

**CRITICAL SERVICE BULLETIN**

Compliance Necessary to Maintain Safety

CATEGORY 2

**CSB 99-3A**

**TECHNICAL PORTIONS  
FAA APPROVED**

**SUBJECT: CRANKSHAFT INSPECTION**

**BACKGROUND:** Teledyne Continental Motors (TCM) has become aware of seven (7) crankshaft fractures which have occurred on engines manufactured during 1998. The cause of the fractures has been identified as a discrepancy in the counterweight bushing installation process. The fractures have all occurred on low time engines having new crankshafts installed with total operating time ranging from 85 to 175 hours. All of the fractures have been grouped around certain manufacturing periods. However, TCM has implemented a much wider inspection program that covers new and rebuilt crankshafts processed from January, 1998 through December, 1998. Review of the manufacturing processes, basic metallurgy, nitride characteristics, dimensional characteristics and supplier practices have not identified any other contributing causes.

**PURPOSE:** To provide instructions for the inspection of the number two and five crankshaft cheeks of crankshafts manufactured or rebuilt in 1998.

**WARNING**

**Inspection is required since undetected cracks can lead to engine failure.**

The inspection requires the removal of two cylinders, two connecting rods and four counterweights to facilitate the visual and ultrasonic inspection of specific areas of the number two and five crankshaft cheeks.

All inspections will be performed by TCM representatives. Call TCM at 1-888-200-7565 to schedule inspection of your aircraft engine crankshaft.

**COMPLIANCE:** For affected engines or crankshafts with 300 hours or less, the inspection must be performed within the next 10 hours of operation.

For affected engines or crankshafts with over 300 hours, the inspection must be performed within the next 50 hours of operation or at the next scheduled maintenance, whichever occurs first.

Uninstalled service spare crankshafts of the affected serial number range must be inspected prior to installation in any engine in accordance with DETAILED INSPECTION, Section C, of this bulletin.

**ENGINES**

**AFFECTED:** O-470, IO-470, TSIO-470, IO-520, TSIO-520, LTSIO-520, IO-550, TSIO-550 and TSIOL-550 Series new and rebuilt direct drive engines assembled utilizing a new or rebuilt crankshaft that was manufactured or rebuilt between January, 1998 and December, 1998. Affected engine serial numbers are specified below. This listing includes 1999 model engines assembled with crankshafts processed in 1998.

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## ENGINES

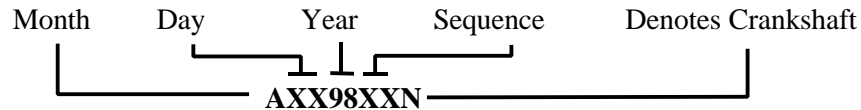
**AFFECTED:** Any of the preceding series engines that have had a 1998 manufactured new crankshaft installed during field overhaul or repair. See Crankshaft Serial Number Identification below for identification of affected 1998 crankshafts.

**Note:** If your engine has recently had a crankshaft installed that may have been manufactured from January through December, 1998 the crankshaft serial number must be verified to determine if this inspection procedure applies.

### CRANKSHAFT SERIAL NUMBER IDENTIFICATION

Crankshaft serial numbers incorporate a manufacturing date. Crankshafts produced in 1998 may be identified as follows:

Code:



All crankshafts with serial numbers beginning with the letters A through L (Jan. through Dec.) in the first position and the year code 98 in the fourth and fifth position are affected. This serial number is stamped on the propeller flange.

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**1998 ENGINES MODELS AND SERIAL NUMBER:**

