

# CYLINDER BLOCK

2. Apply the measured dimension to the “Connecting Rod Bearing Selection Table”.
3. Read the symbol at the cross point of selected row and column in the “Connecting Rod Bearing Selection Table”.
4. Apply the symbol obtained to the “Connecting Rod Bearing Grade Table” to select connecting rod bearing.

**Connecting Rod Bearing Selection Table**

Crankshaft pin journal diameter Unit: mm (in)		Connecting rod big end diameter Unit: mm (in)													
		Hole diameter													
Mark	Axle diameter	Mark													
		A	B	C	D	E	F	G	H	J	K	L	M	N	
A	43.970 - 43.971 (1.7311 - 1.7311)	0	0	0	0	0	01	01	01	1	1	1	12	12	12
B	43.969 - 43.970 (1.7311 - 1.7311)	0	0	0	0	01	01	01	1	1	1	1	12	12	12
C	43.968 - 43.969 (1.7310 - 1.7311)	0	0	0	01	01	01	1	1	1	1	12	12	12	2
D	43.967 - 43.968 (1.7310 - 1.7310)	0	0	01	01	01	1	1	1	12	12	12	2	2	2
E	43.966 - 43.967 (1.7309 - 1.7310)	0	01	01	01	1	1	1	1	12	12	12	2	2	2
F	43.965 - 43.966 (1.7309 - 1.7309)	01	01	01	1	1	1	1	12	12	12	2	2	2	23
G	43.964 - 43.965 (1.7309 - 1.7309)	01	01	1	1	1	1	12	12	12	2	2	2	23	23
H	43.963 - 43.964 (1.7308 - 1.7309)	01	1	1	1	12	12	12	2	2	2	23	23	23	23
J	43.962 - 43.963 (1.7308 - 1.7308)	1	1	1	12	12	12	2	2	2	2	23	23	23	3
K	43.961 - 43.962 (1.7307 - 1.7308)	1	1	12	12	12	2	2	2	2	23	23	23	3	3
L	43.960 - 43.961 (1.7307 - 1.7307)	1	12	12	12	2	2	2	2	23	23	23	3	3	3
M	43.959 - 43.960 (1.7307 - 1.7307)	12	12	12	2	2	2	2	23	23	23	3	3	3	34
N	43.958 - 43.959 (1.7306 - 1.7307)	12	12	2	2	2	2	23	23	23	3	3	3	34	34
P	43.957 - 43.958 (1.7306 - 1.7306)	12	2	2	2	2	23	23	23	3	3	3	34	34	34
R	43.956 - 43.957 (1.7305 - 1.7306)	2	2	2	23	23	23	3	3	3	3	34	34	34	4
S	43.955 - 43.956 (1.7305 - 1.7305)	2	2	23	23	23	3	3	3	3	34	34	34	4	4
T	43.954 - 43.955 (1.7305 - 1.7305)	2	23	23	23	3	3	3	3	34	34	34	4	4	4
U	43.953 - 43.954 (1.7304 - 1.7305)	23	23	23	3	3	3	3	34	34	34	4	4	4	4

PBIC4077E

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## Connecting Rod Bearing Grade Table

Unit: mm (in)

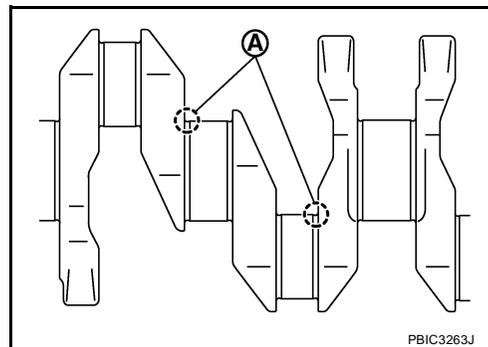
Grade number		Thickness	Identification color	Remarks
0		1.494 - 1.497 (0.0588 - 0.0589)	Black	Grade and color are the same for upper and lower bearings.
1		1.497 - 1.500 (0.0589 - 0.0591)	Brown	
2		1.500 - 1.503 (0.0591 - 0.0592)	Green	
3		1.503 - 1.506 (0.0592 - 0.0593)	Yellow	
4		1.506 - 1.509 (0.0593 - 0.0594)	Blue	
01	UPR	1.494 - 1.497 (0.0588 - 0.0589)	Black	Grade and color are different between upper and lower bearings.
	LWR	1.497 - 1.500 (0.0589 - 0.0591)	Brown	
12	UPR	1.497 - 1.500 (0.0589 - 0.0591)	Brown	
	LWR	1.500 - 1.503 (0.0591 - 0.0592)	Green	
23	UPR	1.500 - 1.503 (0.0591 - 0.0592)	Green	
	LWR	1.503 - 1.506 (0.0592 - 0.0593)	Yellow	
34	UPR	1.503 - 1.506 (0.0592 - 0.0593)	Yellow	
	LWR	1.506 - 1.509 (0.0593 - 0.0594)	Blue	

### Undersize Bearings Usage Guide

- When the specified connecting rod bearing oil clearance is not obtained with standard size connecting rod bearings, use undersize (US) bearings.
- When using undersize (US) bearing, measure the connecting rod bearing inner diameter with bearing installed, and grind the crankshaft pin so that the connecting rod bearing oil clearance satisfies the standard.

**CAUTION:**

In grinding crankshaft pin to use undersize bearings, keep the fillet R [1.5 - 1.7 mm (0.059 - 0.067 in)] (A).



### Bearing undersize table

Unit: mm (in)

Size	Thickness
US 0.25 (0.0098)	1.623 - 1.631 (0.0639 - 0.0642)

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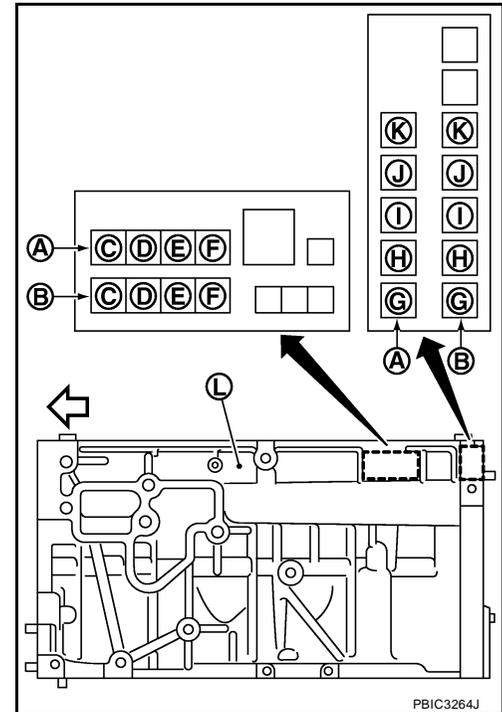
## HOW TO SELECT MAIN BEARING

### When New Cylinder Block and Crankshaft are Used

1. "Main Bearing Selection Table" rows correspond to main bearing housing grade on rear left side of cylinder block (L).

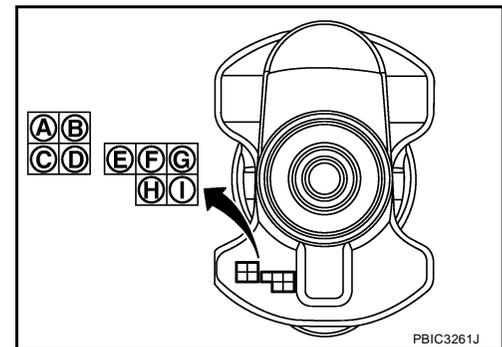
- A : Correction stamp
- B : Standard stamp
- C : Cylinder No. 1 bore grade
- D : Cylinder No. 2 bore grade
- E : Cylinder No. 3 bore grade
- F : Cylinder No. 4 bore grade
- G : No. 1 main bearing housing grade
- H : No. 2 main bearing housing grade
- I : No. 3 main bearing housing grade
- J : No. 4 main bearing housing grade
- K : No. 5 main bearing housing grade
- ↔ : Engine front

- If there is a correction stamp mark on cylinder block, use it as a correct reference.



2. Apply main journal diameter grade stamped on crankshaft front side to column in the "Main Bearing Selection Table".

- A : No. 1 pin journal diameter grade
- B : No. 2 pin journal diameter grade
- C : No. 3 pin journal diameter grade
- D : No. 4 pin journal diameter grade
- E : No. 1 main journal diameter grade
- F : No. 2 main journal diameter grade
- G : No. 3 main journal diameter grade
- H : No. 4 main journal diameter grade
- I : No. 5 main journal diameter grade



3. Read the symbol at the cross point of selected row and column in the "Main Bearing Selection Table".

### CAUTION:

There are two main bearing selection tables. One is for No. 1, 4 and 5 journals and the other is for No. 2 and 3 journals. Make certain to use the appropriate table. This is due to differences in the specified clearances.

4. Apply the symbol obtained to the "Main Bearing Grade Table" to select main bearing.

### NOTE:

Service part is available as a set of both upper and lower.

### When Cylinder Block and Crankshaft are Reused

1. Measure the dimensions of the cylinder block main bearing housing inner diameter and crankshaft main journal diameter individually. Refer to [EM-99, "MAIN BEARING HOUSING INNER DIAMETER"](#) and [EM-101, "CRANKSHAFT MAIN JOURNAL DIAMETER"](#).
2. Apply the measured dimension to the "Main Bearing Selection Table".
3. Read the symbol at the cross point of selected row and column in the "Main Bearing Selection Table".

# CYLINDER BLOCK

**CAUTION:**

There are two main bearing selection tables. One is for No. 1, 4 and 5 journals and the other is for No. 2 and 3 journals. Make certain to use the appropriate table. This is due to differences in the specified clearances.

- Apply the symbol obtained to the "Main Bearing Grade Table" to select main bearing.

**NOTE:**

Service part is available as a set of both upper and lower.

