SMCS - 1217
3400 Series Engines
Reference: Special Instruction Form GMG02442

The 2W3815 Insert, .0628"-.0636" (1.60-1.62) thick, and the 5N93 Insert, .1063"-.1071" (2.70-2.72) thick, are available to make a repair for those engines in the above list, that have erosion (wear caused by heat, plus exhaust gas and coolant leakage around the liner seal) at the top of the cylinder liner seat area. These stainless steel inserts are a slip (loose) fit in the counterbore that must be cut in the cylinder block. After installation, the top of the insert will be far enough above the top surface of the cylinder block to give the necessary liner projection. After the inserts are installed, it is not necessary to machine them. At installation of the insert, do not use sealant on the insert or in the counterbore.

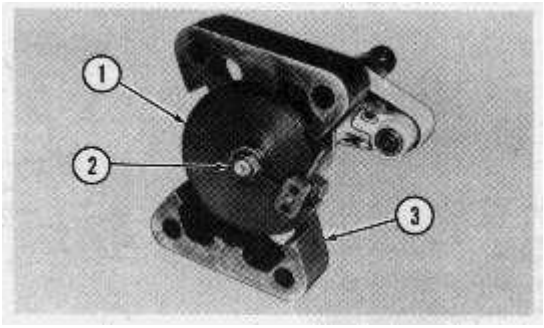
Tools Needed

●PART NO. Nº DE PIÈCE TEIL-Nr. NO. DE PIEZA	●PART NAME DÉSIGNATION BEZEICHNUNG NOMBRE DE LA PIEZA	●PART NO. Nº DE PIÈCE TEIL-Nr. NO. DE PIEZA	●PART NAME DÉSIGNATION BEZEICHNUNG NOMBRE DE LA PIEZA
1P5510*	Liner Projection Indicator Grp.	5P4175*	Counterboring Tool Group
7B5163	Bolts (4)	6V118★	Depth Setting Gauge
5P1630*	Adapter	8T843★★	Depth Setting Gauge
5P1634	Tool Holder	6V6189**	Master Cutter Setting Gauge
5P1645*	Micrometer Fixture	6V6191**	Carbide Cutter Assembly
5P1656	Hook	***	Starrett No. 443 Half Base Depth Micrometer
5P1769*	Washer (4)		

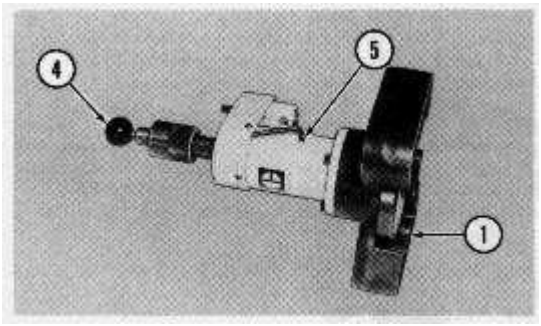
Procedure For Accuracy Check Of 5P4175 Counterboring Tool Group

Since the 2W3815 and 5N93 Inserts are precision made, the counterbore that they fit must be parallel to the top of the cylinder block within .001" (0.03). The 5P4175 Counterboring Tool Group must then be checked for accuracy, to be sure it will cut within this .001" (0.03) tolerance, unless it is already known that the tool group has this type of accuracy. Also, check the tool group at specific intervals to keep this accuracy. Use the procedure that follows to check the tool group.

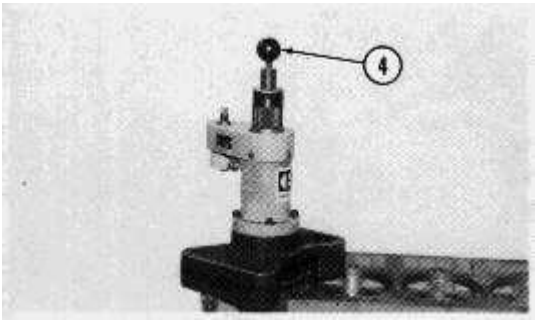
NOTE: The accuracy check procedure does not especially have to be done on a 3400 Series engine cylinder block. It can be done on any cylinder block that has the top deck (top surface) ground smooth and flat, or, one that is in very good condition. If the top deck is not smooth and flat, the result will be depth measurements that are not correct. All adjustments and/or settings in the procedure must be made according to the bore size of the cylinder block that is used for the accuracy check.

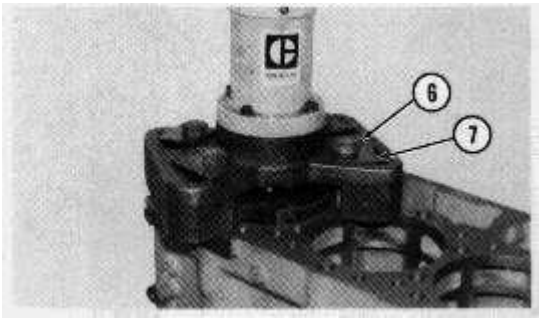


1 Assemble tool holder (1) to boring tool. Make sure the tool holder slot is down and both the pilot on the boring tool and the pilot on the tool holder are clean. Install the washer and nut. Tighten nut (2) to 50 ± 5 lb-ft (70 ± 7) torque. Check the bottom surface of base adapter (3), and remove any nicks or burrs.