ENGINE MODEL	ENGINE SERIAL NUMBER
0470GCI1B	817751
0470J11F	202212
0470J18B	202209, 202210
0470K17F	049497, through 049498, 049500, 049502
0470K27B	049501, 049504
0470L10F	069890
0470L16F	069889, 069894, 069895
0470L32B	069884, through 069888, 069891, 069893, 069897
0470L34B	069881, 069882
0470L9F	069896, 069898
0470M27B	054155, 054156
0470R15B	815762, 815767, 815770, 815776, 815802, 815814, 815828, 815841, 811962, 811996, 811997
0470R25B	466730, 466731, 811968, 811976, 811994, 815761, 815764, 815766, 815768, 815769, 815771, 815775, 815779, 815781, 815782, 815783, 815790, 815792, 815796, 815801, 815813, 815815, 815820, 815817, 815825, 815829, 815837,
0470R25F	811973, 815834, 815787
0470R25M	815812
0470R25U	815756, 815757, 815758, 815780
0470R35B	811986, 811991, 811993, 815760, 815786, 815795, 815797
0470R39B	811989, 815827, 811978
0470R41B	811995, 815816
0470R42B	466729, 811959, 811969, 811970, 811971, 811972, 811974, 811975, 811987, 815765, 815773, 815774, 815793, 815794, 815805, 815806, 815807, 815808, 815819
0470R43B	811988
0470R44B	811958, 811961, 811963, 811981, 811992, 811998, 811999, 815759, 815772, 815784, 815800, 815804, 815809, 815824, 815826
0470R45B	811956, 811983, 811990, 812000, 815753, 815755, 815810
0470R46B	811977, 815763

ENGINE MODEL	ENGINE SERIAL NUMBER
0470R52B	815751, 811967, 811980
0470R55B	815778
0470R56B	815785, 815818
0470R57B	811964, 811984, 815752
0470R58B	815822
0470R60B	815798
0470R61B	815754, 815791, 815823
0470R65B	815788, 815830, 815835
0470R66B	815811, 815836
0470S1B	269453, 269456, 269461, 269463, 269464, 269472, 269474, 269480, 269485
0470S2B	269454, 269458, 269470, 269473, 269476, 269479, 269487
0470S3B	269452, 269482
0470S6B	269460, 269466, 269465, 269471, 269481, 269484
0470S7B	269450, 269455, 269457, 269459, 269467, 269468, 269469, 269483, 269486
0470S8B	269475
0470S9B	269477, 269478
0470S11B	269462
0470U11B	813331, 813356, 813416
0470U13B	813344, 813358, 813367, 813370, 813372, 813381, 813413, 813334, 813339, 813388, 813420, 813421, 813440
0470U14B	813339
0470U17B	813340, 813348, 813353, 813355, 813361, 813377, 813380, 813395, 813396, 813398, 813399, 813400, 813404, 813417, 813425, 813427, 813434, 813437
0470U18B	470756, 470758, 813349, 813364, 813366, 813382, 813383, 813402, 813414, 813422, 813424, 813431, 813439
0470U19B	813410
0470U20B	813335, 813401, 813342
0470U21B	813390, 813435
0470U22B	813345
0470U23B	813338, 813362
0470U24B	813409, 813438

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0470U25B	813341, 813346, 813352, 813354, 813357, 813378, 813406, 813407, 813412, 813419, 813428, 813429, 813441
0470U26B	813371
0470U27B	813332, 813337, 813347, 813373, 813374, 813375, 813397, 813403, 813411, 813423, 813426, 813432
0470U28B	813418, 813433
0470U29B	813365, 813391, 813392
0470U31B	813328
0470U37B	813376, 813442
0470U45B	813360, 813386, 819993, 813405, 813415, 813436
I0470C8B	295549, 295550, 295551, 295553
I0470C9B	295552, 295554, 295555
I0470D44B	105643, 105644
I0470D53B	105645
I0470D55B	105642
I0470E17B	088764, 088763, 088766
I0470E19B	088765
I0470E20B	088767
I0470F18B	089920, 089926
I0470F19K	089927
I0470F26B	089916
I0470F27B	089915, 089917, 089918, 089921, 089923, 089924
I0470F29B	089919
I0470F31B	089922
I0470F36B	089925
I0470H6B	087344
I0470K3B	092994, 092995
I0470K11B	092991
I0470K17B	092990, 092992, 092999
I0470K18B	092993, 092998
I0470K21B	092989
I0470K22B	092997
I0470L12B	297825
I0470L15B	297845, 297846
I0470L21B	468607, 468608, 468611, 297793, 297794, 297797, 297798, 297800, 297803, 297807, 297812, 297814, 297815, 297818, 297826, 297827, 297828, 297830, 297832, 297833, 297835, 297836, 297839 through 297843