**Main Bearing Selection Table (No. 1, 4 and 5 journals)**

Cylinder block main bearing housing inner diameter Unit: mm (in)		Crankshaft main journal diameter Unit: mm (in)		Mark																							
				Hole diameter																							
Mark	Axle diameter	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W						
A	51.978 - 51.979 (2.0464 - 2.0464)	0	0	0	0	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23				
B	51.977 - 51.978 (2.0463 - 2.0464)	0	0	0	0	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23				
C	51.976 - 51.977 (2.0463 - 2.0463)	0	0	0	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23					
D	51.975 - 51.976 (2.0463 - 2.0463)	0	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3				
E	51.974 - 51.975 (2.0462 - 2.0463)	0	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3					
F	51.973 - 51.974 (2.0462 - 2.0462)	0	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	3					
G	51.972 - 51.973 (2.0461 - 2.0462)	0	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	3	3	34				
H	51.971 - 51.972 (2.0461 - 2.0461)	01	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	3	34	34	34				
J	51.970 - 51.971 (2.0461 - 2.0461)	01	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	3	34	34	34	34				
K	51.969 - 51.970 (2.0460 - 2.0461)	01	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4				
L	51.968 - 51.969 (2.0460 - 2.0460)	1	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4				
M	51.967 - 51.968 (2.0459 - 2.0460)	1	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4	4				
N	51.966 - 51.967 (2.0459 - 2.0459)	1	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4	4	45				
P	51.965 - 51.966 (2.0459 - 2.0459)	12	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4	45	45	45				
R	51.964 - 51.965 (2.0458 - 2.0459)	12	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4	45	45	45					
S	51.963 - 51.964 (2.0458 - 2.0458)	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4	45	45	45	5	5				
T	51.962 - 51.963 (2.0457 - 2.0458)	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4	45	45	45	5	5	5				
U	51.961 - 51.962 (2.0457 - 2.0457)	2	2	23	23	23	3	3	3	34	34	34	4	4	4	4	45	45	45	5	5	5	5				
V	51.960 - 51.961 (2.0457 - 2.0457)	2	23	23	23	3	3	3	34	34	34	4	4	4	4	45	45	45	5	5	5	5	5				
W	51.959 - 51.960 (2.0456 - 2.0457)	23	23	23	3	3	3	34	34	34	4	4	4	4	45	45	45	5	5	5	5	5	5				

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## Main Bearing Selection Table (No. 2 and 3 journals)

Cylinder block main bearing housing inner diameter Unit: mm (in)		Mark		Hole diameter																																											
				A B C D E F G H J K L M N P R S T U V W																																											
Mark	Axle diameter	Crankshaft main journal diameter Unit: mm (in)																																													
		55.997 - 55.998 (2.2046 - 2.2046) 55.998 - 55.999 (2.2046 - 2.2047) 55.999 - 56.000 (2.2047 - 2.2047) 56.000 - 56.001 (2.2047 - 2.2048) 56.001 - 56.002 (2.2048 - 2.2048) 56.002 - 56.003 (2.2048 - 2.2048) 56.003 - 56.004 (2.2048 - 2.2049) 56.004 - 56.005 (2.2049 - 2.2049) 56.005 - 56.006 (2.2049 - 2.2050) 56.006 - 56.007 (2.2050 - 2.2050) 56.007 - 56.008 (2.2050 - 2.2050) 56.008 - 56.009 (2.2050 - 2.2051) 56.009 - 56.010 (2.2051 - 2.2051) 56.010 - 56.011 (2.2051 - 2.2052) 56.011 - 56.012 (2.2052 - 2.2052) 56.012 - 56.013 (2.2052 - 2.2052) 56.013 - 56.014 (2.2052 - 2.2053) 56.014 - 56.015 (2.2053 - 2.2053) 56.015 - 56.016 (2.2053 - 2.2053) 56.016 - 56.017 (2.2053 - 2.2054)																																													
A	51.978 - 51.979 (2.0464 - 2.0464)	1	12	12	12	2	2	2	23	23	23	23	3	3	3	34	34	34	34	4	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	
B	51.977 - 51.978 (2.0463 - 2.0464)	12	12	12	2	2	2	23	23	23	23	3	3	3	34	34	34	34	4	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7		
C	51.976 - 51.977 (2.0463 - 2.0463)	12	12	2	2	2	23	23	23	3	3	3	34	34	34	34	4	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7				
D	51.975 - 51.976 (2.0463 - 2.0463)	12	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	7	7	7			
E	51.974 - 51.975 (2.0462 - 2.0463)	2	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	7	7	7	7			
F	51.973 - 51.974 (2.0462 - 2.0462)	2	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	7	7	7	7	7			
G	51.972 - 51.973 (2.0461 - 2.0462)	2	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	7	7	7	7	7	7	7		
H	51.971 - 51.972 (2.0461 - 2.0461)	23	23	23	3	3	3	34	34	34	4	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	7	7	7	7	7	7	7	7		
J	51.970 - 51.971 (2.0461 - 2.0461)	23	23	3	3	3	34	34	34	4	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7		
K	51.969 - 51.970 (2.0460 - 2.0461)	23	3	3	3	34	34	34	4	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7		
L	51.968 - 51.969 (2.0460 - 2.0460)	3	3	3	34	34	34	4	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7		
M	51.967 - 51.968 (2.0459 - 2.0460)	3	3	34	34	34	4	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7		
N	51.966 - 51.967 (2.0459 - 2.0459)	3	34	34	34	4	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	
P	51.965 - 51.966 (2.0459 - 2.0459)	34	34	34	4	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	
R	51.964 - 51.965 (2.0458 - 2.0459)	34	34	4	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	
S	51.963 - 51.964 (2.0458 - 2.0458)	34	4	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
T	51.962 - 51.963 (2.0457 - 2.0458)	4	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
U	51.961 - 51.962 (2.0457 - 2.0457)	4	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
V	51.960 - 51.961 (2.0457 - 2.0457)	4	45	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
W	51.959 - 51.960 (2.0456 - 2.0457)	45	45	45	5	5	5	56	56	56	56	6	6	6	67	67	67	67	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7

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# CYLINDER BLOCK

## Main Bearing Grade Table (All Journals)

Unit: mm (in)

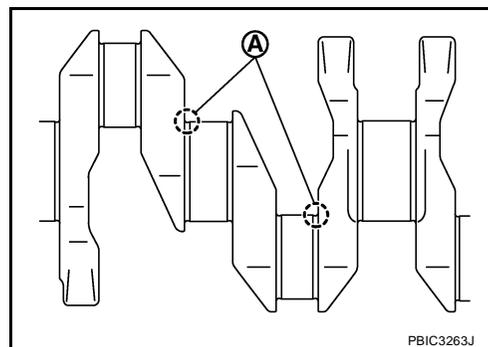
Grade number	Thickness	Identification color	Remarks
0	1.996 - 1.999 (0.0786 - 0.0787)	Black	Grade and color are the same for upper and lower bearings.
1	1.999 - 2.002 (0.0787 - 0.0788)	Brown	
2	2.002 - 2.005 (0.0788 - 0.0789)	Green	
3	2.005 - 2.008 (0.0789 - 0.0791)	Yellow	
4	2.008 - 2.011 (0.0791 - 0.0792)	Blue	
5	2.011 - 2.014 (0.0792 - 0.0793)	Pink	
6	2.014 - 2.017 (0.0793 - 0.0794)	Purple	
7	2.017 - 2.020 (0.0794 - 0.0795)	White	
01	UPR	1.996 - 1.999 (0.0786 - 0.0787)	Grade and color are different between upper and lower bearings.
	LWR	1.999 - 2.002 (0.0787 - 0.0788)	
12	UPR	1.999 - 2.002 (0.0787 - 0.0788)	
	LWR	2.002 - 2.005 (0.0788 - 0.0789)	
23	UPR	2.002 - 2.005 (0.0788 - 0.0789)	
	LWR	2.005 - 2.008 (0.0789 - 0.0791)	
34	UPR	2.005 - 2.008 (0.0789 - 0.0791)	
	LWR	2.008 - 2.011 (0.0791 - 0.0792)	
45	UPR	2.008 - 2.011 (0.0791 - 0.0792)	
	LWR	2.011 - 2.014 (0.0792 - 0.0793)	
56	UPR	2.011 - 2.014 (0.0792 - 0.0793)	
	LWR	2.014 - 2.017 (0.0793 - 0.0794)	
67	UPR	2.014 - 2.017 (0.0793 - 0.0794)	
	LWR	2.017 - 2.020 (0.0794 - 0.0795)	

### Use Undersize Bearing Usage Guide

- When the specified main bearing oil clearance is not obtained with standard size main bearings, use undersize (US) bearing.
- When using undersize (US) bearing, measure the main bearing inner diameter with bearing installed, and grind main journal so that the main bearing oil clearance satisfies the standard.

#### CAUTION:

In grinding crankshaft main journal to use undersize bearings, keep the fillet R [1.5 - 1.7 mm (0.059 - 0.067 in)] (A).



### Bearing undersize table

Unit: mm (in)

Size	Thickness
US 0.25 (0.0098)	2.126 - 2.134 (0.0837 - 0.0840)

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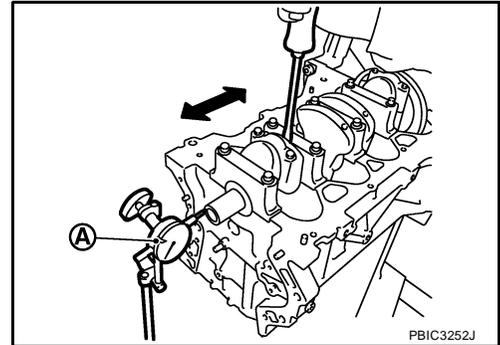
## Inspection After Disassembly CRANKSHAFT END PLAY

- Measure the clearance between thrust bearings and crankshaft arm when crankshaft is moved fully forward or backward with a dial indicator (A).

**Standard : 0.10 - 0.26 mm (0.0039 - 0.0102 in)**

**Limit : 0.30 mm (0.012 in)**

- If the measured value exceeds the limit, replace thrust bearings, and measure again. If it still exceeds the limit, replace crankshaft also.



