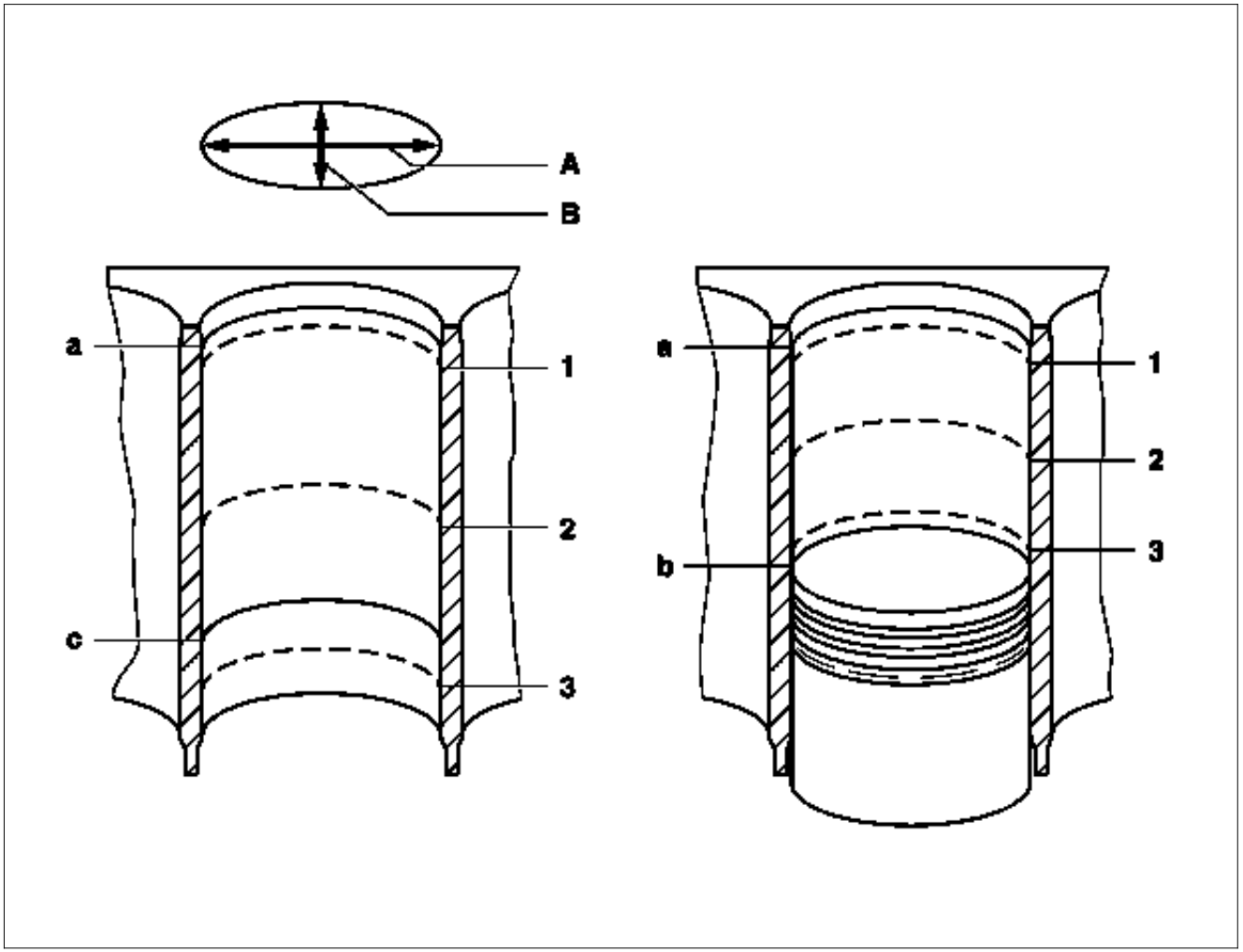
Dokumenttitel	Measuring, boring and honing cylinder bores
Dokumentnummer	ar0140p9201aa