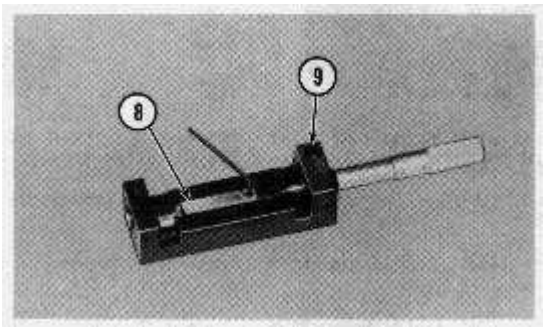
2 With the boring tool in the horizontal position, remove plug (5) and check the oil level in the hydraulic feed unit. Fill the unit with SAE10W, 20W or 30W oil. Install plug (5). Loosen knob (4) to release the feed control valve and move tool holder (1) in and out several times. Remove plug (5) and again check the oil level. Fill with oil if necessary and install plug (5). Tighten knob (4). NOTE: If the oil level is low, the tool may not cut smoothly.



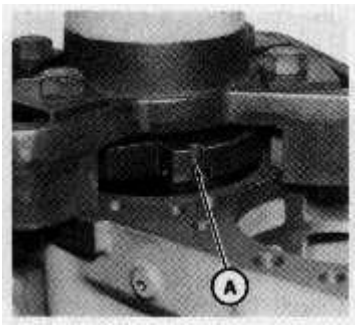


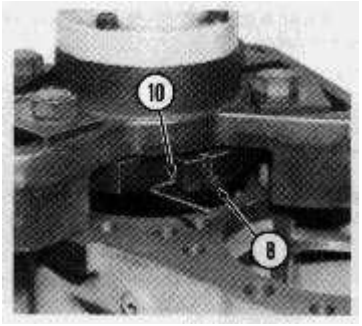
3 Put the boring tool in position on the cylinder block. Release feed control valve (4) so the tool holder will go down, into the pilot bore of the cylinder liner. Use 7B5163 Bolts (6) with 5P1769 Washers (7) to fasten the boring tool in position. Tighten bolts (6) to a torque of 50 ± 5 lb-ft (70 ± 7). The tool holder must turn freely after bolts (6) are tightened.

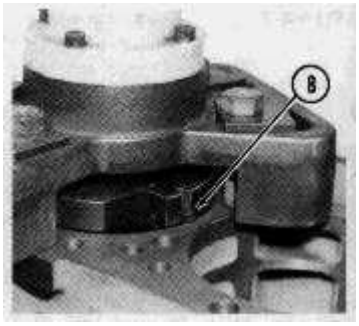
4 Pull the tool holder up out of the cylinder liner bore, and close the feed control valve to keep the tool holder in the UP position.



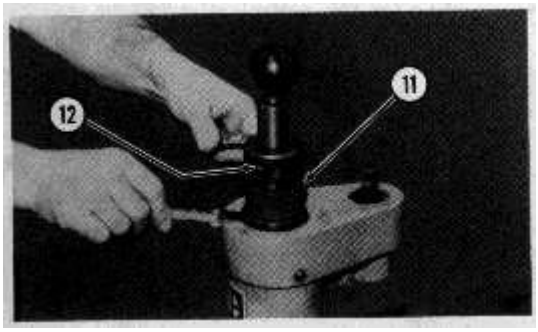
5 Put 6V6191 Cutter (8) into micrometer fixture (9) and adjust the cutter to a diameter that is .03" (0.8) less than the diameter needed for installation of an insert in this cylinder block.

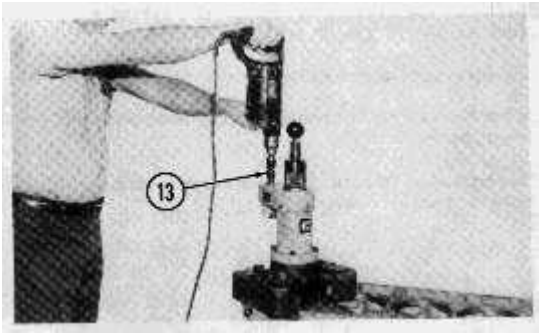






6 Clean slot (A) in the tool holder, then install cutter (8) and tighten screw (10). Carefully loosen knob (4) and move the boring bar down, until cutter (8) is against the top face of the cylinder block.





7 Put a .003" (0.08) feeler gauge under adjusting nut (11). Make an adjustment to the nut so it is against the feeler gauge, then tighten screw (12) to hold the adjusting nut in position.

NOTICE

To prevent damage to the cutting tool, never hit the cutter or let it fall. Never turn the cutter backward while it is in contact with the cylinder block.

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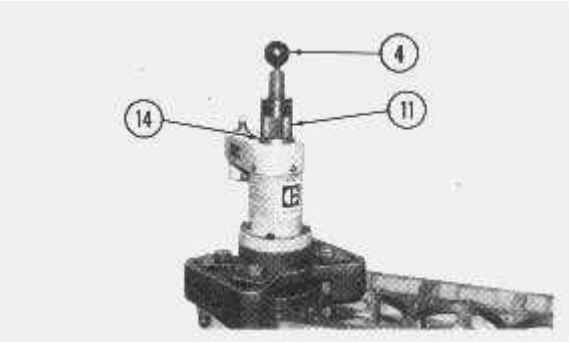
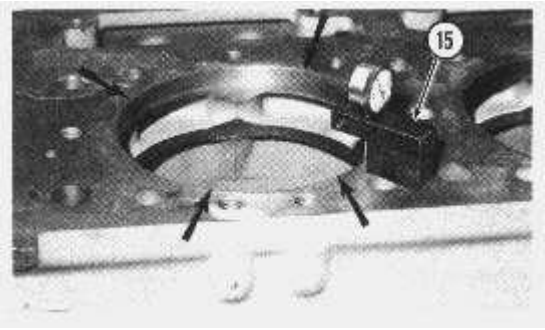
8 Lift the tool holder so the cutter is approximately .06" (1.5) above the top face of the cylinder block and close the feed control valve. Use a heavy duty industrial drill and adapter (13) to operate the boring tool. Remove the depth gauge and start the cut.



