Date:February 14, 2017Subject:Liner maintenance job cardsEngine type:all variants of M20, M25, M32, GCM34, M34DF, M43, M46DF

Caterpillar confidential: green

New Liner maintenance job cards

To meet today's documentation requirements the layout of our maintenance job cards was changed. When developing a new maintenance job card in this regard we are implementing new or additional maintenance hints for better judgement of engine parts condition where necessary or useful. In case new job cards containing new important information or wear limits that are of interest for our customers we will use our "Service Information" format for publishing these documents.

Besides the known liner wear limit descriptions our current job card "cylinder liner check / measurement" contains advice regarding the liner landing and radial liner fit. Due to the typically low liner wear rates of MaK engines, it is possible to provide an additional safety margin to piston skirts by reducing the total liner wear limit to 0.5 mm for all engine types.

The current job card "cylinder liner maintenance / removal / installation" also contains caution hints regarding compensation rings under liners. Depending on the equipment and engine type these rings are occasionally used during manufacturing of an engine block. Such compensation rings might also have been installed during previous maintenance activities depending on engine condition after long operation hours.

Please assure that the new job cards will be issued on board and exchanged in all your engine maintenance manuals.





Operating medium:	Every fuel	
Personnel qualification:	Skilled engine hand / chief engineer	
Personnel requirement:	2 pers.	
Spare parts sheets:		
See also:	A5.05.02.05.50.nn, A5.05.02.06.01.nn, A5.05.03.04.01.nn, A5.05.02.07.01.nn)3

Activities:

- 1.
- Check/measurement and evaluation of the cylinder liners Check of the contact surfaces (cylinder liner and engine block) Check of the radial fits (cylinder liner and engine block) 2.
- 3.

Engine type	Tools and auxiliary materials	Index	Tool No.	
M 20 C	Measuring ruler for cylinder liner	W1	2.9216-022	
M 25 C / M 25 E	Measuring ruler for cylinder liner	W1	259216-001	
M 32 C / VM 32 C/ M 32 E / GCM34	Measuring ruler for cylinder liner	W1	9.2084 A	
M 34 DF	Measuring ruler for cylinder liner	W1	342253 A	
M 43 C / VM 43 C M 46 DF / VM 46 DF	Measuring ruler for cylinder liner	W1	439218-001	
M 20 C	High-precision inside micrometer	W2	1.9419 M	*
M 25 C / M 25 E	High-precision inside micrometer	W2	1.9419 K	*
M 32 C / VM 32 C / M 32 E / M 34 DF	High-precision inside micrometer	W2	1.9419 B	*
GCM34	High-precision inside micrometer	W2	1.9419 L	*
M 43 C / VM 43 C M 46 DF / VM 46 DF	High-precision inside micrometer	W2	1.9419 G	*
* no picture				

NOTE
For diesel oil (MDO) engines and gas engines it is recommended to replace all cylinder liners after 90,000 h.
For heavy fuel oil (HFO) engines we recommend to replace all cylinder liners after 60,000 h already.
If cylinder liners with irregular or critical contact patterns of the contact surfaces are found during the 15,000 h / 30,000 h (for gas engines 15,000 h / 45,000 h) standard check, follow-up checks according to Table 2 are required.



NOTE
 Every 15,000 h a standard check (see Table 1) at one cylinder liner must be carried out. If the checked cylinder liner presents irregularities, a follow-up check must be carried out after another 7,500 h (Table 2) in which the irregular cylinder liner plus one more cylinder liner must be checked. On V-engines the irregular cylinder liner and one more liner per cylinder bank shall be checked. The outer cylinder units are not suitable for the checks mentioned above and should be left out.

Standard check (Table 1):

•	of one cylinder liner	every	15,000 h
•	of all cylinder liners (diesel engines only)	every	30,000 h
•	of all cylinder liners (gas engines only)	every	45,000 h
•	of the cylinder liner after each piston removal (Activity 1.)		

Table 1

Standard check	In-line engines	V-engines
	Number of	cylinder liners to be checked
15,000 h	1	1 x bank A 1 x bank B
30,000 h (diesel engine) 45,000 h (gas engine)	All	All

Follow-up check (Table 2):

Only required if irregularities according to Table 5 (Figure 2, *Irregular contact patterns*), are identified during a standard check.