ENGINES 112.910 /911 /912 /920 /921 /922 /923 /940 /941 /942 /943 /944 /945 /946 /947 /960 /961 /970
ENGINES 113.940 /941 /942 /943 /960 /961 /962 /963 /965 /968 /981 /982 /990 /991 /992 /993 /995

1, 2, 3 *Measuring points*
A *Longitudinal direction*
B *Transverse direction*
a *Upper reversal point for 1st piston ring*
b *Bottom dead center of piston*
c *Bottom reversal point of oil scraper ring*



P01.40-0228-06

1	Clean cylinder bores		

2	Measure cylinder bore	ⓘ Measure cylinder bores with an internal measuring instrument at 3 measuring points (1, 2, 3) in a longitudinal direction (A) and transverse direction (B). Cylinder diameter Cylinder bore Cylinder length Undercut ⓘ Internal measuring instrument 50 to 150 mm ∅ with 0.01 mm indication and measuring point pressure relief ⓘ Use a setting micrometer for internal measuring instrument GRM 2125 with a setting range of 50 to 200 mm	 *BE01.40-P-1001-01F *BE01.40-P-1001-02E *BE01.40-P-1004-01F *BE01.40-P-1005-01F
3	Set honing machine for pre-honing	Cylinder diameter setting for repair size (+0.25) Stroke setting with 70 mm stone length on 70th stroke scale of machine Stone overrun at top and bottom Rpm Feed Stroke Display ⓘ Use an automatic cylinder repair machine. Set of stones for rough honing C 30-A 53, or C30 J64, 70 mm long	*BE01.40-P-1002-01F *BE01.40-P-1006-01F *BE01.40-P-1007-01F *BE01.40-P-1008-01F *BE01.40-P-1009-01F *BE01.40-P-1010-01F *BE01.40-P-1011-01F
4	Cylinder bore pre-honing	ⓘ With full honing oil feed.	
5	Measure cylinder bore	ⓘ Immediately after pre-honing, the measurement deviates by approx. +0.02 mm due to heat expansion. ⓘ Internal measuring instrument 50 to 150 mm ∅ with 0.01 mm indication and measuring point pressure relief	*BE01.40-P-1003-01F

6	Set honing machine for precision honing	Cylinder diameter setting for repair size (+0.25) Stroke setting with 70 mm stone length on 70th stroke scale of machine Stone overrun at top and bottom Rpm Feed Stroke Display Finish-honing, stone set C 30-J 84, 70 mm long	*BE01.40-P-1002-01F *BE01.40-P-1006-01F *BE01.40-P-1007-01F *BE01.40-P-1008-01F *BE01.40-P-1009-01F *BE01.40-P-1010-01F *BE01.40-P-1011-01F
7	Cylinder bore precision honing	With full honing oil feed.	
8	Measure cylinder bore	Immediately after precision honing, an oversize of approx. +0.01 mm is obtained because of heating. Internal measuring instrument 50 to 150 mm ∅ with 0.01 mm indication and measuring point pressure relief	*BE01.40-P-1003-01F
9.1	Chamfer cylinder bore	Except engines 112.945, 113.962 /982 in model 463.	AR01.40-P-9201-01A
10	Set honing machine for polishing	Cylinder diameter setting for repair size (+0.25) Stroke setting with 70 mm stone length on 70th stroke scale of machine Stone overrun at top and bottom Rpm Feed Stroke Display Set of stones for polishing C 30-C 03-81, 70 mm long	*BE01.40-P-1002-01F *BE01.40-P-1006-01F *BE01.40-P-1007-01F *BE01.40-P-1008-01F *BE01.40-P-1009-01F *BE01.40-P-1010-01F *BE01.40-P-1011-01F
11	Polish cylinder bore	Polish with full honing oil feed up to final repair size.	*BE01.40-P-1003-01F

