

Caterpillar C-Series Cylinder Liner Dilemma

BY STEVE SCOTT

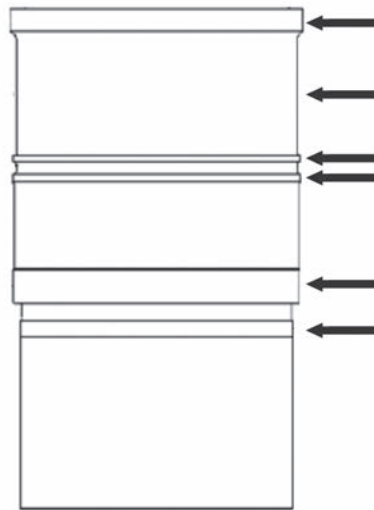
This article addresses concerns from some service technicians regarding the fitment of cylinder liners in Cat C9 and C12 engines. As the liner is placed into the block, some resistance may be encountered requiring some added force that is not typical with other Cat engines. If technicians are unsure if this situation is correct, having a question like this arise so early in the assembly process can result in a delay in the overhaul completion date.

Without seals installed, fitment issues are normally non-existent as the liners slip easily into most Cat cylinder blocks. However, with C9 and C12 engines, technicians can encounter different fitment issues even without the liner seals in place due to the stack dimensions of the liner OD vs. those of the block ID. For these liners, Cat has published specifications for several OD dimensions at various locations on the liners.

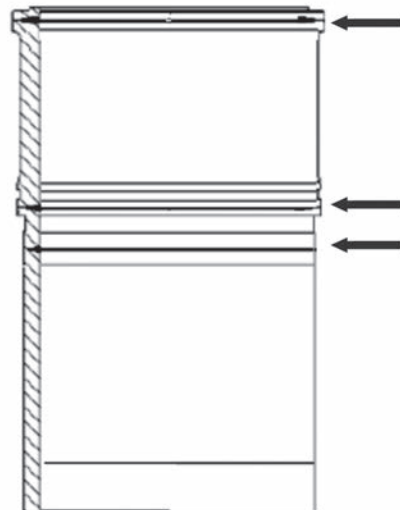
Although the mid-sections of these liners do have close clearances to the cylinder block, the tightest of the mid-area specification ranges still allows approximately .0015" clearance between the block and liner. Thus, the area most likely to result in fitment concerns is the upper liner flange diameter.

(continued)

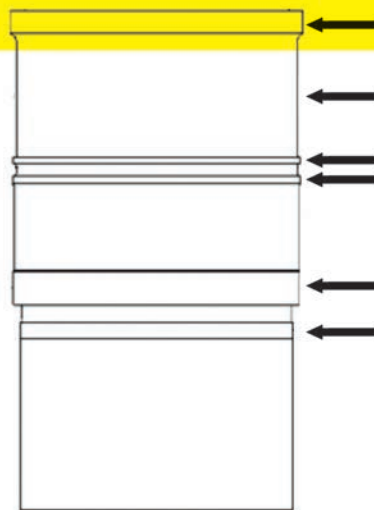
Measurement locations for C9 liner



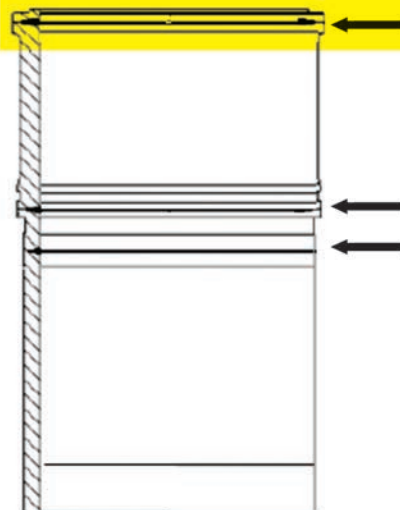
Measurement locations for C12 liner



Measurement locations for C9 liner



Measurement locations for C12 liner



Although the mid-sections of the cylinder liners in Cat C9 and C12 engines do have close clearances to the cylinder block, the tightest of the mid-area specification ranges still allows approximately .0015" clearance between the block and liner. Thus, the area most likely to result in fitment concerns is the upper liner flange diameter.