9 Stop the cutter immediately when adjusting nut (11) is against positive stop (14). Loosen knob (4), lift the tool holder and then tighten knob (4) to hold the tool holder in the UP position.

10 Check the location of the tool group in relation to its position on the cylinder block, then remove the boring tool from the cylinder block.

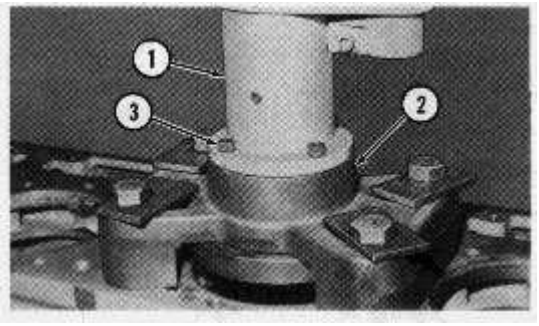


11 Use the 1P5510 Liner Projection Tool Group (15) to check the depth of the cut. Adjust the indicator bezel to zero (0), then check and write down the depth of cut at a minimum of four locations, as shown, around the counterbore.

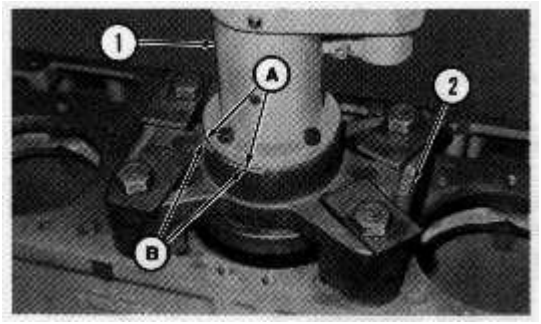
12 If all measurements in step 11 are not within .001" (0.03), make reference to ADJUSTMENT OF COUNTERBORING TOOL GROUP in this instruction. If all measurements are within .001" (0.03) make reference to COUNTERBORE PROCEDURE FOR 2W3815 AND 5N93 INSERTS.

Adjustment Of Counterboring Tool Group

1 When the deepest point of the counterbore is known, install the counterboring tool group on the cylinder block so it is in the same position as it was before.



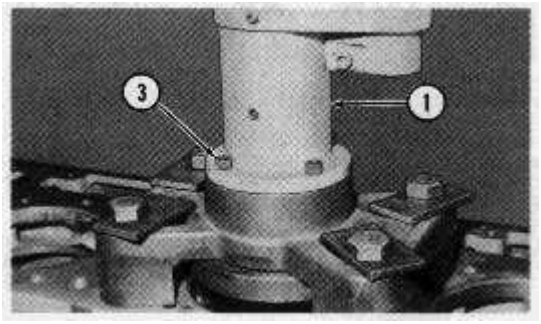
2 Thoroughly clean housing (1) and base adapter (2). Loosen the four bolts (3) that fasten the housing to the base adapter.



3 Install the shims at the correct location (A), between housing (1) and base adapter (2), that is next to the deepest point of the counterbore. Shims must be put on each side of a bolt or, if only one shim is to be used, it must have a hole in it for the bolt to go through. Shims must be installed all the way in so there is complete contact of the full width between the surfaces of housing (1) and adapter (2). [Shims (B) in the illustration are in the position shown only to give the correct location for shim installation.] A .001" (0.03) shim will normally change the depth of cut approximately .002" (0.05).

NOTE: If only one shim is used on one side of a bolt, the result will be distortion of housing (1). Also, since metal shims of less than .0015" (0.04) are not available, a cellophane wrapper or a plastic material can be used as shims if necessary.

4 Now do the procedure in steps 3 through 12 in PROCEDURE FOR ACCURACY CHECK OF 5P4175 COUNTERBORING TOOL GROUP.



5 If the depth of cut is still not within the .001" (0.03) specification, it is possible that the shims can be made either shorter or longer to improve the accuracy of the boring tool. Also, for some boring tools if the four bolts (3) are removed, and housing (1) is turned either 90° or 180° and installed in a new position on base adapter (2), it is possible that accuracy can be improved.

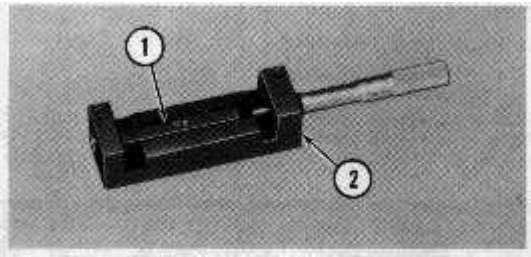
6 When the accuracy for the depth of cut of the 5P4175 Counterboring Tool Group is within the specifications needed, the complete counterbore can then be cut for installation of the 2W3815 and 5N93 Insert. See COUNTERBORE PROCEDURE USING THE 5P4175 COUNTERBORING TOOL GROUP.

NOTE: If the accuracy of the 5P4175 Counterboring Tool Group cannot be improved with the methods given, it will be necessary to use the 8S3140 Counterboring Tool Arrangement to finish cutting the counterbore. See COUNTERBORE PROCEDURE FOR THE INSERT USING 8S3140 COUNTERBORING TOOL ARRANGEMENT.

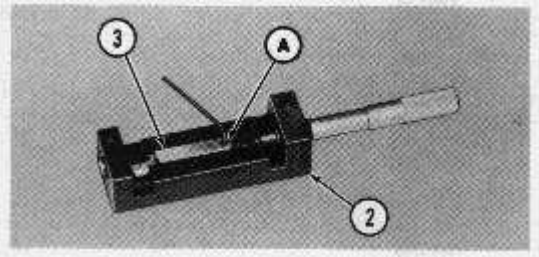
Counterbore Procedure Using The 5P4175 Counterboring Tool Group

NOTE: Before this procedure is started, the 5P4175 Counterboring Tool Group must be installed on the cylinder block, and then checked for accuracy. See PROCEDURE FOR ACCURACY CHECK OF 5P4175 COUNTERBORING TOOL GROUP.