12	Measure cylinder bore	ℹ Allow crankcase to cool down to approx. 20 °C before measuring. Cylinder diameter ℹ Internal measuring instrument 50 to 150 mm ∅ with 0.01 mm indication and measuring point pressure relief	 *BE01.40-P-1001-01F
13	Clean cylinder bore and dry		
14	Set honing machine for lapping	ℹ Set to same diameter as after polishing (final diameter). Cylinder diameter according to machining stage. Stroke setting with 70 mm felt length on 70th stroke scale of machine Felt insert overrun at top and bottom Rpm Feed Stroke Display Set of felt inserts C 30-F 85 Felt insert holder set CK3130 Stone holder for set of felt inserts CK-30 35	 *BE01.40-P-1003-01F *BE01.40-P-1012-01F *BE01.40-P-1013-01F *BE01.40-P-1008-01F *BE01.40-P-1009-01F *BE01.40-P-1010-01F *BE01.40-P-1011-01F
15	Rub-in cylinder bore and filter insert using honing paste	ℹ Without honing oil feed, the cylinder wall must be dry. Only the specified honing paste may be used. Only this one guarantees the specified final result. Polmot honing paste order no. 600.11	 *BR00.45-Z-1050-06A
16	Lap cylinder bore and expose silicone crystals.	ℹ Without honing oil feed. Operating time of honing machine	 *BE01.40-P-1014-01F
17	Coat filter insert again with honing paste	ℹ Do not coat cylinder bore with honing paste. Polmot honing paste order no. 600.11	 *BR00.45-Z-1050-06A

18	Lap cylinder bore and expose silicone crystals.	Without honing oil feed, removed material cannot be measured. Operating time of honing machine	*BE01.40-P-1014-01F
19	Clean cylinder bore and dry	Clean crankcase very carefully with honing paste. If possible, clean crankcase in major assembly washing machine, so that no cylinder wall damage will be caused by residues when running the engine later.	a
20	Inspect cylinder bore	Allow crankcase to cool down to approx. 20°C before inspecting. Cylinder diameter of repair size	*BE01.40-P-1001-01F

Check values of crankcase

Number	Designation		Engines 112 except 112.951, 113.940/941/942/943/944/945/946/948/960/961/963/965/966/967/968/980/981/984/986/992/995	Engine 113.962/982/987/988/989/990/991/993
BE01.40-P-1001-02E	Cylinder bore	Peak-to-valley height (R_Z) of top contact surface mm	0.001 to 0.0045	0.001 to 0.0045

		Wear limit at BDC and TDC of 1st piston ring	mm	≤0.03	≤0.03
		Permissible deviation of cylinder shape	mm	0.014	0.007
		contact surface peak-to-valley height	µm	-	-

Test specifications for cylinder bore

Number	Designation			Engine 112.910/ 911	Engine 112.913/920/921/922/ 923/940/941/942/943/ 944/945/949 113.940/941/942/943/ 945
BE01.40-P-1001-01F	Cylinder dia.	Standard marking X	mm	83.200 to 83.215	89.900 to 89.915
		Auxiliary stage marking ⊗	mm	83.250 to 83.265	89.950 to 89.965
		Repair stage	mm	83.450 to 83.465	90.150 to 90.165
BE01.40-P-1002-01F	Cylinder dia., setting for repair size (+0.25)	Pre-honing	mm	83.200	89.900

		Precision honing	mm	83.380	90.080
		Polishing	mm	83.430	90.130
BE01.40-P-1003-01F	Cylinder dia. according to machining phase	Pre-honing	mm	83.380	90.080
		Precision honing	mm	83.430	90.130
		Polishing	mm	83.450 to 83.465	90.150 to 90.165
BE01.40-P-1004-01F	Cylinder length		mm	129.5	129.5
BE01.40-P-1005-01F	Undercut		mm	12	12
BE01.40-P-1006-01F	Stroke setting with 70 mm stone length on 70th stroke scale of machine		mm	130	130
BE01.40-P-1007-01F	Stone overrun at top and bottom		mm	9.5	9.5
BE01.40-P-1008-01F	Rpm	Pre-honing	rpm	125	125
		Precision honing	rpm	125	125
		Polishing	rpm	125	125
		Lapping	rpm	230	230
BE01.40-P-1009-01F	Feed	Pre-honing		4	4
		Precision honing		3	3

