	**592**	**340**	**280**	**125**
12 - 16 M551 / 552	**735**	**410**	**435**	**165**
Turbocharger				
BBC VTR	**320**	**1352**	**752**	**855**
770				
321	**1460**	**852**	**855**	**870**
400	**1630**	**935**	**1056**	**1180**
401	**1761**	**935**	**1056**	**1420**
454				**3240**
Napier NA 455	**1767**		**915 / 1070**	**1670**
Charge air cooler				
GEA	**1344**	**700**	**660**	**940**
	1761	**935**	**1056**	**1420**
Vibration damper				
Sleeve spring damper			**1120**	**1127**
Holset type		**140**	**895**	**570**
		180	**968**	**920**
Friction spring type		**200**	**920**	**916**
		200	**1050**	**1156**
Geislinger (D140 / 24)		**250**	**1400**	**2590**
Flywheels			**190**	**1281**
1035				
		190	**1380**	**1245**
		450	**1500**	**3600**
		400	**1700**	**4700**

Designation	Length mm	Breadth mm	Height mm	Weight kg
Flywheels		400	2000	6900
		475	2060	8785
		475	2100	9240
Liner	1295		576	575
Cylinder head		780	900	830