NOTE: It is not possible to give a good explanation of how much erosion is too much. Each cylinder block must have its own complete inspection, to see if it can be machined for insert installation. If there is erosion, it can be seen on the top of the cylinder block and/or in the bore for the cylinder liner. When the new counterbore is cut for installation of an insert, the bottom surface of that counterbore must clean up 100%. It is permissible to have erosion at the outer diameter of the counterbore. A small amount of erosion is permissible in the filler band area [.38" (9.7) down from the top of the cylinder block] in each liner bore. It must be remembered that excessive (too much) erosion in the filler band area can cause a reduction in the ability of the filler band to give a good seal. Erosion below the filler band is acceptable.



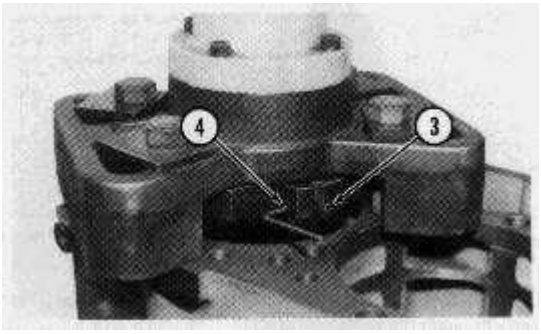
1 Put the 6V6189 Master Gauge (1) [6.537" (166.049)] in 5P1645 Micrometer Fixture (2) with the side marked UP, on top as shown. Adjust the micrometer until the micrometer stem is against the master gauge.



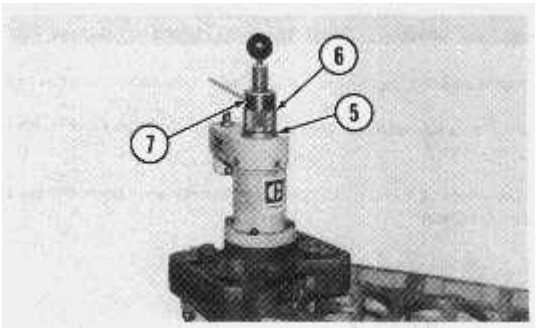
2 Remove the master gauge and put 6V6191 Cutter Assembly (3) in micrometer fixture (2). Adjust cutter (3) so it is the exact same size as the master gauge.

NOTICE

Be careful and do not loosen screw (A) too fast, because the adjustment of cutter (3) has a spring load behind it, and the result can be damage to the cutting edge.



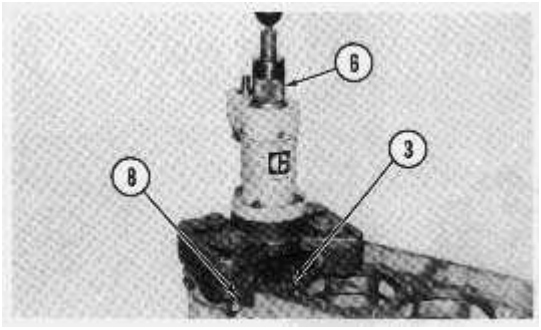
3 Clean the tool holder slot carefully before the cutting tool is installed. Install cutter (3) in the slot and push the tool into the slot as far as it will go. Tighten screw (4).



4 Lower the tool until the cutter is against the top of the cylinder block. Install 6V118 Depth Setting Gauge (5) under adjusting nut (6). Adjust nut (6) so it is against gauge (5), then tighten screw (7) to hold nut (6) in this position.

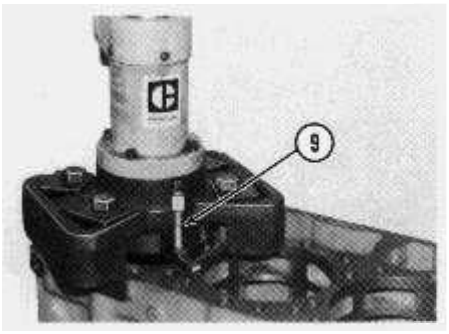
NOTICE

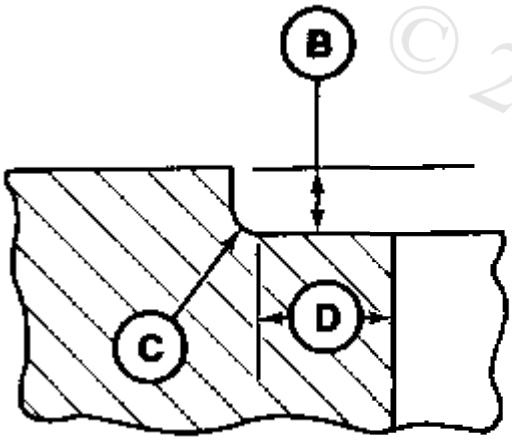
Correct adjustment of nut (6) in step 4 is important. If the depth setting gauge is too loose, it will cause the counterbore to be cut too deep. If the adjusting nut is tightened too much, the counterbore will be cut too shallow (not deep enough).



NOTE: If it is known that it will be necessary to use the 8S3140 Counterboring Tool Arrangement to make the finish cut for the counterbore, put a .003" (0.08) feeler gauge (8) under cutter (3) as shown, before adjustment of nut (6) as given in step 4.