Table 2

Follow-up check	In-line engines	V-engines	
	Number of cylinder liners to be checked		
7,500 h	At least two	At least three	



1. Check/measurement and evaluation of the cylinder liners.



	CAUTION
	Risk of damage to the engine due to dirt!
•	When a main running gear (piston and connecting rod) is removed, there is a risk of dirt particles and other contaminants entering the crankcase.
	Especially the crank pin and the oil guide bore must be carefully covered and protected.

- 1.1 Remove the anti-polishing ring, see **A5.05.02.05.50.nn**.
- 1.2 Remove the piston, see **A5.05.02.06.01.nn**.
- 1.3 Remove the cylinder liner **A5.05.03.04.01.nn** (Not required for each inspection, see Maintenance Plan).
- 1.4 Remove sealing ring and O-ring.
- 1.5 Cover the crankcase and protect the crank pin against contamination.
- 1.6 Clean the cylinder liner (**Fig. 1**/1) inside.
- 1.7 Check the cylinder liner visually for traces of wear according to Table 4.
- 1.8 Using the high-precision inside micrometer (W2) measure the cylinder liner at the measuring points determined with the measuring ruler (**Fig. 1**/W1) and shown in Table 3 lengthwise, crosswise and 2 x diagonally to the engine axis.
- 1.9 Enter the measured values in Table 3 and then calculate the **wear value** (D1 D3).
- 1.10 When the wear limit is reached, which is usually in the area of the top piston ring reversal point (TDC, 1st piston ring), or another limit in Table 4 (**Fig. 2**), replace the cylinder liner.



03







Table 4M 20 C - List of wear limits

Evaluat	tion criteria	Wear limits (mm)	Explanation
Nominal Ø new condit 200.0 +0.0	dimension (in ion) 46		Entire cylinder running surface
Wear dime	nsion	0.5	
Max. ovalit	у	0.25	
1. Wedge s	shape Height Depth *	6.0 0.03	Wedge-shaped indentation across the entire circumference, beginning at TDC of 1st piston ring and extending downward. * Probe radius r≥ 3 mm
2. Pocket	Max. number Length Width ** Depth *	3 45.0 15.0 0.02	Extensive, irregular indentations * Probe radius r≥ 3 mm ** In circumferential direction
3. Score	Number Length Depth	3 to max. 19*** 140.0 0.5	Severe vertical, linear friction marks interrup- ting the TDC area of the 1st piston ring. *** See Note
4. Striping			See 1.11
5. Canyon	Max. number Length Total width	3 6.0 3.0	Individual deep blow-by grooves in the area of the 1st piston ring (TDC)





NOTE



Table 4 M 25 C / M 25 E - List of wear limits

Evaluation criteria		Wear limits (mm)	Explanation
Nominal Ø dimension (in new condition) 255.0 +0.052			Entire cylinder running surface
Wear dime	nsion	0.5	
Max. ovalit	у	0.25	
1. Wedge s	shape Height Depth *	6.0 0.03	Wedge-shaped indentation across the entire circumference, beginning at TDC of 1st piston ring and extending downward. * Probe radius r≥ 3 mm
2. Pocket	Max. number Length Width ** Depth *	3 60.0 20.0 0.02	Extensive, irregular indentations * Probe radius r≥ 3 mm ** In circumferential direction
3. Score	Number Length Depth	3 to max. 19*** 150.0 0.5	Severe vertical, linear friction marks interrup- ting the TDC area of the 1st piston ring. ***See Note
4. Striping			See 1.11
5. Canyon	Max. number Length Total Width	3 6.0 3.5	Individual deep blow-by grooves in the area of the 1st piston ring (TDC)





NOTE



Table 4M 32 C / VM 32 C / M 32 E - List of wear limits

Evaluation criteria	Wear limits (mm)	Explanation
Nominal Ø dimension (in new condition) 320.0 + 0.057		Entire cylinder running surface
Wear dimension	0.5	
Max. ovality	0.3	
1. Wedge shape Height Depth *	8.0 0.03	Wedge-shaped indentation across the entire circumference, beginning at TDC of 1st piston ring and extending downward. * Probe radius r≥ 3 mm
2. Pocket Max. number Length Width ** Depth *	3 90.0 30.0 0.02	Extensive, irregular indentations * Probe radius r≥ 3 mm ** In circumferential direction
3. Score Number Length Depth	3 to max. 19*** 180.0 0.5	Severe vertical, linear friction marks interrup- ting the TDC area of the 1st piston ring. *** See Note
4. Striping		See 1.11
5. Canyon Max. number Length Total Width	3 8.0 4.0	Individual deep blow-by grooves in the area of the 1st piston ring (TDC)