ENGINE MODEL	ENGINE SERIAL NUMBER
I0470L22B	297790, 297796, 297810, 297823, 297824
I0470L23B	297817, 297820, 297834, 297844
I0470L24B	297801, 297802, 297804, 297809, 297829, 297831, 297837, 297838, 297847
I0470L25B	297795, 297811, 297816
I0470L26B	297813
I0470L27B	297819
I0470L28B	297791, 297792
I0470L29B	297805
I0470N10K	096711
I0470N11B	096701, 096704, 096707
I0470N13B	096721
I0470N14B	096700, 096703, 096713, 096714, 096715, 096719, 096720
I0470N16B	096705, 096712, 096718, 096722
I0470N17B	096702, 096708, 096716, 096717
I0470N21B	096710
I0470S10B	109384, 109385, 109386, 109388
I0470S14B	109387
I0470U4B	118454
I0470V6B	171198, 171205
I0470V9B	171195, 171196, 171199, 171207
I0470V15B	171204
I0470V16B	171202, 171206
I0520A5B	112825, 112827, 112830, 112840, 112841, 112842, 112845
I0520A14B	112838, 112851
I0520A21B	112828, 112832, 112850
I0520A23B	112821, 112822, 112833, 112839, 112849, 112848
I0520A29B	112836, 112837, 112846
I0520A32B	112834, 112844, 112847
I0520A33B	112823, 112831, 112843
I0520A37B	112826
I0520A38B	112829
I0520B6B	234783, 234784, 234785
I0520BA2B	814286, 814288, 814289, 814292, 814305, 814306, 814311, 814316, 814318, 814320, 814321, 814332, 814344, 814349, 814350, 814358
I0520BA3B	814293

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I0520BA6B	814301, 814312, 814338, 814356
I0520BA10B	814280, 814283, 814291, 814296, 814299, 814304, 814307, 814309, 814314, 814317, 814323, through, 814326, 814328, 814330, 814343, 814345, 814346, 814351, 814353, 814354, 814357, 814360, 814362
I0520BA11B	814302
I0520BA12B	814279, 814297, 814298, 814313, 814300, 814322, 814331, 814333, 814335, 814342, 814359, 814361, 814364, 814366, 814368
I0520BA14B	814336, 814337, 814341
I0520BA14M	814319
I0520BA23B	814303, 814329
I0520BA26B	814365
I0520BA32B	814315
I0520BA37B	814294, 814339, 814347, 814355
I0520BA38B	814293, 814295, 814327, 814348, 814352, 814363
I0520BB3B	813856, 813859, 813893
I0520BB6B	813826, 813840, 813880, 813891, 813896, 813900, 813906
I0520BB10B	813849, 813852, 813857, 813870, 813871, 813875, 813879, 813886, 813890, 813892, 813899, 813902, 813908, 813913
I0520BB12B	813829, 813838, 813845, 813846, 813850, 813855, 813858, 813862, 813869, 813877
I0520BB14B	813839, 813847, 813865, 813876
I0520BB15B	813832, 813837, 813873, 813889, 813894, 813897, 813914, 813915
I0520BB16B	813888, 813898, 813907, 813912
I0520BB16U	813831, 813841
I0520BB18B	813844, 813878
I0520BB18U	813860
I0520BB19B	813848, 813866, 813904
I0520BB21B	813835, 813910
I0520BB23B	813836, 813867
I0520BB29B	813853, 813863
I0520BB31B	813843, 813861, 813864, 813884, 813903
I0520BB37B	813854, 813905, 813921
I0520BB52B	813833, 813874, 813895
I0520BB54B	813885
I0520BB56B	813909