		Polishing		2	2
		Lapping		1	1
BE01.40-P-1010-01F	Stroke	Pre-honing	rpm	57	57
		Precision honing	rpm	57	57
		Polishing	rpm	57	57
		Lapping	rpm	80	80
BE01.40-P-1011-01F	Display	Pre-honing	%	20 to 30	20 to 30
		Precision honing	%	20 to 30	20 to 30
		Polishing	%	20 to 30	20 to 30
		Lapping	%	20 to 30	20 to 30
BE01.40-P-1012-01F	Stroke setting with 70 mm felt length on 70th stroke scale of machine		mm	115	115
BE01.40-P-1013-01F	Felt insert overrun at top and bottom		mm	2 to 4	2 to 4
BE01.40-P-1014-01F	Operating time of honing machine		s	40	40

Test specifications for cylinder bore

Number	Designation			Engine 112.951/961	Engine 112.970
BE01.40-P-1001-01F	Cylinder dia.	Standard marking X	mm	89.900 to 89.915	97.000 to 97.015
		Auxiliary stage marking ⊗	mm	89.950 to 89.965	97.050 to 97.065
		Repair stage	mm	90.150 to 90.165	97.250 to 97.265
BE01.40-P-1002-01F	Cylinder dia., setting for repair size (+0.25)	Pre-honing	mm	-	97.000
		Precision honing	mm	-	97.180
		Polishing	mm	-	97.230
BE01.40-P-1003-01F	Cylinder dia. according to machining phase	Pre-honing	mm	-	97.180
		Precision honing	mm	-	97.230
		Polishing	mm	-	97.250 to 97.265
BE01.40-P-1004-01F	Cylinder length		mm	-	130.90 to 131.00
BE01.40-P-1005-01F	Undercut		mm	-	0.6 to 1.0

BE01.40-P-1006-01F	Stroke setting with 70mm stone length on 70th stroke scale of machine		mm	-	132
BE01.40-P-1007-01F	Stone overrun at top and bottom		mm	-	9.5
BE01.40-P-1008-01F	Rpm	Pre-honing	rpm	-	125
		Precision honing	rpm	-	125
		Polishing	rpm	-	125
		Lapping	rpm	-	230
BE01.40-P-1009-01F	Feed	Pre-honing		-	4
		Precision honing		-	3
		Polishing		-	2
		Lapping		-	1
BE01.40-P-1010-01F	Stroke	Pre-honing	rpm	-	57
		Precision honing	rpm	-	57
		Polishing	rpm	-	57
		Lapping	rpm	-	80
BE01.40-P-1011-01F	Display	Pre-honing	%	-	20 to 30
		Precision honing	%	-	20 to 30

		Polishing	%	-	20 to 30
		Lapping	%	-	20 to 30
BE01.40-P-1012-01F	Stroke setting with 70 mm felt length on 70th stroke scale of machine		mm	-	115
BE01.40-P-1013-01F	Felt insert overrun at top and bottom		mm	-	2 to 4
BE01.40-P-1014-01F	Operating time of honing machine		s	-	70

Test specifications for cylinder bore

Number	**Designation**			**Engine 112.946/947/948/960**	**Engine 112.912**
BE01.40-P-1001-01F	Cylinder dia.	Standard marking X	mm	89.900 to 89.915	83.200 to 83.215
		Auxiliary stage marking ⊗	mm	89.950 to 89.965	83.250 to 83.265
		Repair stage	mm	90.150 to 90.165	83.450 to 83.465