NOTE



Table 4 GCM34 / M 34 DF - List of wear limits

Evaluation criteria		Wear limits (mm)	Explanation
Nominal Ø dimension (in new condition) 340.0 +0.057			Entire cylinder running surface
Wear dime	ension	0.5	
Max. ovali	ty	0.3	
1. Wedge	shape Height Depth *	8.0 0.03	Wedge-shaped indentation across the entire circumference, beginning at TDC of 1st piston ring and extending downward. * Probe radius r≥ 3 mm
2. Pocket	Max. number Length Width ** Depth *	3 90.0 30.0 0.02	Extensive, irregular indentations * Probe radius r≥ 3 mm ** In circumferential direction
3. Score	Number Length Depth	3 to max. 19*** 180.0 0.5	Severe vertical, linear friction marks interrup- ting the TDC area of the 1st piston ring. *** See Note
4. Striping			See 1.11
5. Canyon	Max. number Length Total Width	3 8.0 4.0	Individual deep blow-by grooves in the area of the 1st piston ring (TDC)





Table 4M 43 C / VM 43 C - List of wear limits

Evaluation criteria		Wear limits (mm)	Explanation
Nominal Ø dimension (in new condition) 430.0 +0.063			Entire cylinder running surface
Wear dime	nsion	0.5	
Max. ovalit	у	0.3	
1. Wedge shape Height Depth *		13.0 0.05	Wedge-shaped indentation across the entire circumference, beginning at TDC of 1st piston ring and extending downward. * Probe radius r≥ 3 mm
2. Pocket	Max. number Length Width ** Depth *	3 120.0 40.0 0.03	Extensive, irregular indentations * Probe radius r≥ 3 mm ** In circumferential direction
3. Score	Number Length Depth	3 to max. 19*** 250.0 0.5	Severe vertical, linear friction marks interrup- ting the TDC area of the 1st piston ring. *** See Note
4. Striping			See 1.11
5. Canyon	Max. number Length Total Width	3 13.0 6.0	Individual deep blow-by grooves in the area of the 1st piston ring (TDC)





NOTE



Table 4M 46 DF / VM 46 DF - List of wear limits

Evaluation criteria		Wear limits (mm)	Explanation
Nominal Ø dimension (in new condition) 460.0 +0.063			Entire cylinder running surface
Wear dimen	nsion	0.5	
Max. ovality	1	0.3	
1. Wedge shape Height Depth *		13.0 0.05	Wedge-shaped indentation across the entire circumference, beginning at TDC of 1st piston ring and extending downward. * Probe radius r≥ 3 mm
2. Pocket	Max. number Length Width ** Depth *	3 120.0 40.0 0.03	Extensive, irregular indentations * Probe radius r≥ 3 mm ** In circumferential direction
3. Score	Number Length Depth	3 to max. 19*** 250.0 0.5	Severe vertical, linear friction marks interrup- ting the TDC area of the 1st piston ring. *** See Note
4. Striping			See 1.11
5. Canyon	Max. number Length Total Width	3 13.0 6.0	Individual deep blow-by grooves in the area of the 1st piston ring (TDC)





NOTE



1.11 Striping

As a basic rule, there are three degrees of striping formation:

- 1. Faint striping (s-) / only visible = harmless
- 2. Normal striping (s) / only visible = harmless
- 3. Unacceptable striping (s+) / visible and palpable= replacement required

The most important wear criterion is the condition of the honing structure in the area of the striping. If the honing structure is **not** destroyed, it can be assumed, based on insights gained to date, that such striping will not lead to a critical condition and that the affected cylinder liner can remain in the engine. This also applies in particular if there is a higher amount of stripes of this degree in one cylinder liner.