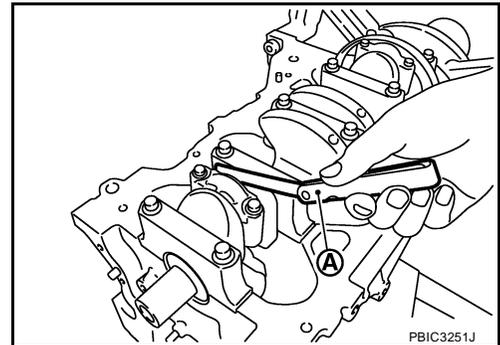
## CONNECTING ROD SIDE CLEARANCE

- Measure the side clearance between connecting rod and crankshaft arm with a feeler gauge (A).

**Standard : 0.20 - 0.35 mm (0.0079 - 0.0138 in)**

**Limit : 0.40 mm (0.0157 in)**

- If the measured value exceeds the limit, replace connecting rod, and measure again. If it still exceeds the limit, replace crankshaft also.

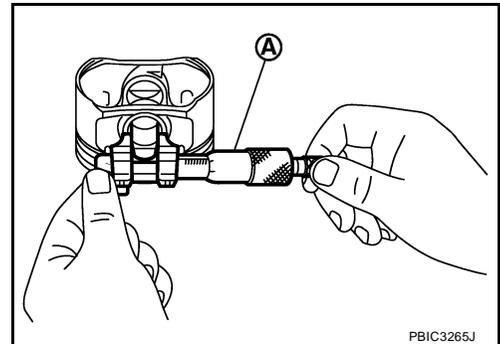


## PISTON TO PISTON PIN OIL CLEARANCE

### Piston Pin Hole Diameter

Measure the inner diameter of piston pin hole with an inside micrometer (A).

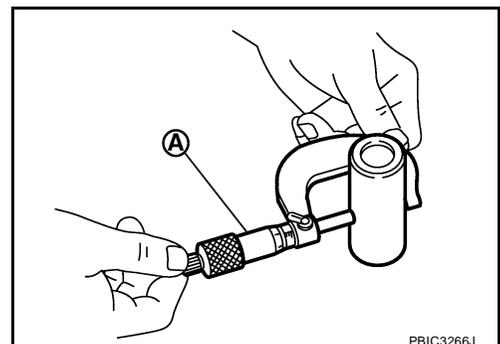
**Standard: 19.993 - 19.999 mm (0.7871 - 0.7874 in)**



### Piston Pin Outer Diameter

Measure the outer diameter of piston pin with a micrometer (A).

**Standard: 19.989 - 19.995 mm (0.7870 - 0.7872 in)**



### Piston to Piston Pin Oil Clearance

(Piston to piston pin oil clearance) = (Piston pin hole diameter) – (Piston pin outer diameter)

**Standard: 0.002 - 0.006 mm (0.0001 - 0.0002 in)**

- If oil clearance is out of the standard, replace piston and piston pin assembly.

# CYLINDER BLOCK

- When replacing piston and piston pin assembly, refer to [EM-100, "Piston to Cylinder Bore Clearance"](#) .

## NOTE:

- Piston is available together with piston pin as assembly.
- Piston pin (piston pin hole) grade is provided only for the parts installed at the plant. For service parts, no grades can be selected. (Only grade "0" is available.)

## PISTON RING SIDE CLEARANCE

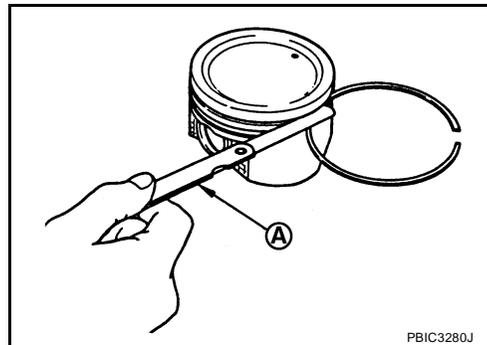
- Measure the side clearance of piston ring and piston ring groove with a feeler gauge (A).

### Standard:

- Top ring : 0.04 - 0.08 mm (0.002 - 0.003 in)
- 2nd ring : 0.03 - 0.07 mm (0.001 - 0.003 in)
- Oil ring : 0.015 - 0.185 mm (0.001 - 0.007 in)

### Limit:

- Top ring : 0.11 mm (0.0043 in)
- 2nd ring : 0.10 mm (0.0039 in)



- If the measured value exceeds the limit, replace piston ring, and measure again. If it still exceeds the limit, replace piston also.

## PISTON RING END GAP

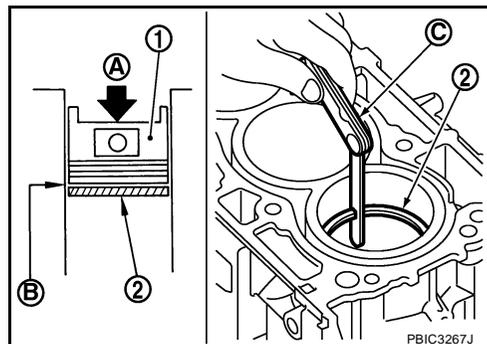
- Make sure that cylinder bore inner diameter is within specification. Refer to [EM-100, "Cylinder Bore Inner Diameter"](#) .
- Lubricate with new engine oil to piston (1) and piston ring (2), and then insert (A) piston ring until middle of cylinder (B) with piston, and measure piston ring end gap with a feeler gauge (C).

### Standard:

- Top ring : 0.20 - 0.30 mm (0.008 - 0.012 in)
- 2nd ring : 0.50 - 0.65 mm (0.020 - 0.026 in)
- Oil ring (rail ring) : 0.15 - 0.45 mm (0.006 - 0.018 in)

### Limit:

- Top ring : 0.51 mm (0.020 in)
- 2nd ring : 0.83 mm (0.033 in)
- Oil ring (rail ring) : 0.78 mm (0.031 in)



- If the measured value exceeds the limit, replace piston ring, and measure again. If it still exceeds the limit, re-bore cylinder and use oversized piston and piston rings.

# CYLINDER BLOCK

## CONNECTING ROD BEND AND TORSION

- Check with a connecting rod aligner.

C : Feeler gauge

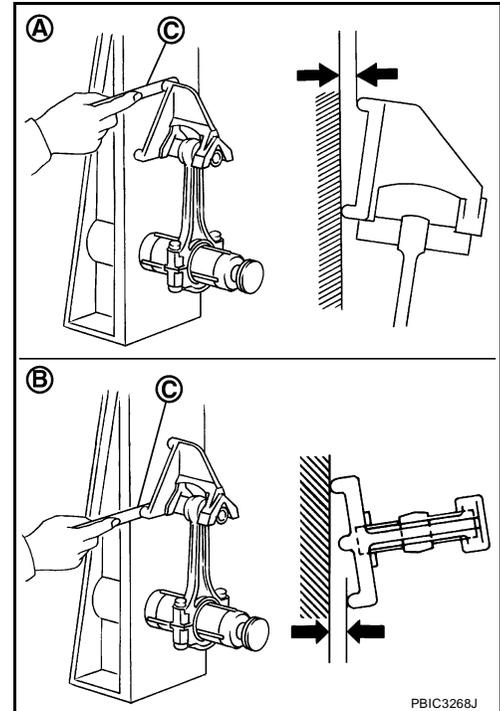
### Bend (A):

Limit: 0.15 mm (0.0059 in) per 100 mm (3.94 in) length

### Torsion (B):

Limit: 0.30 mm (0.0118 in) per 100 mm (3.94 in) length

- If it exceeds the limit, replace connecting rod assembly.



## CONNECTING ROD BIG END DIAMETER

- Install connecting rod cap (1) without connecting rod bearing installed, and tightening connecting rod bolts to the specified torque. Refer to [EM-82, "ASSEMBLY"](#) for the tightening procedure.

2 : Connecting rod

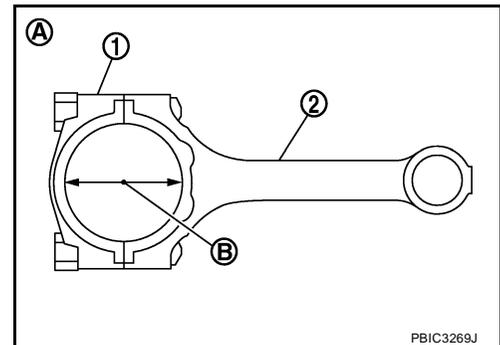
A : Example

B : Measuring direction of inner diameter

- Measure the inner diameter of connecting rod big end with an inside micrometer.

Standard: 47.000 - 47.013 mm (1.8504 - 1.8509 in)

- If out of the standard, replace connecting rod assembly.

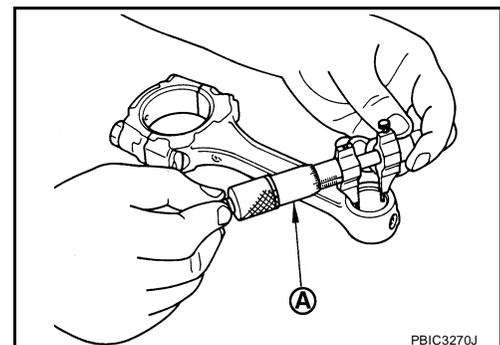


## CONNECTING ROD BUSHING OIL CLEARANCE

### Connecting Rod Bushing Inner Diameter

Measure the inner diameter of connecting rod bushing with an inside micrometer (A).

Standard: 20.000 - 20.012 mm (0.7874 - 0.7879 in)

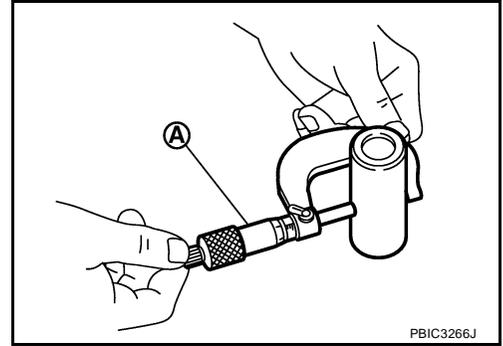


# CYLINDER BLOCK

## Piston Pin Outer Diameter

Measure the outer diameter of piston pin with a micrometer (A).