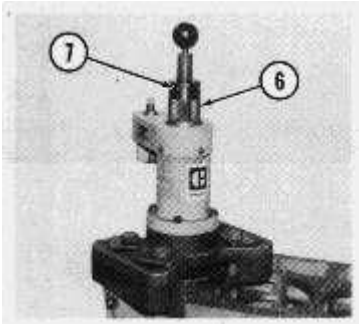
5 Lift the tool holder so the cutter is approximately .06" (1.5) above the top face of the cylinder block, close the feed control valve and make the cut for the counterbore.

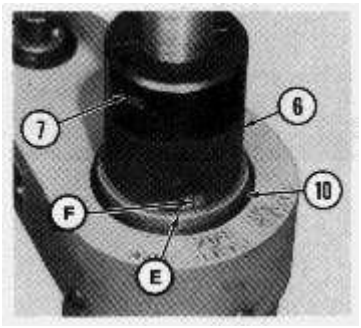


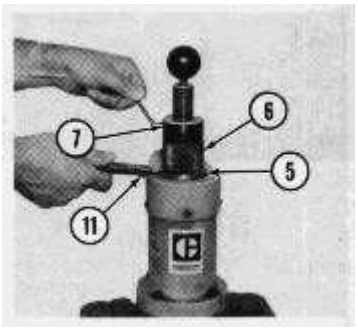


6 Use a half base depth micrometer (9) as shown, or a 1P5510 Liner Projection Indicator Group to check the depth of the counterbore. [Check counterbore depth (B) at a minimum of four locations around the bore.] The correct depth of the counterbore for installation of the 2W3815 Insert is .060" ± .001" (1.5 ± 0.03). Also, the bottom of the counterbore must clean up 100% (be even and smooth and have no visual signs of erosion), from the edge of counterbore radius (C) to the edge of the cylinder liner bore, area (D).

NOTE: If the 1P5510 Liner Projection Indicator Group is used to check the .060" ± .001" (1.5 ± 0.03) counterbore depth for the 2W3815 Insert, use the 6V118 Gauge and the 1P5507 Gauge to zero the dial indicator.







7 If the counterbore is not deep enough, loosen screw (7) and turn adjusting nut (6) counterclockwise a very small amount, then again tighten screw (7).

NOTE: For those counterbore tools that have a 6V2120 Sprocket (10), dots (E) on the sprocket and reference line (F) on adjusting nut (6) can be used to make a depth of cut adjustment. The distance between two adjacent dots is equal to .001" (.03) in depth of cut. To adjust for a deeper cut, loosen screw (7) and turn nut (6) counterclockwise (CCW) the necessary number of dots to get the depth of cut needed. Tighten screw (7).

8 A good way also, to make a correction for the depth of cut, is to loosen screw (7) and adjusting nut (6). Now put a feeler gauge (11) that is the same thickness as the additional depth needed, between adjusting nut (6) and depth gauge (5). Adjust nut (6) to the feeler gauge, then tighten screw (7).

9 Do the counterboring procedure again to get the depth needed [.060" ± .001" (1.5 ± 0.03)] for the 2W3815 Insert.

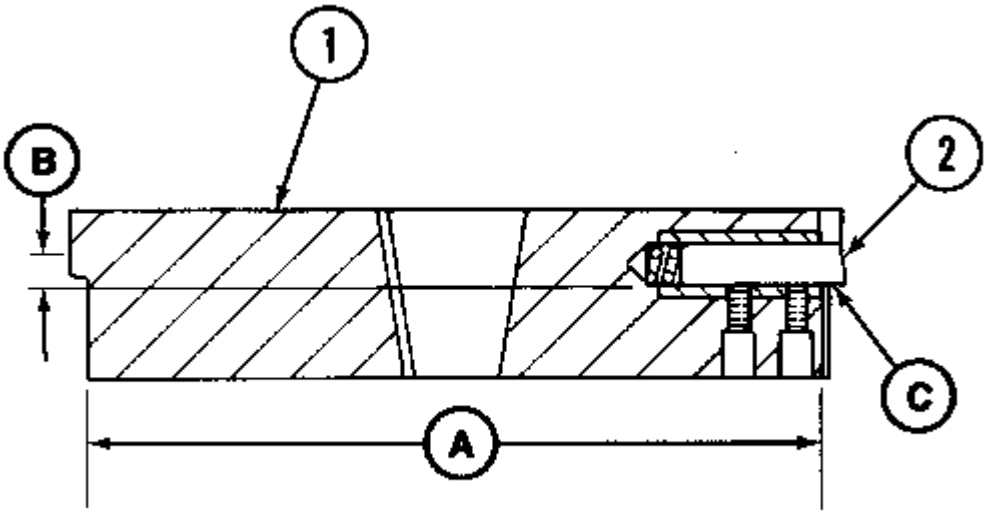
NOTE: If the counterbore does not clean up 100% at the depth needed for installation of the 2W3815 Insert, it is permissible to make the counterbore deeper to a depth of .104" ± .001" (2.64 ± 0.03), for installation of a 5N93 Insert.

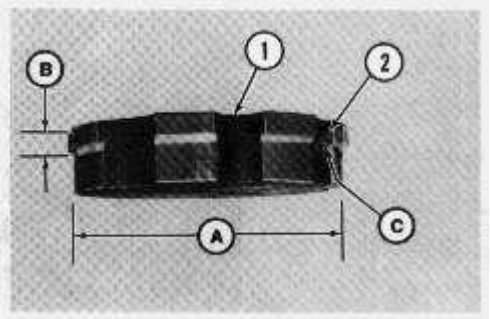
10 After the counterbore has been cut to the correct size (diameter and depth), use a fine emery cloth to remove any burrs or sharp edges, then make reference to the insert installation procedure.