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I0520BB58B	813911, 813920
I0520BB61B	813842, 813872, 813882, 813883, 813901, 813919
I0520C3B	810968, 810977, 810979, 810980, 810992
I0520C7B	810949, 810961, 810962, 810964, through 810967, 810970, 810972, 810973, 810974, 810976, 810978, 810986, 810987, 810988, 810990, 810995, 810996, 810997, 816754, 816755, 816756, 816761, 816762, 816763, 816765, 816768, through 816777, 816780, through 816784, 816786, through 816789
I0520C10B	810958, 810959, 810960, 810969, 810971, 810981, 810982, 816752, 816753, 816759, 816764, 816766, 816778
I0520C13B	816785
I0520C15B	810963, 810984, 810985, 810989, 810991, 810993, 810994, 810998, 816767
I0520C16B	816760, 810954, 810983, 810999
I0520CB3B	298983, 299044, 299045, 299061, 299066, 576321
I0520CB7B	298965, 298966, 298968, 298971, 298977, 298979, 298985, 298986, 298987, 298990, 298993, 298996, 299007, 299008, 299015, 299016, 299017, 299025, 299030, 299031, 299033, 299034, 299040, 299043, 299046, 299048, 299052, 299057, 299058, 299062, 299071, 299072, 299073, 299076, 299079, 299085, 299086, 299088, 299092
I0520CB8B	298997, 298998, 299009, 299010, 299014, 299077, 299083
I0520CB8F	299020, 299023, 299029, 299039
I0520CB8W	298984, 299000, 299001, 299005, 299006, 299049
I0520CB9F	298972 298973 299012 299013 299019 299021 299022 299054 299055 299056 299063 299068 299069 299070
I0520CB12B	299011
I0520CB17B	298995, 299027, 299028
I0520CB19B	299059, 299060

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I0520CB21B	298969, 298970, 298976
I0520CB22B	298991, 298992, 299018, 299074
I0520CB40B	298974, 298981, 298982, 298988, 298989, 299003, 299004, 299035, 299036, 299037, 299038, 299041, 299042, 299050, 299051, 299067, 299080, 299081, 299082
I0520CB41B	298978, 298999, 299026, 299032, 299047, 299064, 299075, 299078
I0520D10B	816511, 816525, 816543
I0520D22B	812945, 812987, 816532
I0520D23B	812918 812962 812963 812980 812996 816508 816515 816522 816527 816533 816547 816554
I0520D24B	812991, 812940, 816564
I0520D24M	816502
I0520D24N	812954
I0520D26B	575935 812947 812961 816503 816524 816536 816550
I0520D27B	812977, 816526
I0520D29B	812924
I0520D30B	816510, 816518, 816531, 816544
I0520D31B	812992
I0520D32B	812968, 816506, 816507
I0520D35B	575934
I0520D39B	812966
I0520D40B	812919, 812943, 812979, 816512, 816545
I0520D44B	575938, 812934, 816546
I0520D45B	816560
I0520D48B	812917
I0520D51B	812933, 812939, 812958, 812981
I0520D56B	812927, 812929, 812944, 812948, 812949, 812952, 812957, 812959, 812990, 816523, 816529, 816553, 816555, 816557, 816563
I0520D70B	816513
I0520D75B	812928
I0520D79B	816539
I0520D7B	812997, 812998, 812999
I0520D84B	816530, 816534
I0520D90B	812937
I0520D91B	812989
I0520D95B	816517, 816559
I0520D96B	816501
I0520D9B	812922, 812931, 812973, 816548

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I0520D100B	816516
I0520D113B	816561
I0520D116B	812930, 812938, 812941, 812950, 812951, 812969, 812975, 812976, 816505, 816514, 816520, 816537, 816540, 816558, 816565
I0520D117B	812956
I0520D119B	816538, 812993
I0520D120B	812982, 812984, 816567
I0520D124B	812960, 812985, 812986, 812988, 813000, 816521, 816535, 816549
I0520D139B	812942, 812946, 812983, 816519, 816528, 816541, 816542, 816556
I0520D142B	812994, 816509, 816552
I0520D149B	812955
I0520D152B	816504, 816551
I0520D173B	812935, 816566
I0520D177B	812932, 812972
I0520E2B	215906, 215907, 215918, 215919, 215921, 215922
I0520E7B	215914, 215915, 215916, 215917
I0520E9B	215920
I0520E11B	215904, 215905
I0520E14B	215908, through 215913
I0520F3B	814787, 814795, 814806, 814817, 814851, 814856, 814858, 814882, 814898, 814905, 814952
I0520F4B	814836, 814825, 814826, 814925,
I0520F6B	814852
I0520F7B	579256, 814837, 814946, 814949
I0520F9B	814783, 814810, 814820, 814832, 814835, 814838, 814839, 814894, 814916
I0520F12B	579247, 579248, 579250, 579257, 814814, 814815, 814848, 814850, 814876, 814903, 814907, 814919, 814937, 814953, 814961
I0520F13B	579251, 579253, 814770, 814777, 814788, 814831, 814877, 814880, 814885, 814890
I0520F13U	814791
I0520F16B	814822, 814857, 814899, 814910, 814926, 814938
I0520F17B	814768, 814775, 814865, 814883, 814884, 814906, 814950, 814956
I0520F18B	814873