**Standard: 19.989 - 19.995 mm (0.7870 - 0.7872 in)**



## Connecting Rod Bushing Oil Clearance

(Connecting rod bushing oil clearance) = (Connecting rod bushing inner diameter) – (Piston pin outer diameter)

**Standard : 0.005 - 0.023 mm (0.0002 - 0.0009 in)**

**Limit : 0.03 mm (0.0012 in)**

- If the measured value is out of the standard, replace connecting rod assembly and/or piston and piston pin assembly.
- If replacing piston and piston pin assembly, refer to [EM-96, "PISTON TO PISTON PIN OIL CLEARANCE"](#)
- If replacing connecting rod assembly, refer to [EM-99, "Connecting Rod Bushing Oil Clearance"](#) to select connecting rod bearing.

## CYLINDER BLOCK TOP SURFACE DISTORTION

- Using a scraper, remove gasket on the cylinder block surface, and also remove engine oil, scale, carbon, or other contamination.

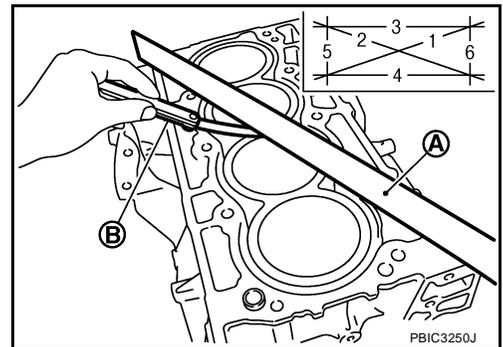
### CAUTION:

**Be careful not to allow gasket flakes to enter engine oil or engine coolant passages.**

- Measure the distortion on the cylinder block upper face at some different points in six directions with a straight edge (A) and feeler gauge (B).

**Limit: 0.1 mm (0.004 in)**

- If it exceeds the limit, replace cylinder block.



## MAIN BEARING HOUSING INNER DIAMETER

- Install main bearing cap without main bearings installed, and tighten main bearing cap bolts to the specified torque. Refer to [EM-82, "ASSEMBLY"](#) for the tightening procedure.
- Measure the inner diameter of main bearing housing with a bore gauge.

# CYLINDER BLOCK

- Measure the position shown [5 mm (0.20 in)] backward from main bearing housing front side in the 2 directions as shown. The smaller one is the measured value.

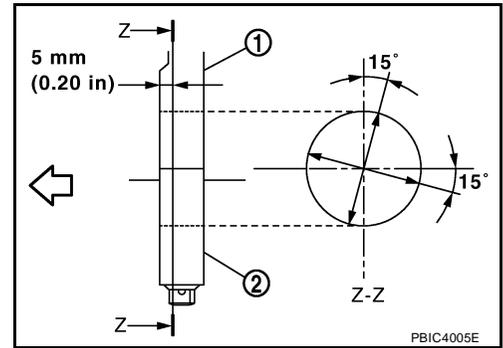
- 1 : Cylinder block
- 2 : Main bearing cap
- ⇐ : Engine front

**Standard: 55.997 - 56.017 mm (2.2046 - 2.2054 in)**

- If out of the standard, replace cylinder block and main bearing caps assembly.

**NOTE:**

Main bearing caps cannot be replaced as a single, because it is machined together with cylinder block.



## PISTON TO CYLINDER BORE CLEARANCE

### Cylinder Bore Inner Diameter

- Using a bore gauge (A), measure the cylinder bore for wear, out-of-round and taper at six different points on each cylinder. ("X" and "Y" directions at "A", "B" and "C") ("Y" is in longitudinal direction of engine)

**NOTE:**

When determining cylinder bore grade, measure the cylinder bore "X" direction at "B" position.

**Standard inner diameter:**

**84.000 - 84.020 mm (3.3071 - 3.3079 in)**

**Out-of-round (Difference between "X" and "Y"):**

**0.015 mm (0.0006 in)**

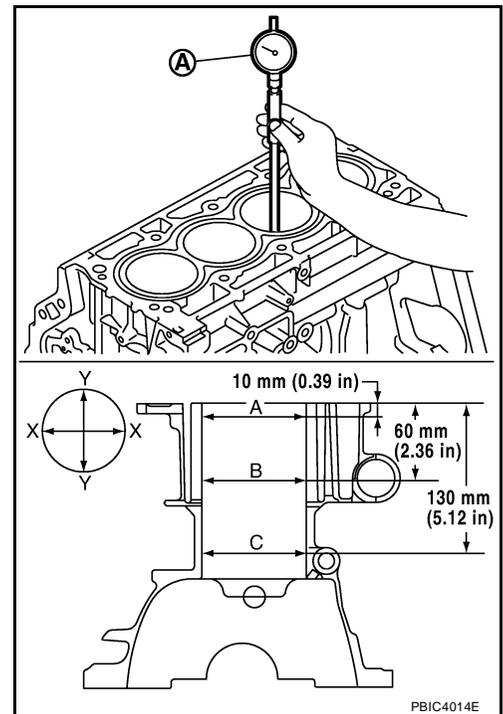
**Taper limit (Difference between "A" and "C"):**

**0.01 mm (0.0004 in)**

- If the measured value exceeds the limit, or if there are scratches and/or seizure on the cylinder inner wall, replace cylinder block.

**NOTE:**

Oversize piston is not provided.



### Piston Skirt Diameter

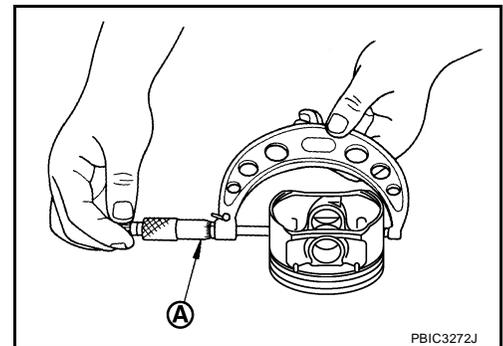
Measure the outer diameter of piston skirt with a micrometer (A).

**Measure point**

**: Distance from the top 39.9 mm (1.571 in)**

**Standard**

**: 83.970 - 83.990 mm (3.3059 - 3.3067 in)**



### Piston to Cylinder Bore Clearance

Calculate by piston skirt diameter and cylinder bore inner diameter (direction "X", position "B").  
 (Clearance) = (Cylinder bore inner diameter) – (Piston skirt diameter)

**Standard : 0.020 - 0.040 mm (0.0008 - 0.0016 in)**

**Limit : 0.08 mm (0.0031 in)**

# CYLINDER BLOCK

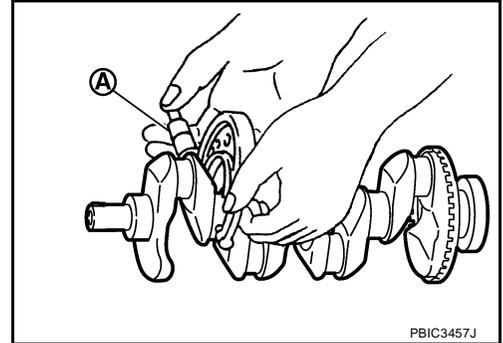
- If it exceeds the limit, replace piston and piston pin assembly and/or cylinder block. Refer to [EM-88, "HOW TO SELECT PISTON"](#) .

## CRANKSHAFT MAIN JOURNAL DIAMETER

- Measure the outer diameter of crankshaft main journals with a micrometer (A).

**Standard: 51.959 - 51.979 mm (2.0456 - 2.0464 in) dia.**

- If out of the standard, measure the main bearing oil clearance. Then use undersize bearing. Refer to [EM-102, "MAIN BEARING OIL CLEARANCE"](#) .



## CRANKSHAFT PIN JOURNAL DIAMETER

- Measure the outer diameter of crankshaft pin journal with a micrometer.

**Standard: 43.953 - 43.971 mm (1.7304-1.7311 in) dia.**

- If out of the standard, measure the connecting rod bearing oil clearance. Then use undersize bearing. Refer to [EM-102, "CONNECTING ROD BEARING OIL CLEARANCE"](#) .

## OUT-OF-ROUND AND TAPER OF CRANKSHAFT

- Measure the dimensions at four different points as shown on each main journal and pin journal with a micrometer.
- Out-of-round is indicated by the difference in dimensions between "X" and "Y" at "A" and "B".
- Taper is indicated by the difference in dimension between "A" and "B" at "X" and "Y".

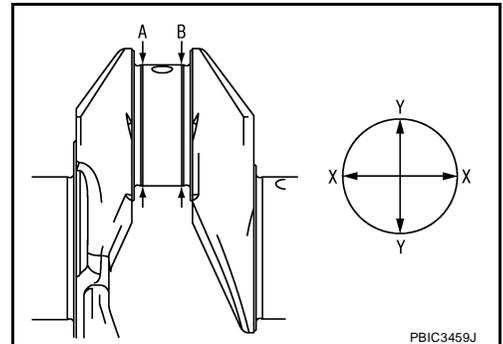
**Limit:**

**Out-of-round (Difference between "X" and "Y")**

**: 0.0035 mm (0.0001 in)**

**Taper (Difference between "A" and "B")**

**: 0.0035 mm (0.0001 in)**



- If the measured value exceeds the limit, correct or replace crankshaft.
- If corrected, measure the bearing oil clearance of the corrected main journal and/or pin journal. Then select main bearing and/or connecting rod bearing. Refer to [EM-102, "MAIN BEARING OIL CLEARANCE"](#) and/or [EM-102, "CONNECTING ROD BEARING OIL CLEARANCE"](#) .

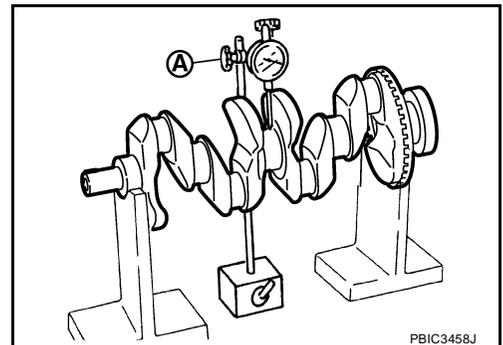
## CRANKSHAFT RUNOUT

- Place a V-block on a precise flat table to support the journals on the both end of the crankshaft.
- Place a dial indicator (A) straight up on the No. 3 journal.
- While rotating crankshaft, read the movement of the pointer on the dial indicator. (Total indicator reading)

**Standard : 0.05 mm (0.0020 in)**

**Limit : 0.10 mm (0.0040 in)**

- If it exceeds the limit, replace crankshaft.