View	Evaluation	Action
	 Faint striping (s-) Striping clearly visible. Honing structure preserved. 	None
2	 Normal striping (s) Striping clearly visible. Honing structure preserved. 	None
3	 Unacceptable striping (s+) Pronounced striping. Honing structure locally destroyed. 	 Replace the cylinder liner Check piston and piston rings(A5.05.02.07.01.nn) Check the anti-polishing ring and replace it if necessary

Vertical irregularities between top and bottom dead centre



2. Check of the contact surfaces (cylinder liner and engine block)

2.1 Turn the cylinder liner and put down on a suitable support with the liner collar (anti-polishing ring side) facing downward and secure against tipping.

Clean the contact surfaces (Fig. 3/X), evaluate them based on Table 5 and enter the results in Table 6.



Table 5

Evaluation table for contact surfaces (Fig. 3/X) [applies to cylinder liner and engine block]:

Table 5	Fig. 1 Irregular areas	Fig. 2 Irregular contact pat- terns	Fig. 3 Critical contact patterns
Wear patterns =>	Totinued next page	Continued next page	Continued next page



Table 5	Fig. 1 Irregular areas	Fig. 2 Irregular contact pat- terns	Fig. 3 Critical contact patterns
Condition of the contact surfaces	Corrosive/abrasive material erosion of max. 10 % of the total contact surface up to a width of 7 mm from the inside diameter of the contact surface.	 Corrosive/abrasive material erosion of max. 25 % of the total contact surface with up to 7 mm of the width from the inside diameter of the contact surface. Material erosion is clearly palpable 	 Corrosive/abrasive material erosion of more than 25 % of the total contact surface and/or more than 7 mm of the width from the inside diameter of the contact surface. Material erosion is clearly palpable
		- Measurable max. 0.2 mm	- Measurable more than 0.2 mm
		- Over the entire circumference of the contact surface there is still a continuous ridge of a min. width of 7 mm.	- Over the entire circumference of the contact surface there is no continuous ridge of a min. width of 7 mm.
Evaluation of con- tact surfaces	Harmless	Basically harmless. However, carefully	Immediate refinishing of engine block and cylinder liner required.
		irregular cylinder units.	In case of material erosion of more than 0.3 mm replace the corresponding cylinder liners. Refinishing is then no longer possible.
Rework	No	No	Yes
Check of other cylinder units	No	No	Yes (of all cylinder units)
Follow-up check	As part of regular maintenance	Shortened mainte- nance interval Check of the irregular cylinder units and one additional unit per bank. Latest, however, after 7,500 h.	As part of regular mainte- nance
Installation instruc- tions	Before installing the cylinder liner clean the contact surfaces and smooth any possible material build-up.	Before installing the cylinder liner clean the contact surfaces and smooth any possible material build-up.	Before installing the cylin- der liner clean the rewor- ked contact surfaces.



2.2 Documentation of the measuring results

Document the condition of the checked cylinder liner contact surfaces!

For this purpose, enter the cylinder unit, the operating hours, date and time of inspection as well as the condition of the contact surface in the following table to be able to compare this data with subsequent findings.

For examples and evaluation criteria see Table 5.

Table 6

Cylinder unit	Illustration	_ h check Remark	Illustration	_ h check Remark









3.5 Example photos of critical and uncritical fretting marks on radial fits

Uncritical fretting marks	Fretting marks are critical if the total surface of material erosion amounts to > 50% of one of the main load areas and local material erosion is > 0.5 mm.

3.6 Remove friction rust with fine emery cloth and carefully smooth material build-up of uncritical friction rust marks.



See also:

A5.05.02.06.01.nn, A5.05.03.03.01.nn, A5.05.02.06.02.nn

Spare parts sheets:

Personnel requirement: 2 pers.

Personnel qualification: Skilled engine hand

Operating medium: Every fuel

Activities:

- 1. Remove the cylinder liner, replace the O-ring
- 2. Install the cylinder liner

Engine type	Tools and auxiliary materials	Pos.	Tool No.	
M 20 C	Cylinder liner mounting device, con- sisting of:	W1	2.9216 A	
	Traverse, upper	W1.1	2.9216-001	
	Traverse, lower	W1.2	2.9216-001	
	Lifting rod	W1.3	2.9216-002	
	Hexagon nut	W1.4		
M 25 C / M 25 E	Cylinder liner mounting device, con- sisting of:	W1	259216 E	
	Traverse, upper	W1.1	259216-201	
	Traverse, lower	W1.2	259216-202	
	Lifting rod	W1.3	259216-102	
	Hexagon nut	W1.4		
M 32 C / M 32 E	Cylinder liner mounting device, con- sisting of:	W1	9.9216 E	
	Traverse, upper	W1.1		
	Traverse, lower	W1.2		
	Lifting rod	W1.3		
	Hexagon nut	W1.4		
* or equivalent product				
** optional / not included	in the standard tool kit			