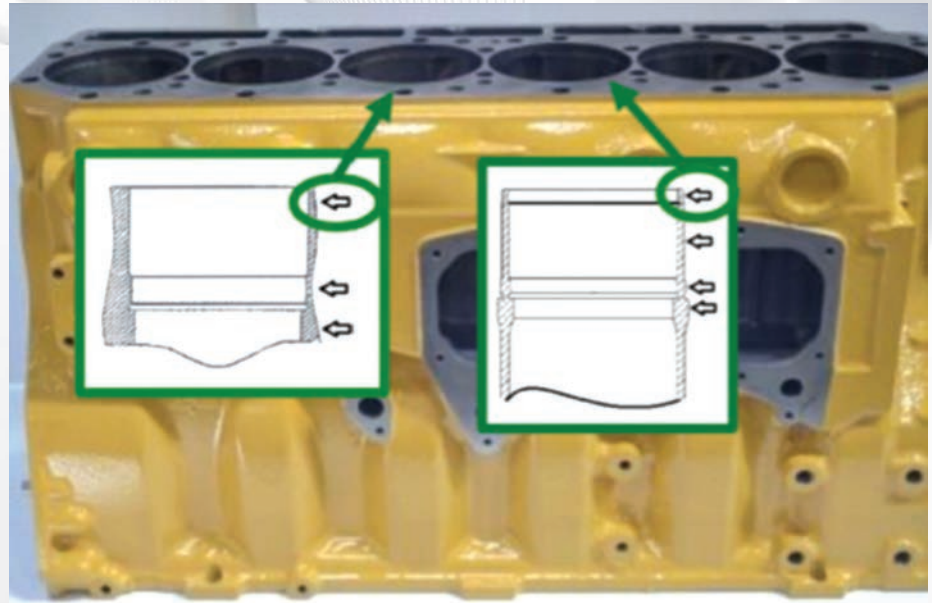
CATERPILLAR C-SERIES CYLINDER LINER DILEMMA

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Similar to the liners, the cylinder blocks have multiple locations to measure dimensions. The top location (indicated in the photo at the right) has the tightest fitment location for the cylinder liner.

Using these specifications, Chart 1 lists the minimum and maximum dimensions for liners (OD) and blocks (ID). However, a comparison of the maximum liner OD to the minimum block ID (see Chart 2) shows that the “stack” tolerances can leave zero, or even a negative final clearance specification.

It is important to note that the clearances shown in these charts are extremes, and they also do not take into consideration any distortion in the cylinder block or liner, or scale, or deposits, or burrs in a used block can cause further resistance.



Scale, deposits or burrs in a used block can cause further resistance when fitting cylinder liners in Cat C9 and C12 engines.



Chart 1

C9	Published Spec	Min	Max
Liner Flange Diameter (A)	128.95 ± 0.03mm Convert to inches	128.92 5.0755	128.98 mm 5.0779 "
C9	Published Spec	Min	Max
Bore in Block for Liner flange	129.00 ± .03mm Convert to inches	128.97 5.0775	129.03 mm 5.0779 "
C12	Published Spec	Min	Max
Liner Flange Diameter (A)	151.42 ± .05mm Convert to inches	151.37 5.9594	151.47 mm 5.9633 "
C12	Published Spec	Min	Max
Bore in Block for Liner flange	150.50 ± .03 Convert to inches	151.47 5.9633	151.53 mm 5.9657 "

Chart 2

C9	Published Spec	Min	Max	Minimum Clearance
Liner Flange Diameter (A)	128.95 ± 0.03mm Convert to inches	128.92 5.0755	128.98 mm 5.0779 "	-0.01 -0.0004
C9	Published Spec	Min	Max	
Bore in Block for Liner flange	129.00 ± .03mm Convert to inches	128.97 5.0775	129.03 mm 5.0779 "	
C12	Published Spec	Min	Max	Minimum Clearance
Liner Flange Diameter (A)	151.42 ± .05mm Convert to inches	151.37 5.9594	151.47 mm 5.9633 "	0.00 0.0000
C12	Published Spec	Min	Max	
Bore in Block for Liner flange	150.50 ± .03 Convert to inches	151.47 5.9633	151.53 mm 5.9657 "	

Chart 1 lists the minimum and maximum dimensions for liners (OD) and blocks (ID) and Chart 2 shows that the stack tolerances can leave zero or even a negative final clearance specification.



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Even simple temperature variances can affect fitment ease. We measured the liner flange in the image above after sitting in an air conditioned office overnight, then moved it into the sun for a few hours. The temperature variation encountered resulted in a 7/10's of a thousandths (0.0007") expansion in the liner flange diameter.

Hopefully this information can provide some insight into why the liner fitment with these engines may be different from past experiences, and help the overhaul process to continue without delay. The specifications used in this article were current at the time of this publication, and should only be used as a reference to illustrate the issue of fitment ease between engines from one manufacturer. Please consult the latest O.E. service publications for further updates. ■



Steve Scott joined the service department at IPD in 1982, working with parts, service and sales for a variety of equipment, diesel, and natural gas engines. Since 2004, he has been the director of product development and technical support for IPD. For more information, email sscott@ipdparts.com.