# CYLINDER BLOCK

## CONNECTING ROD BEARING OIL CLEARANCE

### Method by Calculation

- Install connecting rod bearings (2) to connecting rod (3) and connecting rod bearing cap (1), and tighten connecting rod bolts to the specified torque. Refer to [EM-82, "ASSEMBLY"](#) for tightening procedure.

A : Example

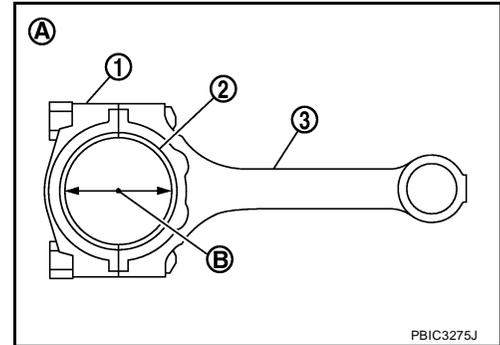
B : Inner diameter measuring direction

- Measure the inner diameter of connecting rod bearing with an inside micrometer.  
(Bearing oil clearance) = (Connecting rod bearing inner diameter) – (Crankshaft pin journal diameter)

**Standard** : 0.037 - 0.047 mm (0.0015 - 0.0019 in)

**Limit** : 0.07 mm (0.0028 in)

- If clearance exceeds the limit, select proper connecting rod bearing according to connecting rod big end diameter and crankshaft pin journal diameter to obtain specified bearing oil clearance. Refer to [EM-89, "HOW TO SELECT CONNECTING ROD BEARING"](#).



### Method of Using Plastigage

- Remove engine oil and dust on crankshaft pin and the surfaces of each bearing completely.
- Cut a plastigage slightly shorter than the bearing width, and place it in crankshaft axial direction, avoiding oil holes.
- Install connecting rod bearings to connecting rod and cap, and tighten connecting rod bolts to the specified torque. Refer to [EM-82, "ASSEMBLY"](#) for the tightening procedure.

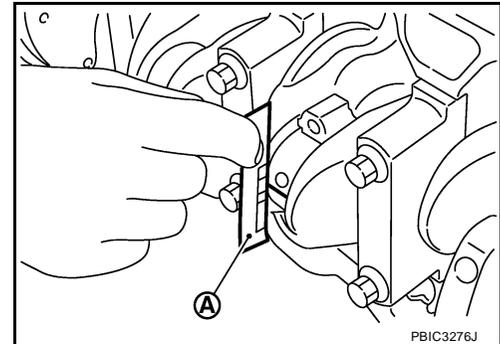
#### CAUTION:

**Never rotate crankshaft.**

- Remove connecting rod cap and bearing, and using the scale (A) on the plastigage bag, measure the plastigage width.

#### NOTE:

The procedure when the measured value exceeds the limit is same as that described in the "Method by Calculation".



## MAIN BEARING OIL CLEARANCE

### Method by Calculation

- Install main bearings (3) to cylinder block (1) and main bearing cap (2), and tighten main bearing cap bolts to the specified torque. Refer to [EM-82, "ASSEMBLY"](#) for the tightening procedure.

A : Example

B : Inner diameter measuring direction

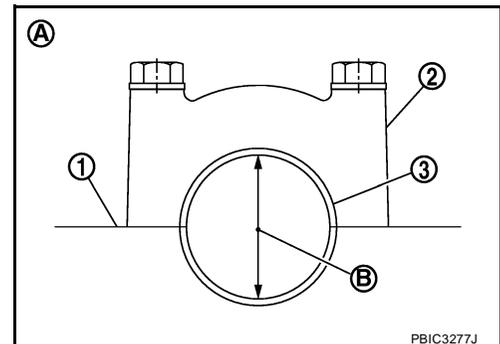
- Measure the inner diameter of main bearing with a bore gauge.  
(Bearing oil clearance) = (Main bearing inner diameter) – (Crankshaft main journal diameter)

**Standard:**

**No. 1, 4 and 5 journals**

: 0.024 - 0.034 mm (0.0009 - 0.0013 in)

**No. 2 and 3 journals**



# CYLINDER BLOCK

: 0.012 - 0.022 mm (0.0005 - 0.0009 in)

Limit : 0.065 mm (0.0026 in)

- If clearance exceeds the limit, select proper main bearing according to main bearing inner diameter and crankshaft main journal diameter to obtain specified bearing oil clearance. Refer to [EM-92, "HOW TO SELECT MAIN BEARING"](#) .

## Method of Using Plastigage

- Remove engine oil and dust on crankshaft main journal and the surfaces of each bearing completely.
- Cut a plastigage slightly shorter than the bearing width, and place it in crankshaft axial direction, avoiding oil holes.
- Install main bearings to cylinder block and main bearing cap, and tighten main bearing cap bolts to the specified torque. Refer to [EM-82, "ASSEMBLY"](#) for the tightening procedure.

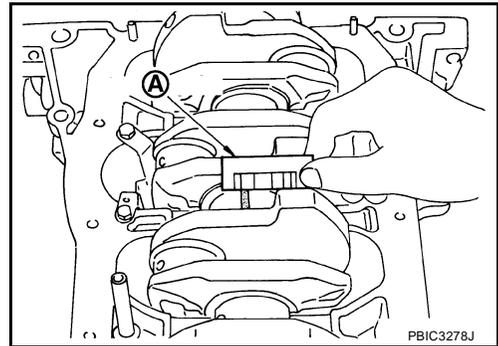
### CAUTION:

**Never rotate crankshaft.**

- Remove main bearing cap and bearings, and using the scale (A) on the plastigage bag, measure the plastigage width.

### NOTE:

The procedure when the measured value exceeds the limit is same as that described in the "Method by Calculation".



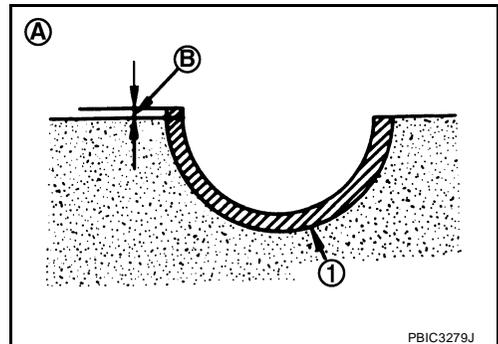
## MAIN BEARING CRUSH HEIGHT

- When main bearing cap is removed after being tightened to the specified torque with main bearings (1) installed, the tip end of bearing must protrude (B). Refer to [EM-82, "ASSEMBLY"](#) for the tightening procedure.

A : Example

Standard : There must be crush height.

- If the standard is not met, replace main bearings.



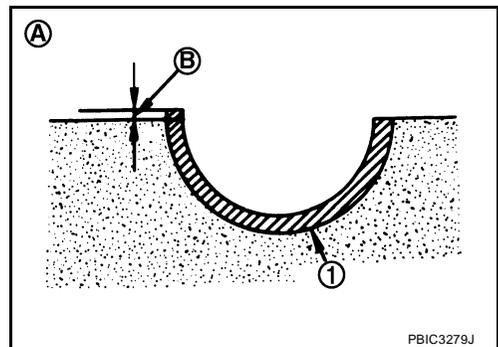
## CONNECTING ROD BEARING CRUSH HEIGHT

- When connecting rod bearing cap is removed after being tightened to the specified torque with connecting rod bearings (1) installed, the tip end of bearing must protrude. Refer to [EM-82, "ASSEMBLY"](#) for the tightening procedure (B).

A : Example

Standard : There must be crush height.

- If the standard is not met, replace connecting rod bearings.



# CYLINDER BLOCK

## MAIN BEARING CAP BOLT OUTER DIAMETER

- Measure the outer diameters (“d1”, “d2”) at two positions as shown.

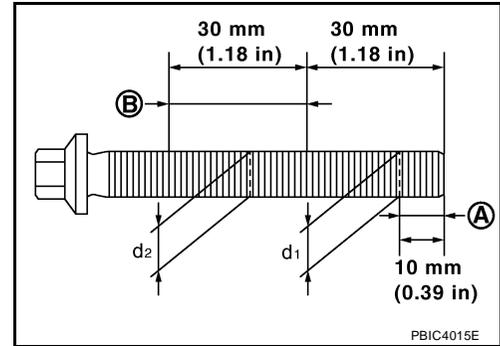
A : “d1” measuring position

B : “d2” measuring position

- If reduction appears in places other than “B” range, regard it as “d2”.

**Limit (“d1” – “d2”): 0.15 mm (0.0059 in)**

- If it exceeds the limit (a large difference in dimensions), replace main bearing cap bolt with a new one.

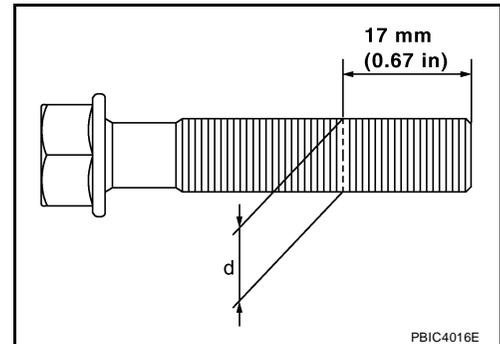


## CONNECTING ROD BOLT OUTER DIAMETER

- Measure the outer diameter “d” at position as shown.
- If reduction appears in a position other than “d”, regard it as “d”.

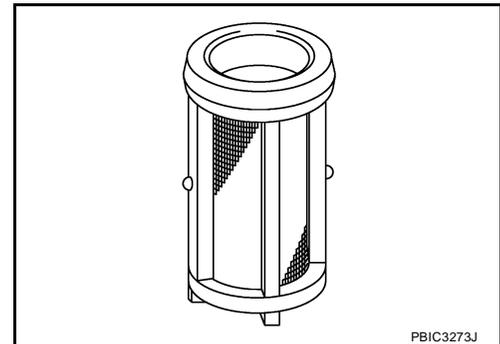
**Limit: 7.75 mm (0.3051 in)**

- When “d” exceeds the limit (when it becomes thinner), replace connecting rod bolt with a new one.