Engine type	Tools and auxiliary materials	Pos.	Tool No.	
M 34 DF	Cylinder liner mounting and removal device, consisting of:	W1	342249 A	
	Traverse, upper	W1.1		
	Traverse, lower	W1.2		
	Lifting rod	W1.3		
	Hexagon nut	W1.4		
M 43 C	Cylinder liner mounting device, con- sisting of:	W1	439216 A	
	Traverse, upper	W1.1	439216-101	
	Traverse, lower	W1.2	439216-103	
	Lifting rod	W1.3	439216-102	
	Lifting eye nut	W1.5	439216-104	
M 46 DF	Cylinder liner mounting and removal device, consisting of:	W1	462229 A	
	Traverse, upper	W1.1		
	Traverse, lower	W1.2		
	Lifting rod	W1.3		
	Lifting eye nut	W1.5		
M 20 C / M 25 C	Petro Gel Amber			*
M 25 E / M 32 C M 32 E / M 34 DF M 43 C / M 46 DF	Textile round sling			**
* or equivalent product				
** ontional / not included i	in the standard tool kit			

optionally			
		-	

	CAUTION
	Risk of damage to the sealing and contact surface of the cylinder liner!
÷	While extracting and inserting the cylinder liner $(1/1)$ the sealing and contact surface is especially put at risk.
	Therefore, the sealing and contact surface of the cylinder liner $(1/1)$ must be protected against any damage!



1. Remove the cylinder liner, replace the O-ring

- 1.1 Remove the piston of the cylinder unit to be serviced (A5.05.02.06.01.nn).
- 1.2 Install the cylinder liner mounting device (W1):
- 1.2.1 Firmly connect both traverse halves

 (1/W1.1, W1.2) with the lifting rod (1/W1.3) and the hexagon nut (1/W1.4) [for M 43 C and M 46 DF lifting eye nut, 1/W1.5]. In doing so, make sure that the collar of the cylinder liner (1/1) is not damaged.

CAUTION

Risk of engine damage due to incomplete installation!

Depending on the equipment and engine type, a compensation ring may be inserted in the contact surface (1/8) of one or several cylinder units. Upon removal, these cylinder units with the related compensation rings must be marked in order to prevent any mistakes upon reassembly.

- Attach the cylinder liner mounting device (W1) with a textile sling to the crane, extract the cylinder liner (1/1) from the engine block, place it onto a suitable support and secure to prevent shifting / tilting.
- 1.4 Remove and mark the compensation ring (1/8), if any.
- 1.5 Take the O-ring (1/2) out of the cooling collar (1/3).





2. Install the cylinder liner

	NOTE
1	Before installing a new cylinder liner a measurement has to be carried out (A5.05.03.03.01.nn).
	Observe the running-in instructions (engine documentation, chapter "Operating Instructions")!

- 2.1 Clean the cylinder liner landing, the upper and the lower fit (1/4) in the engine block (1/5).
- 2.2 Clean the inside of the cooling collar (1/3), the groove of the O-ring (1/2) and the cylinder liner (1/1).
- Check all sealing and contact surfaces of the engine block (1/5) and the cylinder liner (1/1) as well as the upper and lower fit (1/4) in the engine block (1/5) for damage and fretting (A5.05.03.03.01.nn).
 Remove slight friction rust with fine emery cloth and carefully smooth material build-up of uncritical friction rust marks.
- 2.4 If necessary, insert the compensation ring (1/8) provided for this cylinder unit.
- 2.5 Coat the **new** O-ring (1/2) with Petro Gel Amber and insert it untwisted into the groove of the cooling collar (1/3).
- 2.6 Install the cylinder liner mounting device (W1) on the cylinder liner (1/1) as under 1.2.1.
- 2.7 Attach the cylinder liner mounting device (W1) with a textile sling to the crane and introduce the cylinder liner (1/1) carefully into the engine block (1/5).
- 2.8 Insert the cylinder liner (1/1) so that the marking (2/6) on the cylinder liner collar points in longitudinal direction towards the driving end.

i	NOTE
	The marking $(2/7)$ on the cooling collar $(2/3)$ serves as an alignment aid.