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I0520F20B	814887, 814936
I0520F21B	814803, 814935
I0520F22B	814844, 814902
I0520F23B	814913, 814914
I0520F24B	814891 814785 814790 814801 814802 814823 814862 814863 814867
I0520F26B	579254, 579255, 814849, 814872, 814924
I0520F27B	814765, 814766, 814767, 814794, 814811, 814812, 814818, 814819, 814833, 814855, 814861, 814871, 814875, 814911, 814933, 814934, 814940, 814942, 814948, 814954
I0520F39B	814878, 814799
I0520F42B	814792, 814816, 814824, 814827, 814868, 814879, 814889
I0520F43B	814840, 814853, 814859
I0520F46B	814796
I0520F47B	814784
I0520F48B	814771, 814778, 814779, 814781, 814782, 814786, 814797, 814800, 814828, 814830, 814834, 814854, 814908, 814912, 814923, 814929, 814939, 814941
I0520F56B	814789, 814793, 814843, 814845, 814846, 814886, 814944, 814945
I0520F57B	814776, 814805, 814847, 814864, 814869, 814874, 814909, 814920, 814921, 814943
I0520F59B	814813, 814915
I0520F60B	814808
I0520F61B	814893, 814897, 814900
I0520F64B	814780, 814807, 814821
I0520F67B	579252
I0520F68B	814804, 814896
I0520F69B	814842
I0520F70B	814947
I0520J1B	216532, 216533, 216536, 216537
I0520J2B	216535
I0520K1B	224133 through 224136
I0520L1B	294874, 294902, 294905, 294913
I0520L5B	294919
I0520L7B	294878, 294885, 294887, 294888, 294889, 294899, 294909, 294912, 294914, 294918, 294935, 294940, 294943, 294954

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I0520L8B	294880, 294883, 294884, 294886, 294921, 294930, 294936, 294937, 294938, 294950
I0520L12B	294906, 294932
I0520L13B	294894, 294907, 294910, 294939
I0520L14B	294893, 294917, 294931
I0520L16B	294879, 577231
I0520L17B	294882, 294904, 294933
I0520L18B	294945
I0520L19B	294908
I0520L1B	294941
I0520L32B	294920
I0520L46B	294890, 294897, 294923, 294944, 294951, 294953
I0520L47B	294911, 294922
I0520L48B	294875, 294881, 294895, 294901
I0520L51B	294891, 294892, 294896, 294898, 294903, 294915, 294924, 294925, 294926, 294927, 294928, 294929, 294934, 294947
I0520L53B	294952
I0520L54B	294946
I0520M1B	811590, 811892 through 811600, 811602 through 811612, 811614 through 811630
I0520M2B	811601, 811613
I0520MB1B	277683, 277685, 277688, through 277702, 277703 through 277717, 277719, 277721, 277723, through 277728
I0520MB2B	277684, 277686, 277687, 277718
I0550A2B	280478, 280479, 817005
I0550A3B	280475 through 280477, 280480 through 280483, 280485, 280486, 280488 through 280493, 280496 through 280500, 817001, 817002, 817003
I0550A5B	280494, 280495, 280487, 817004
I0550B1F	297048, 297050, 297074, 297115
I0550B4F	297039, 297059, 297101, 297105, 297108, 297118
I0550B5F	297037,
I0550B6F	297040, 297041, 297042, 297043, 297057, 297064, 297066, 297069, 297070, 297071, 297072, 297077, 297078, 297083, 297084, 297085,