Counterbore Procedure For The Insert Using 8S3140 Counterboring Tool Arrangement

A Modification of 1P7399 Tool Holder

NOTE: It is necessary to machine the 1P7399 Tool Holder (1) before it is used to cut the counterbore. If the tool holder is not machined to the dimensions given here, it will not be possible to cut the counterbore to the correct depth for installation of the insert.



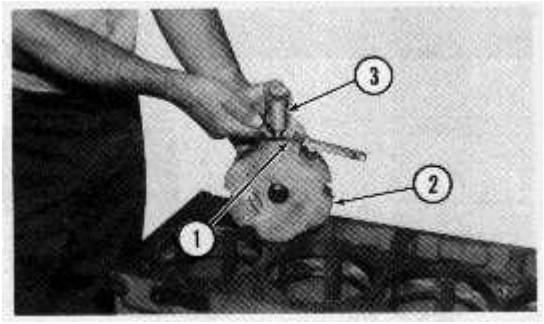


Diameter (A) of tool holder (1), must extend a minimum of .130" (3.3) [dimension (B)] above bottom edge (C) of cutter (2).

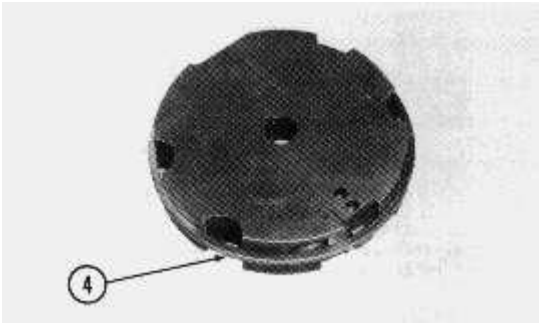
B Installation and Use of 8S3140 Counterboring Tool Arrangement

NOTE: The 6V6191 Cutter must be cut to a length of 1.50" (38.1) before it can be used with the 8S3140 Counterboring Tool Arrangement. The cutter has a .025" ± .005" (0.64 ± 0.13) radius and this radius must not be changed.

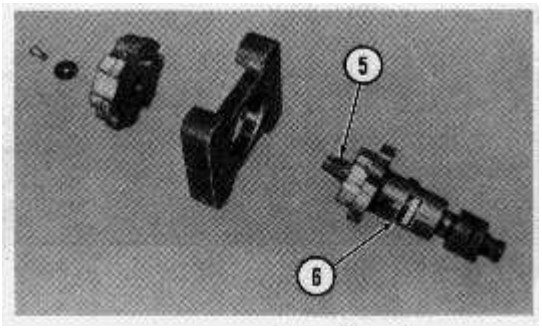
1 The procedure for use of the 8S3140 Counterboring Tool Arrangement is the same as the standard procedure for use of the tool arrangement, except the method of adjustment for the cutter is different. Use the procedure that follows to adjust the cutter.



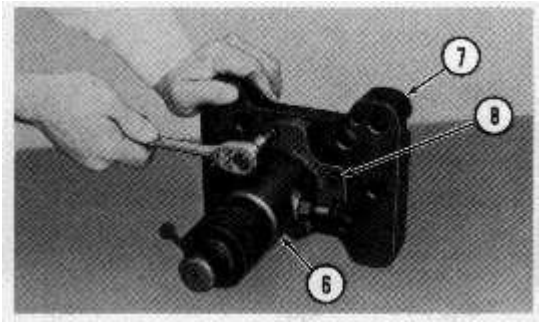
2 Put a .007" (0.18) feeler gauge (1) on tool holder (2). Put the 8S3180 Tool Bit Gauge (3) on the feeler gauge, and lock the tool adjusting pin in position as shown. Install and adjust the 6V6191 Cutter.

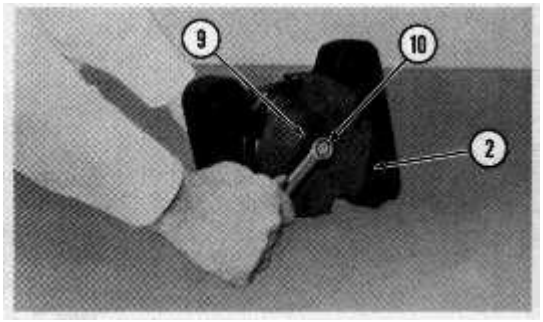


3 Put a 2W3815 or 5N93 Insert (4) on the tool holder to check cutter adjustment. The 6V6191 Cutter must not extend beyond the edge of the insert.

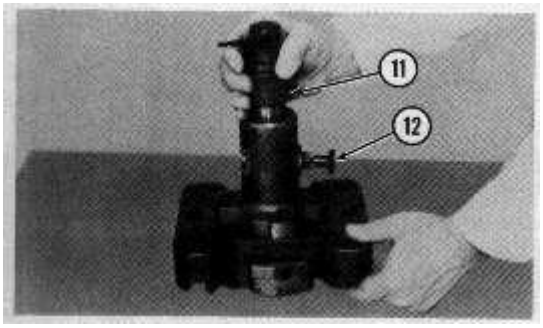


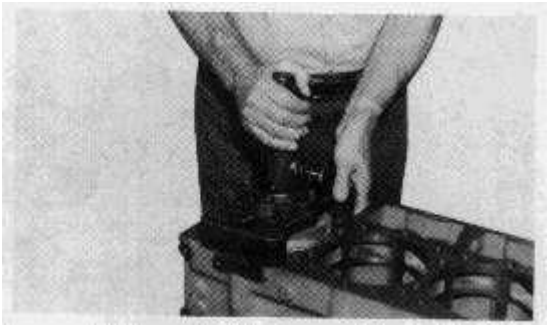
4 Assemble key (5) to driver group (6). NOTE: If 8S3166 Extension is needed, install it on driver group (6).