2.9 Introduce the cylinder liner (1/1) completely.



2.10 Install the piston (A5.05.02.06.02.nn).



See also:	A5.05.02.06.01.nn, A5.05.03.03.01.nn, A5.05.02.06.02.nn
Spare parts sheets:	
Personnel requirement:	2 pers.
Personnel qualification:	Skilled engine hand
Operating medium:	Every fuel

Activities:

- 1. Remove the cylinder liner, replace the O-ring
- Install the cylinder liner 2.

Engine type	Tools and auxiliary materials	Pos.	Tool No.	
VM 43 C	Cylinder liner mounting and removal device	W1	432094-A	
VM 46 DF	Cylinder liner mounting and removal device	W1	462211-A	
	each consisting of:			
	Clamping plate	W1.1		
	Cross-piece	W1.2		
	Threaded rod	W1.3		
	Hexagon nut	W1.4		
	Lifting beam	W1.5		
VM 43 C / VM 46 DF	Petro Gel Amber			*
	Textile sling			**

* or equivalent product ** not included in the tool kit

CAUTION
Risk of damage to the sealing and contact surface of the cylinder liner!
While extracting and inserting the cylinder liner $(1/1)$ the sealing and contact surface is especially put at risk.
Therefore, the sealing and contact surface of the cylinder liner $(1/1)$ must be protected against any damage!

1. Remove the cylinder liner, replace the O-ring

- 1.1 Remove the piston of the cylinder unit to be serviced (A5.05.02.06.01.nn).
- 1.2 Install the cylinder liner mounting and removal device (1/W1):



- 03
- 1.2.1 Insert the threaded rod (1/W1.3) and the cross-piece (1/W1.2) into the cylinder liner (1/1).
- 1.2.2 Firmly connect the clamping plate (1/W1.1) and cross-piece (1/W1.2) via the threaded rod (1/W1.3)) by means of the hexagon nut (1/W1.4). In doing so, make sure that the cross-piece (1/W1.2) rests correctly at the cylinder liner (1/1).
- 1.2.3 Install the lifting beam (1/W1.5).



- 1.3 Attach the crane with the textile sling to the lifting eye (1/A) of the lifting beam (1/W1.5) and extract the cylinder liner (1/1) in direction of the cylinder axis out of the engine block. Place the cylinder liner (1/1) onto a suitable support and secure it to prevent shifting/tilting.
- 1.4 Remove and mark the compensation ring (1/8), if any.
- 1.5 Take the O-ring (2/2) out of the cooling collar (2/3).





2. Install the cylinder liner



- Clean the cylinder liner landing, the upper and the lower fit (3/4) in the engine block (3/5).
- 2.2 Clean the inside of the cooling collar (2/3), the groove of the O-ring (2/2) and the cylinder liner (2/1).



- 2.3 Clean the contact surfaces of the cylinder liner (**3**/1) on the engine block (**3**/5).
- 2.4 Check all sealing and contact surfaces of the engine block (3/5) and the cylinder liner (3/1) as well as the upper and lower fit (3/4) in the engine block (3/5) for damage and fretting (A5.05.03.03.01.nn). Remove slight friction rust with fine emery cloth and carefully smooth material build-up of uncritical friction rust marks.
- 2.5 If necessary, insert the compensation ring (**2**/8) provided for this cylinder unit.
- 2.6 Coat the **new** O-ring (2/2) with Petro Gel Amber and insert it untwisted into the groove of the cooling collar (2/3).
- 2.7 Install the cylinder liner mounting and removal device (1/W1) on the cylinder liner to be inserted (1/1) as described under 1.2.1 1.2.3.
- 2.8 Attach the crane with the textile sling to the lifting eye (1/A) of the lifting beam (1/W1.5) and introduce the cylinder liner (1/1) into the engine block (3/5). Insert the cylinder liner (3/1) in such a way that the marking (4/6)
 - of cylinder liners of bank A
 points towards the free end and
 - of cylinder liners of bank B
 points towards the driving end.



NOTE

The marking (4/7) on the cooling collar (4/3) serves as an alignment aid.





2.9 Introduce the cylinder liner (**3**/1) completely.



2.10 Install the piston (A5.05.02.06.02.nn).