## CLOGGED OR DAMAGED OIL FILTER (FOR INTAKE VALVE TIMING CONTROL)

- Make sure that there is no foreign material on the oil filter and check it for clogging.
  - Clean it if necessary.
- Check the oil filter for damage.
  - Replace it if necessary.



## FLYWHEEL DEFLECTION (M/T MODELS)

- Measure the deflection of flywheel contact surface to clutch with a dial indicator (A).
- Measure the deflection at 210 mm (8.27 in) diameter.

**Limit : 0.45 mm (0.0177 in) or less.**

- If measured value is out of the standard, replace flywheel.
- If a trace of burn or discoloration is found on the surface, repair it with sandpaper.

### CAUTION:

When measuring, keep magnetic fields (such as dial indicator stand) away from signal plate of the rear end of crankshaft.

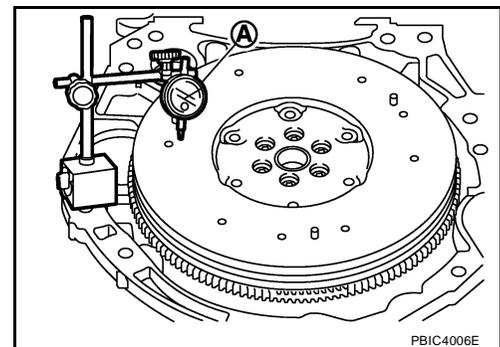
## MOVEMENT AMOUNT OF FLYWHEEL (M/T MODELS)

### CAUTION:

Never disassemble double mass flywheel.

## Movement Amount of Thrust (Fore-and-Aft) Direction

- Measure the movement amount of thrust (fore-and-aft) direction when 100 N (10.2 kg, 22 lb) force is added at the portion of 125 mm (4.92 in) radius from the center of flywheel.



# CYLINDER BLOCK

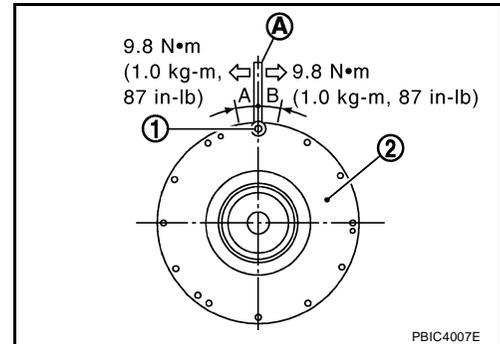
**Standard : 1.8 mm (0.071 in) or less**

- If measured value is out of the standard, replace flywheel.

## Movement Amount in Radial (Rotation) Direction

Check the movement amount of radial (rotation) direction with the following procedure:

1. Install clutch cover bolt (1) to clutch cover mating hole, and place a torque wrench (A) on the extended line of the flywheel (2) center line.
  - Tighten bolt at a force of 9.8 N·m (1.0 kg-m, 87 in-lb) to keep it from loosening.
2. Put a mating mark on circumferences of the two flywheel masses without applying any load (Measurement standard points).
3. Apply a force of 9.8 N·m (1.0 kg-m, 87 in-lb) in each direction, and mark the movement amount on the mass on the transaxle side.
4. Measure the dimensions of movement amounts "A" and "B" on circumference of the flywheel on the transaxle side.



**Limit: 33.2 mm (1.307 in) or less.**

- If measured value is out of the standard, replace flywheel.

# SERVICE DATA AND SPECIFICATIONS (SDS)

## SERVICE DATA AND SPECIFICATIONS (SDS)

PF0:00030

### Standard and Limit GENERAL SPECIFICATIONS

EBS00U80

Engine type		MR18DE
Cylinder arrangement		In-line 4
Displacement	cm <sup>3</sup> (cu in)	1,797 (109.65)
Bore and stroke	mm (in)	84.0 x 81.1 (3.307 x 3.192)
Valve arrangement		DOHC
Firing order		1-3-4-2
Number of piston rings	Compression	2
	Oil	1
Compression ratio		9.9
Compression pressure kPa (bar, kg/cm <sup>2</sup> , psi) / 250 rpm	Standard	1,500 (15.0, 15.3, 217.6)
	Minimum	1,200 (12.0, 12.2, 174)
	Differential limit between cylinders	100 (1.0, 1.0, 15)

### DRIVE BELT

Tension of drive belt	Auto adjustment by auto-tensioner
-----------------------	-----------------------------------

### WATER CONTROL VALVE

Valve opening temperature	93.5 - 96.5°C (200 - 206°F)
Maximum valve lift	8 mm/ 108°C (0.315 in/ 226°F)
Valve closing temperature	More than 90°C (194°F)

### EXHAUST MANIFOLD

Unit: mm (in)

Items	Limit	
Surface distortion	Each exhaust port	0.3 (0.012)
	Entire part	0.7 (0.028)

### THERMOSTAT

Valve opening temperature	80.5 - 83.5°C (177 - 182°F)
Maximum valve lift	8 mm/ 95°C (0.315 in/ 203°F)
Valve closing temperature	More than 77°C (171°F)

### SPARK PLUG

Unit: mm (in)

Plug type	Iridium-tipped TYPE
Make	DENSO
Standard type	FXE20HR11
Spark plug gap	Nominal: 1.1 (0.043)

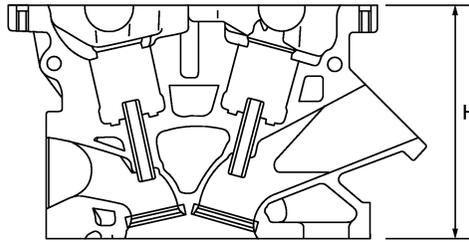
### CYLINDER HEAD

Unit: mm (in)

Items	Standard	Limit
Head surface distortion	—	0.1 (0.004)

# SERVICE DATA AND SPECIFICATIONS (SDS)

Items	Standard	Limit
Normal cylinder head height "H"	130.9 (5.15)	—



PBIC0924E

## VALVE Valve Timing

Unit: degree

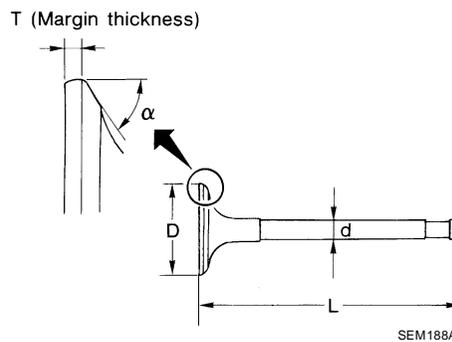
Valve timing	<p>The diagram shows a crankshaft with TDC (Top Dead Center) at the top and BDC (Bottom Dead Center) at the bottom. The intake valve timing is defined by angles a° (intake valve opening) and c° (intake valve closing). The exhaust valve timing is defined by angles b° (exhaust valve opening) and f° (exhaust valve closing). The overlap angle is e°.</p>					
	a	b	c	d	e	f
	212	224	-8 (32)	52 (12)	7	25

PBIC4542E

( ): Valve timing control "ON"

## Valve Dimensions

Unit: mm (in)



SEM188A

Valve head diameter "D"	Intake	33.8 - 34.1 (1.331 - 1.343)
	Exhaust	27.6 - 27.9 (1.087 - 1.098)
Valve length "L"	Intake	106.27 (4.184)
	Exhaust	105.26 (4.144)
Valve stem diameter "d"	Intake	5.465 - 5.480 (0.2152 - 0.2157)
	Exhaust	5.455 - 5.470 (0.2148 - 0.2154)
Valve seat angle " $\alpha$ "		45°15' - 45°45'
Valve margin "T"	Intake	1.1 (0.043)
	Exhaust	1.2 (0.047)

# SERVICE DATA AND SPECIFICATIONS (SDS)

## Valve Clearance

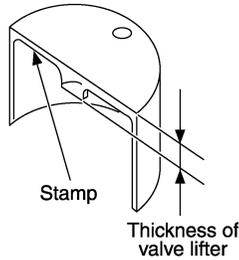
Unit: mm (in)

Items	Cold	Hot* (reference data)
Intake	0.26 - 0.34 (0.010 - 0.013)	0.304 - 0.416 (0.012 - 0.016)
Exhaust	0.29 - 0.37 (0.011 - 0.015)	0.308 - 0.432 (0.012 - 0.017)

\*: Approximately 80°C (176°F)

## Available Valve Lifter

Thickness mm (in)	Identification mark
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KBIA0119E

3.00 (0.1181)	300
3.02 (0.1189)	302
3.04 (0.1197)	304
3.06 (0.1205)	306
3.08 (0.1213)	308
3.10 (0.1220)	310
3.12 (0.1228)	312
3.14 (0.1236)	314
3.16 (0.1244)	316
3.18 (0.1252)	318
3.20 (0.1260)	320
3.22 (0.1268)	322
3.24 (0.1276)	324
3.26 (0.1283)	326
3.28 (0.1291)	328
3.30 (0.1299)	330
3.32 (0.1307)	332
3.34 (0.1315)	334
3.36 (0.1323)	336
3.38 (0.1331)	338
3.40 (0.1339)	340
3.42 (0.1346)	342
3.44 (0.1354)	344
3.46 (0.1362)	346
3.48 (0.1370)	348
3.50 (0.1378)	350

# SERVICE DATA AND SPECIFICATIONS (SDS)

## Valve Spring

Items	Intake	Exhaust
Free height	44.90 - 45.10 mm (1.7677 - 1.7755 in)	45.74 - 45.94 mm (1.8007 - 1.8086 in)
Installation height	35.30 mm (1.390 in)	35.30 mm (1.390 in)
Installation load	153 - 173 N (15.6 - 17.6 kg, 34 - 39 lb)	139 - 157 N (14.2 - 16.0 kg, 31 - 35 lb)
Height during valve open	26.36 mm (1.0377 in)	27.80 mm (1.0944 in)
Load with valve open	335 - 377 N (34.2 - 38.5 kg, 75 - 85 lb)	266 - 297 N (27.1 - 30.3 kg, 60 - 67 lb)
Identification color	White	Orange