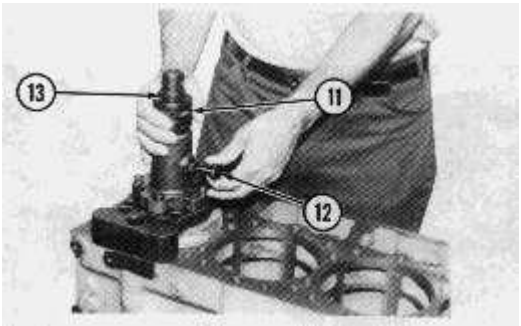
5 Assemble driver group (6) to adapter plate (7) with the 2J5245 Bolts (8). Align the keyway with the key and install tool holder (2) on drive group (6). Install washer (9) and bolt (10). Tighten bolt (10).





6 Pull up on adjusting nut (11) until the plunger (12) will hold the tool holder in the UP position.

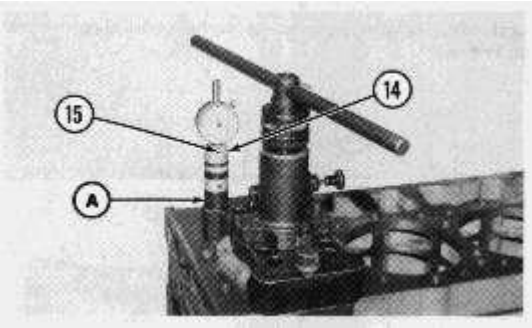
7 Install the counterboring tool on the cylinder block.



8 Hold adjusting nut (11), pull out on plunger (12) and slowly lower the tool holder until the tool bit seats on top of the cylinder block, or adjusting nut (11) comes in contact with the housing of drive group (6). If the tool bit seats on the cylinder block, loosen setscrew (13) and turn adjusting nut (11) clockwise until the adjusting nut rests on the housing of the drive group, and the tool group will turn freely in a clockwise direction. Tighten setscrew (13).

9 Use 9S1364 Bolts with 5P8248 Washers to install the drive group on the cylinder block. Always use the hardened washers between the bolt head and the adapter plate. Tighten the bolts in a two-step sequence to a torque of 20 ± 3 lb-ft (25 ± 4). The tool holder must still turn freely in a CLOCKWISE DIRECTION ONLY.

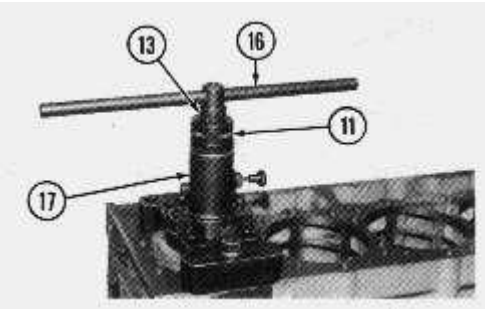
10 Use a .0015" (0.04) feeler gauge and check all around the bottom of the adapter plate to be sure it is correctly seated on the cylinder block. If the feeler gauge will go between the bottom of the adapter plate and the top of the cylinder block at any location, remove the tool group, clean it thoroughly, and remove any nicks or burrs. Again install the tool group.



11 Put depth gauge (14) into gauging hole (A) of the adapter plate. Loosen setscrew (15) and push the dial indicator down to the end of its travel. Pull the dial indicator up .010"-.020" (0.3-0.5) and tighten setscrew (15). Turn the indicator dial to zero. The revolution counter on the dial must be in the zero position to give a direct reading of counterbore depth. Turn the tool holder CLOCKWISE until the red lines on the tool holder and adapter plate are in alignment.

12 Use depth gauge (14) in each of the four measuring holes of the adapter plate and check the depth of the counterbore. The dial indicator gives a direct reading of counterbore depth.

NOTE: Before setting the cutting depth, make sure there is no grease or dirt between the adjusting nut and the top of the housing of the driver group.



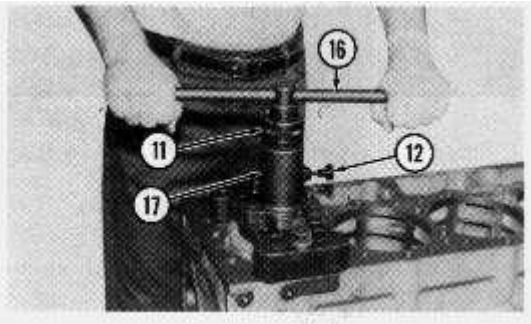
13 Loosen setscrew (13), hold handle (16) stationary and turn adjusting nut (11) counterclockwise until the tool bit seats on the cylinder block. A good indication of this is if there is clearance between adjusting nut (11) and housing (17).

14 Hold handle (16) and turn adjusting nut (11) clockwise until it just makes contact with housing (17). Check the nut reading that is opposite the reference line on the housing. Again, hold handle (16) and turn the adjusting nut counterclockwise the amount necessary to get the .060" (1.5) depth

needed to install the 2W3815 Insert. Do not adjust more than .002" (0.05) at one time. Tighten setscrew (13).

NOTICE

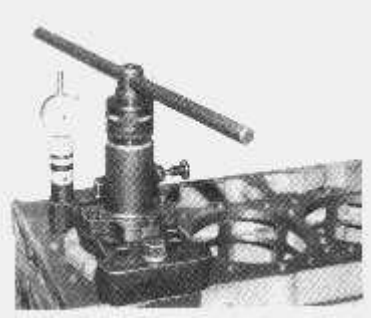
To prevent tool chatter and damage to the tool bit, never cut more than .002" (0.05) of material at one setting, on a cylinder block that uses a spacer plate.