BE01.40-P-1002-01F	Cylinder dia., setting for repair size (+0.25)	Pre-honing	mm	89.900	83.200
		Precision honing	mm	90.080	83.380
		Polishing	mm	90.130	83.430
BE01.40-P-1003-01F	Cylinder dia. according to machining phase	Pre-honing	mm	90.080	83.380
		Precision honing	mm	90.130	83.430
		Polishing	mm	90.150 to 90.165	83.450 to 83.465
BE01.40-P-1004-01F	Cylinder length		mm	129.5	129.5
BE01.40-P-1005-01F	Undercut		mm	12	12
BE01.40-P-1006-01F	Stroke setting with 70mm stone length on 70th stroke scale of machine		mm	130	130
BE01.40-P-1007-01F	Stone overrun at top and bottom		mm	9.5	9.5
BE01.40-P-1008-01F	Rpm	Pre-honing	rpm	125	125
		Precision honing	rpm	125	125
		Polishing	rpm	125	125
		Lapping	rpm	230	230

BE01.40-P-1009-01F	Feed	Pre-honing		4	4
		Precision honing		3	3
		Polishing		2	2
		Lapping		1	1.
BE01.40-P-1010-01F	Stroke	Pre-honing	rpm	57	57
		Precision honing	rpm	57	57
		Polishing	rpm	57	57
		Lapping	rpm	80	80
BE01.40-P-1011-01F	Display	Pre-honing	%	20 to 30	20 to 30
		Precision honing	%	20 to 30	20 to 30
		Polishing	%	20 to 30	20 to 30
		Lapping	%	20 to 30	20 to 30
BE01.40-P-1012-01F	Stroke setting with 70 mm felt length on 70th stroke scale of machine		mm	115	115
BE01.40-P-1013-01F	Felt insert overrun at top and bottom		mm	2 to 4	2 to 4
BE01.40-P-1014-01F	Operating time of honing machine		s	40	40

Number	Designation			Engine 113.960/961/962/963/964/965/967/968/971/980/981/982/984/987/988/989/990/991/992/993/995
BE01.40-P-1001-01F	Cylinder dia.	Standard marking X	mm	97.000 to 97.015
		Auxiliary stage marking ⊗	mm	97.050 to 97.065
		Repair stage	mm	97.250 to 97.265
BE01.40-P-1002-01F	Cylinder dia., setting for repair size (+0.25)	Pre-honing	mm	97.000
		Precision honing	mm	97.180
		Polishing	mm	97.230
BE01.40-P-1003-01F	Cylinder dia. according to machining phase	Pre-honing	mm	97.180

		Precision honing	mm	97.230
		Polishing	mm	97.250 to 97.265
BE01.40-P-1004-01F	Cylinder length		mm	129.5
BE01.40-P-1005-01F	Undercut		mm	12
BE01.40-P-1006-01F	Stroke setting with 70mm stone length on 70th stroke scale of machine		mm	130
BE01.40-P-1007-01F	Stone overrun at top and bottom		mm	9.5
BE01.40-P-1008-01F	Rpm	Pre-honing	rpm	125
		Precision honing	rpm	125
		Polishing	rpm	125
		Lapping	rpm	230
BE01.40-P-1009-01F	Feed	Pre-honing		4
		Precision honing		3
		Polishing		2
		Lapping		1
BE01.40-P-1010-01F	Stroke	Pre-honing	rpm	57

		Precision honing	rpm	57
		Polishing	rpm	57
		Lapping	rpm	80
BE01.40-P-1011-01F	Display	Pre-honing	%	20 to 30
		Precision honing	%	20 to 30
		Polishing	%	20 to 30
		Lapping	%	20 to 30
BE01.40-P-1012-01F	Stroke setting with 70 mm felt length on 70th stroke scale of machine		mm	115
BE01.40-P-1013-01F	Felt insert overrun at top and bottom		mm	2 to 4
BE01.40-P-1014-01F	Operating time of honing machine		s	70

Repair materials

Number	Designation	Order number
BR00.45-Z-1050-06A	Polmot honing paste Order no. 600.11	Polmat - Poliertechnik GmbH Troggberg 11 38302 Wolfenbüttel Germany