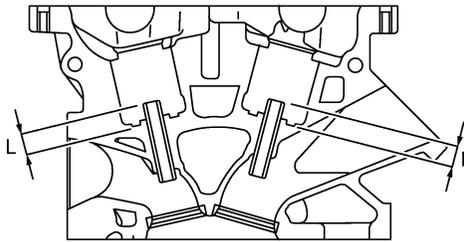
## Valve Lifter

Unit: mm (in)

Items		Standard
Valve lifter outer diameter	Intake	33.977 - 33.987 (1.3377 - 1.3381)
	Exhaust	29.977 - 29.987 (1.1802 - 1.1806)
Valve lifter hole diameter	Intake	34.000 - 34.021 (1.3386 - 1.3394)
	Exhaust	30.000 - 30.021 (1.1811 - 1.1819)
Valve lifter clearance		0.013 - 0.044 (0.0005 - 0.0017)

## Valve Guide

Unit: mm (in)



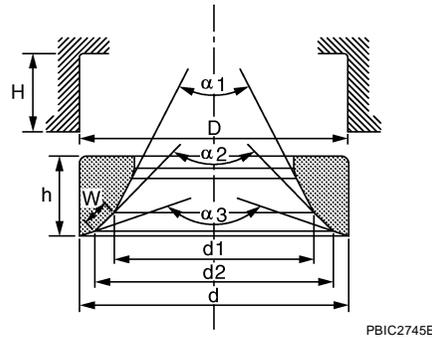
PBIC0184E

Items		Standard part	Service part
Valve guide	Outer diameter	9.523 - 9.534 (0.3749 - 0.3754)	9.723 - 9.734 (0.3828 - 0.3832)
	Inner diameter (Finished size)	5.500 - 5.518 (0.2165 - 0.2172)	
Cylinder head valve guide hole diameter		9.475 - 9.496 (0.3730 - 0.3739)	9.675 - 9.696 (0.3809 - 0.3817)
Interference fit of valve guide		0.027 - 0.059 (0.0011 - 0.0023)	
Items		Standard	Limit
Valve guide clearance	Intake	0.020 - 0.053 (0.0008 - 0.0021)	0.1 (0.004)
	Exhaust	0.030 - 0.063 (0.0012 - 0.0025)	
Projection length "L"		13.35 - 13.65 (0.526 - 0.537)	

# SERVICE DATA AND SPECIFICATIONS (SDS)

## Valve Seat

Unit: mm (in)



Items		Standard	Oversize [0.5 (0.02)] (Service)
Cylinder head seat recess diameter "D"	Intake	34.700 - 34.727 (1.3661 - 1.3672)	35.200 - 35.227 (1.3858 - 1.3869)
	Exhaust	28.700 - 28.727 (1.1299 - 1.1310)	29.200 - 29.227 (1.1496 - 1.1507)
Valve seat outer diameter "d"	Intake	34.808 - 34.824 (1.3704 - 1.3710)	35.308 - 35.324 (1.3901 - 1.3907)
	Exhaust	28.808 - 28.824 (1.1342 - 1.1348)	29.308 - 29.324 (1.1539 - 1.1545)
Valve seat interference fit		0.081 - 0.124 (0.0032 - 0.0049)	
Diameter "d1"*1	Intake	31.8 (1.252)	
	Exhaust	25.3 (0.996)	
Diameter "d2"*2	Intake	33.1 - 33.6 (1.303 - 1.323)	
	Exhaust	26.9 - 27.4 (1.059 - 1.079)	
Angle "α1"	Intake	60°	
	Exhaust	45°	
Angle "α2"		88°45' - 90°15'	
Angle "α3"		120°	
Contacting width "W"*3	Intake	1.0 - 1.4 (0.039 - 0.055)	
	Exhaust	1.2 - 1.6 (0.047 - 0.063)	
Height "h"	Intake	5.9 - 6.0 (0.232 - 0.236)	5.03 - 5.13 (0.1980 - 0.2020)
	Exhaust	5.9 - 6.0 (0.232 - 0.236)	4.95 - 5.05 (0.1949 - 0.1988)
Depth "H"	Intake	6.04 (0.2378)	
	Exhaust	6.05 (0.2382)	

\*: Diameter made by intersection point of conic angles "α1" and "α2"

\*2 : Diameter made by intersection point of conic angles "α2" and "α3"

\*3 : Machining data

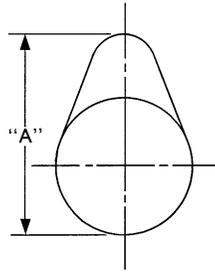
## CAMSHAFT AND CAMSHAFT BEARING

Unit: mm (in)

Items		Standard	Limit
Camshaft journal oil clearance	No. 1	0.045 - 0.086 (0.0018 - 0.0034)	0.15 (0.0059)
	No. 2, 3, 4, 5	0.030 - 0.071 (0.0012 - 0.0028)	
Camshaft bracket inner diameter	No. 1	28.000 - 28.021 (1.1024 - 1.1032)	—
	No. 2, 3, 4, 5	25.000 - 25.021 (0.9843 - 0.9851)	—
Camshaft journal diameter	No. 1	27.935 - 27.955 (1.0998 - 1.1006)	—
	No. 2, 3, 4, 5	24.950 - 24.970 (0.9823 - 0.9831)	—
Camshaft end play		0.075 - 0.153 (0.0030 - 0.0060)	0.24 (0.0094)
Camshaft cam height "A"	Intake	44.605 - 44.795 (1.7560 - 1.7635)	44.405 (1.7482)
	Exhaust	43.175 - 43.365 (1.6997 - 1.7072)	42.975 (1.6919)

# SERVICE DATA AND SPECIFICATIONS (SDS)

Camshaft runout [TIR*]	Less than 0.02 mm (0.0008)	0.05 (0.0020)
Camshaft sprocket runout [TIR*]	—	0.15 (0.0059)

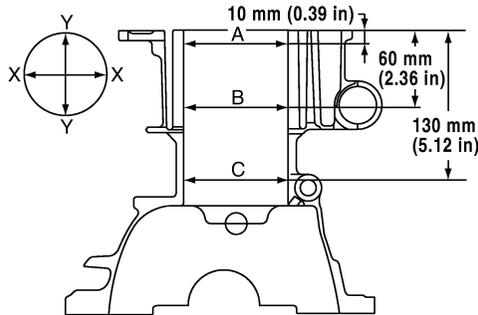


SEM671

\*: Total indicator reading

## CYLINDER BLOCK

Unit: mm (in)



PBIC4017E

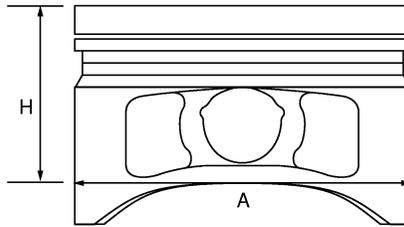
Top surface distortion		Limit		0.1 (0.004)
Cylinder bore	Inner diameter	Standard	Grade No. 1	84.000 - 84.010 (3.3071 - 3.3075)
			Grade No. 2	84.010 - 84.020 (3.3075 - 3.3079)
Out-of-round (Difference between "X" and "Y")		Limit		0.015 (0.0006)
Taper (Difference between "A" and "C")		Limit		0.01 (0.0004)
Main bearing housing inner diameter grade		Grade No. A		55.997 - 55.998 (2.2046 - 2.2046)
		Grade No. B		55.998 - 55.999 (2.2046 - 2.2047)
		Grade No. C		55.999 - 56.000 (2.2047 - 2.2047)
		Grade No. D		56.000 - 56.001 (2.2047 - 2.2048)
		Grade No. E		56.001 - 56.002 (2.2048 - 2.2048)
		Grade No. F		56.002 - 56.003 (2.2048 - 2.2048)
		Grade No. G		56.003 - 56.004 (2.2048 - 2.2049)
		Grade No. H		56.004 - 56.005 (2.2049 - 2.2049)
		Grade No. J		56.005 - 56.006 (2.2049 - 2.2050)
		Grade No. K		56.006 - 56.007 (2.2050 - 2.2050)
		Grade No. L		56.007 - 56.008 (2.2050 - 2.2050)
		Grade No. M		56.008 - 56.009 (2.2050 - 2.2051)
		Grade No. N		56.009 - 56.010 (2.2051 - 2.2051)
		Grade No. P		56.010 - 56.011 (2.2051 - 2.2052)
Grade No. R		56.011 - 56.012 (2.2052 - 2.2052)		
Grade No. S		56.012 - 56.013 (2.2052 - 2.2052)		
Grade No. T		56.013 - 56.014 (2.2052 - 2.2053)		
Grade No. U		56.014 - 56.015 (2.2053 - 2.2053)		
Grade No. V		56.015 - 56.016 (2.2053 - 2.2053)		
Grade No. W		56.016 - 56.017 (2.2053 - 2.2054)		

# SERVICE DATA AND SPECIFICATIONS (SDS)

## PISTON, PISTON RING AND PISTON PIN

### Available Piston

Unit: mm (in)



PBIC0188E

Piston skirt diameter "A"	Standard	Grade No. 1	83.970 - 83.980 (3.3059 - 3.3063)
		Grade No. 2	83.980 - 83.990 (3.3063 - 3.3067)
Piston height "H" dimension			39.9 (1.571)
Piston pin hole diameter			19.993 - 19.999 (0.7871 - 0.7874)
Piston to cylinder bore clearance	Standard		0.020 - 0.040 (0.0008 - 0.0016)
	Limit		0.08 (0.0031)

### Piston Ring

Unit: mm (in)

Items		Standard	Limit
Side clearance	Top	0.04 - 0.08 (0.002 - 0.003)	0.11 (0.0043)
	2nd	0.03 - 0.07 (0.001 - 0.003)	0.10 (0.0039)
	Oil ring	0.015 - 0.185 (0.001 - 0.007)	—
End gap	Top	0.20 - 0.30 (0.008 - 0.012)	0.51 (0.020)
	2nd	0.50 - 0.65 (0.020 - 0.026)	0.83 (0.033)
	Oil (rail ring)	0.15 - 0.45 (0.006 - 0.018)	0.78 (0.031)