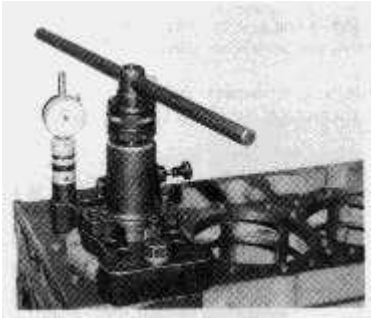
15 Press down on both ends of handle (16) and turn the shaft clockwise until it turns freely and adjusting nut (11) has bottomed out (has contact) against the top of housing (17). Slide handle (16) out, so the long end is over the tool bit. Turn the handle and use constant pressure over the tool bit. Turn the handle until it turns freely. NOTICE: NEVER TURN THE TOOL COUNTERCLOCKWISE WHEN THE TOOL BIT IS IN CONTACT WITH THE COUNTERBORE. Lift the handle and tool holder until plunger (12) locks in place. Clean the chips away from the counterbore.

WARNING

Always wear protective eye covering if using air pressure for the purpose of cleaning parts.



16 Check the depth gauge setting in the gauging hole of the adapter plate. If necessary, zero the dial indicator.

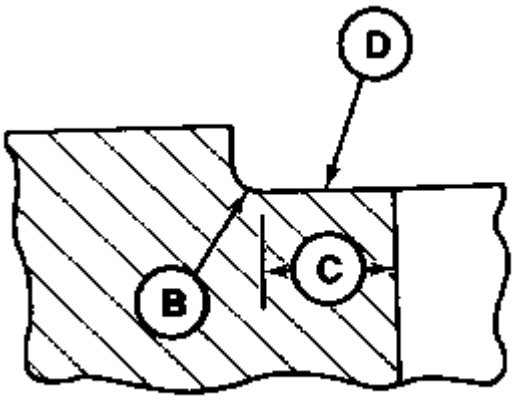


17 Put depth gauge (14) in each of the four measuring holes of the adapter plate to check the depth of the counterbore. If there is a difference of more than .001" (0.03), again turn the handle slowly for several revolutions with constant pressure over the tool bit to get a smooth and clean finish on the counterbore. It is also possible that it will be necessary to remove and thoroughly clean the boring tool and the counterbore. The correct depth for the counterbore must be .060" ± .001" (1.5 ± 0.03) for 2W3815 Inserts, and the counterbore must clean up 100%.

NOTE: If the counterbore does not clean up 100% at the depth needed for installation of the 2W3815 Insert, it is permissible to make the counterbore deeper to a depth of .104" ± .001" (2.64 ± 0.03), for installation of a 5N93 Insert.

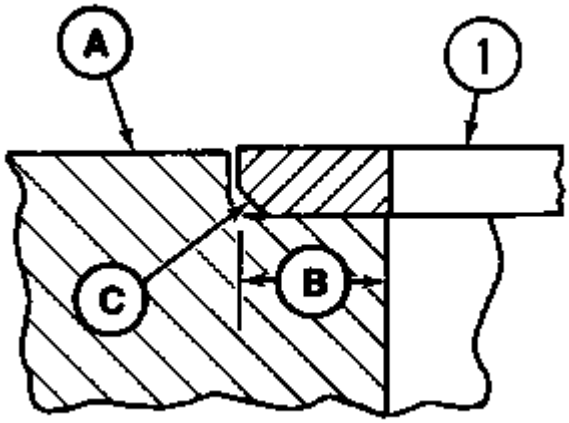
18 Before removal of the boring tool, pull out on plunger (12) and pull up on adjusting nut, until plunger (12) locks in place. This will prevent contact of the tool bit with the counterbore. Remove boring chips and dust from the tool bit after the boring tool has been removed.

19 Use a fine emery cloth to remove any burrs or sharp edges from the counterbore. See INSTALLATION OF INSERT.



20 The illustration above shows the new counterbore and the counterbore radius (B). Area (C) shows the location from the counterbore radius to the edge of the cylinder bore where the liner seat (D) must show no visual signs of erosion.

Installation Of Insert



1 The design of insert (1) and the size of the counterbore give the insert a slip (loose) fit in the cylinder block. If the counterbore has been cut correctly, the top of the insert will be above top surface (A) of the cylinder block to give the necessary projection for the cylinder liner. Location (B) shows the liner seat area that must clean up 100% before it is permissible to install an insert in the counterbore.

2 There is a (±) tolerance for the thickness of the insert, and for the depth of the counterbore. When inserts are installed in a cylinder block, there must be no more than .002" (0.05) difference in height between the inserts of any two counterbores that are next to each other. It is necessary then, to measure the depth of each counterbore, and install an insert of the correct thickness to give the .002" (0.05) specification.

3 Always install inserts (1) clean and dry (no sealant) and with chamfer (C) down in the counterbore. After the spacer plate gasket, spacer plate and cylinder liners are installed, check the projection of all cylinder liners. Permissible projection for any cylinder liner is .002"-.006" (0.05-0.15), but there must be no more than .002" (0.05) difference in projection between any two cylinder liners that are next to each other.

NOTE: If an insert is not to be installed in every cylinder liner bore under one cylinder head, it is possible that additional counterbore depth will be needed for insert installation. This additional depth may be necessary to reduce the difference in projection between any two cylinder liners that are next to each other. See step 3 above.

NOTE: As a result of the (±) tolerance for the depth of the counterbore and the thickness of the insert, in addition to the tolerances for the thickness of the spacer plate gasket, spacer plate and the cylinder liner flange, there can be too much projection for one or more of the cylinder liners. If there is too much liner projection, remove the cylinder liner(s), spacer plate, spacer plate gasket and the inserts. Measure the depth of the counterbore and the thickness of spacer plate, spacer plate gasket, liner flange and the inserts. It will be necessary to either install parts of the correct thickness for each counterbore, or cut the counterbore deeper to get the correct liner projection.

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