### Piston Pin

Unit: mm (in)

Items	Standard	Limit
Piston pin outer diameter	19.989 - 19.995 (0.7870 - 0.7872)	—
Piston to piston pin oil clearance	0.002 - 0.006 (0.0001 - 0.0002)	—
Connecting rod bushing oil clearance	0.005 - 0.023 (0.0002 - 0.0009)	0.03 (0.0012)

# SERVICE DATA AND SPECIFICATIONS (SDS)

## CONNECTING ROD

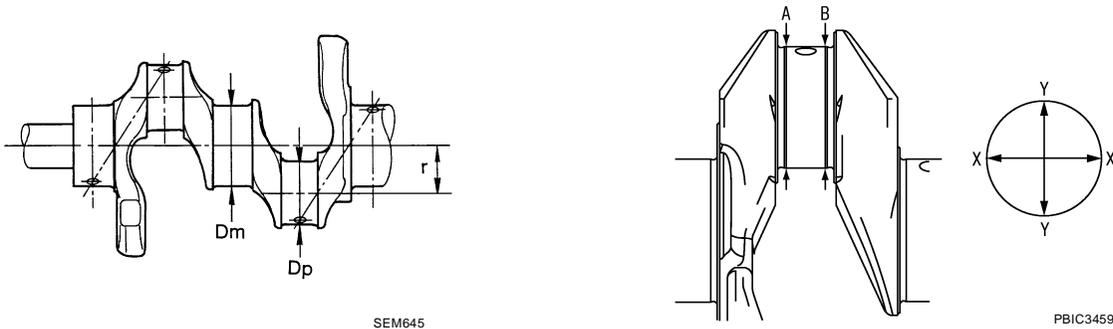
Unit: mm (in)

Center distance		143.44 - 143.54 (5.647 - 5.650)
Bend [per 100 (3.94)]	Limit	0.15 (0.0059)
Torsion [per 100 (3.94)]	Limit	0.30 (0.0118)
Connecting rod bushing inner diameter*		20.000 - 20.012 (0.7874 - 0.7879)
Side clearance	Standard	0.20 - 0.35 (0.0079 - 0.0138)
	Limit	0.40 (0.0157)
Connecting rod big end diameter	Grade No. A	47.000 - 47.001 (1.8504 - 1.8504)
	Grade No. B	47.001 - 47.002 (1.8504 - 1.8505)
	Grade No. C	47.002 - 47.003 (1.8505 - 1.8505)
	Grade No. D	47.003 - 47.004 (1.8505 - 1.8505)
	Grade No. E	47.004 - 47.005 (1.8505 - 1.8506)
	Grade No. F	47.005 - 47.006 (1.8506 - 1.8506)
	Grade No. G	47.006 - 47.007 (1.8506 - 1.8507)
	Grade No. H	47.007 - 47.008 (1.8507 - 1.8507)
	Grade No. J	47.008 - 47.009 (1.8507 - 1.8507)
	Grade No. K	47.009 - 47.010 (1.8507 - 1.8508)
	Grade No. L	47.010 - 47.011 (1.8508 - 1.8508)
	Grade No. M	47.011 - 47.012 (1.8508 - 1.8509)
Grade No. N	47.012 - 47.013 (1.8509 - 1.8509)	

\*: After installing in connecting rod

## CRANKSHAFT

Unit: mm (in)



Center distance "r"		40.41 - 40.49 (1.5909 - 1.5940)
Out-of-round (Difference between "X" and "Y")	Limit	0.0035 (0.0001)
Taper (Difference between "A" and "B")	Limit	0.0035 (0.0001)
Runout [TIR*]	Standard	0.05 (0.0020)
	Limit	0.10 (0.0040)
Crankshaft end play	Standard	0.10 - 0.26 (0.0039 - 0.0102)
	Limit	0.30 (0.012)

## SERVICE DATA AND SPECIFICATIONS (SDS)

Pin journal diameter grade. "Dp"	Grade No. A	43.970 - 43.971 (1.7311 - 1.7311)
	Grade No. B	43.969 - 43.970 (1.7311 - 1.7311)
	Grade No. C	43.968 - 43.969 (1.7310 - 1.7311)
	Grade No. D	43.967 - 43.968 (1.7310 - 1.7310)
	Grade No. E	43.966 - 43.967 (1.7309 - 1.7310)
	Grade No. F	43.965 - 43.966 (1.7309 - 1.7309)
	Grade No. G	43.964 - 43.965 (1.7309 - 1.7309)
	Grade No. H	43.963 - 43.964 (1.7308 - 1.7309)
	Grade No. J	43.962 - 43.963 (1.7308 - 1.7308)
	Grade No. K	43.961 - 43.962 (1.7307 - 1.7308)
	Grade No. L	43.960 - 43.961 (1.7307 - 1.7307)
	Grade No. M	43.959 - 43.960 (1.7307 - 1.7307)
	Grade No. N	43.958 - 43.959 (1.7306 - 1.7307)
	Grade No. P	43.957 - 43.958 (1.7306 - 1.7306)
	Grade No. R	43.956 - 43.957 (1.7305 - 1.7306)
	Grade No. S	43.955 - 43.956 (1.7305 - 1.7305)
Grade No. T	43.954 - 43.955 (1.7305 - 1.7305)	
Grade No. U	43.953 - 43.954 (1.7304 - 1.7305)	
Main journal diameter grade. "Dm"	Grade No. A	51.978 - 51.979 (2.0464 - 2.0464)
	Grade No. B	51.977 - 51.978 (2.0463 - 2.0464)
	Grade No. C	51.976 - 51.977 (2.0463 - 2.0463)
	Grade No. D	51.975 - 51.976 (2.0463 - 2.0463)
	Grade No. E	51.974 - 51.975 (2.0462 - 2.0463)
	Grade No. F	51.973 - 51.974 (2.0462 - 2.0462)
	Grade No. G	51.972 - 51.973 (2.0461 - 2.0462)
	Grade No. H	51.971 - 51.972 (2.0461 - 2.0461)
	Grade No. J	51.970 - 51.971 (2.0461 - 2.0461)
	Grade No. K	51.969 - 51.970 (2.0460 - 2.0461)
	Grade No. L	51.968 - 51.969 (2.0460 - 2.0460)
	Grade No. M	51.967 - 51.968 (2.0459 - 2.0460)
	Grade No. N	51.966 - 51.967 (2.0459 - 2.0459)
	Grade No. P	51.965 - 51.966 (2.0459 - 2.0459)
	Grade No. R	51.964 - 51.965 (2.0458 - 2.0459)
	Grade No. S	51.963 - 51.964 (2.0458 - 2.0458)
Grade No. T	51.962 - 51.963 (2.0457 - 2.0458)	
Grade No. U	51.961 - 51.962 (2.0457 - 2.0457)	
Grade No. V	51.960 - 51.961 (2.0457 - 2.0457)	
Grade No. W	51.959 - 51.960 (2.0456 - 2.0457)	

\*: Total indicator reading

# SERVICE DATA AND SPECIFICATIONS (SDS)

## MAIN BEARING

Unit: mm (in)

Grade number	Thickness	Identification color	Remarks
0	1.996 - 1.999 (0.0786 - 0.0787)	Black	Grade and color are the same for upper and lower bearings.
1	1.999 - 2.002 (0.0787 - 0.0788)	Brown	
2	2.002 - 2.005 (0.0788 - 0.0789)	Green	
3	2.005 - 2.008 (0.0789 - 0.0791)	Yellow	
4	2.008 - 2.011 (0.0791 - 0.0792)	Blue	
5	2.011 - 2.014 (0.0792 - 0.0793)	Pink	
6	2.014 - 2.017 (0.0793 - 0.0794)	Purple	
7	2.017 - 2.020 (0.0794 - 0.0795)	White	
01	UPR	1.996 - 1.999 (0.0786 - 0.0787)	Grade and color are different between upper and lower bearings.
	LWR	1.999 - 2.002 (0.0787 - 0.0788)	
12	UPR	1.999 - 2.002 (0.0787 - 0.0788)	
	LWR	2.002 - 2.005 (0.0788 - 0.0789)	
23	UPR	2.002 - 2.005 (0.0788 - 0.0789)	
	LWR	2.005 - 2.008 (0.0789 - 0.0791)	
34	UPR	2.005 - 2.008 (0.0789 - 0.0791)	
	LWR	2.008 - 2.011 (0.0791 - 0.0792)	
45	UPR	2.008 - 2.011 (0.0791 - 0.0792)	
	LWR	2.011 - 2.014 (0.0792 - 0.0793)	
56	UPR	2.011 - 2.014 (0.0792 - 0.0793)	
	LWR	2.014 - 2.017 (0.0793 - 0.0794)	
67	UPR	2.014 - 2.017 (0.0793 - 0.0794)	
	LWR	2.017 - 2.020 (0.0794 - 0.0795)	

## Undersize

Unit: mm (in)

Item	Thickness	Main journal diameter
US 0.25 (0.0098)	2.126 - 2.134 (0.0837 - 0.0840)	Grind so that bearing clearance is the specified value.

## Bearing Oil Clearance

Unit: mm (in)

Main bearing oil clearance	Standard	No. 1, 4 and 5	0.024 - 0.034 (0.0009 - 0.0013)
		No. 2 and 3	0.012 - 0.022 (0.0005 - 0.0009)
	Limit	0.065 (0.0026)	

## CONNECTING ROD BEARING

Grade number	Thickness mm (in)	Identification color	Remarks
0	1.494 - 1.497 (0.0588 - 0.0589)	Black	Grade and color are the same for upper and lower bearings.
1	1.497 - 1.500 (0.0589 - 0.0591)	Brown	
2	1.500 - 1.503 (0.0591 - 0.0592)	Green	
3	1.503 - 1.506 (0.0592 - 0.0593)	Yellow	
4	1.506 - 1.509 (0.0593 - 0.0594)	Blue	