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I0550B6F	297086, 297087, 297091, 297095, 297116, 297117, 297143, 683996, 684001, 684110
I0550B9F	297047, 297102
I0550B12B	297046, 297051, 297052, 297055, 297056, 297058, 297060, 297062, 297063, 297073, 297079, 297081, 297082, 297088, 297089, 297090, 297094, 297096, 297097, 297100, 297103, 297104, 297113, 297114, 297119, 297120, 297121, 297124, 297125
I0550B13B	297049, 297068, 297080, 297093, 297098, 297109, 297110, 297122, 297123
I0550B14B	297076
I0550B15B	684014
I0550B22B	297044
I0550B23B	297092, 297107
I0550B37B	682983 through 682990, 682993, 682995 through 683003, 683005, 683008 through 683011, 683013, 683015, 683016, 683017, 683019, 683020, 683023, 683025 through 683033, 683941, 683942, 683944, 683995, 683997, 683998, 683999, 684000, 684002
I0550B39B	684004 through 684013, 684015 through 684022, 684745
I0550B40B	297106
I0550C1F	810500, 815251, 815252, 815255 through 815258, 815260, 815261, 815272, 815277, 815278, 815279, 815282, 815286, 815313
I0550C2F	815280, 815281, 815318
I0550C3F	810479 through 810483, 815289 through 815294, 815301, 815302
I0550C6F	684222, 684223, 684232, 684233, 684370, 684371, 810489, 810490, 810494, 810495, 810496, 810497, 810499, 815253, 815254, 815259, 815262, 815263, 815264, 815265, 815266, 815270, 815271, 815273, 815275, 815276, 815283, 815284, 815298, 815299, 815305, 815306, 815307, 815308, 815309, 815310
I0550C8B	815285, 815287, 815288, 815311
I0550C9B	815269, 815304

ENGINE MODEL	ENGINE SERIAL NUMBER
I0550C11B	815267, 815268
I0550C30B	683723 through 683741, 683744 through 683767, 683887 through 683891, 684159 through 684166, 684168 through 684175, 684368, 684369
I0550C31B	684234, 684235, 684237 through 684241, 684243 through 684253, 684255 through 684265, 684534
I0550D2B	284287, 284291
I0550D9B	284282
I0550D10B	284296
I0550D13B	284279, 284284, 284285, 284288, 284293, 284307, 680017
I0550D14B	284280, 284289
I0550D15B	284277, 284278, 284281, 284290
I0550D16B	284276, 284286, 284298
I0550D17B	284300
I0550D1B	284283, 284306
I0550D20B	284292, 284294, 284295, 284299, 284301, 284302
I0550D22B	284297
I0550E1B	283382, through 283389
I0550F1B	284870, 284882
I0550F2B	284845
I0550F3B	284847, 284846, 284865, 284875, 284889
I0550F4B	284879
I0550F6B	284857
I0550F7B	284874
I0550F8B	284897
I0550F9B	284839, 284841, 284842, 284850, 284854, 284855, 284860, 284869, 284876, 284887, 284891
I0550F10B	284866, 284872, 284878, 284894
I0550F11B	284849, 284871
I0550F13B	284843, 284862, 284880, 284892, 284895
I0550F14B	284844, 284861, 284864, 284893
I0550F15B	284848
I0550F16B	284885
I0550F17B	679521
I0550F19B	284886
I0550F20B	284856, 284863, 284881, 284883, 284896

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I0550F21B	284859, 284873, 284888, 284890
I0550F24B	284851
I0550G1B	679341
I0550G2B	679340, 679373
I0550G6B	679316 through 679319, 679323 through 679325, 679328 through 679337, 679343, 679346 through 679353, 679363 through 679372, 679377, 679381, 679393, 808508
I0550L1B	289142
I0550L3B	289136
I0550L6B	289140, 289145
I0550L7B	289134, 289141
I0550L11B	289127, 289130, 289131, 289133, 289137, 289138, 289139, 289143, 289144
I0550L15B	289135
I0550N1B	683355
I0550N2B	683354
LTSI0520AE2B	246667, 246668
LTSI0520AE3B	246666, 246669, 246670, 246671, 246672, 246673
LTSI0520AE4B	246662
LTSI0520AE5B	246663
TSI0520AE2B	246166
TSI0520AE3B	246160, 246165, 246168, 246169, 246171
TSI0520AE4B	246170
TSI0520AE5B	246161, 246163
TSI0520AF3B	245244, 245246 through 245251
TSI0520B5B	176754
TSI0520B9B	176751, 176755, 176756, 176757, 176758, 176762, 176763
TSI0520B10B	176750, 176752, 176761
TSI0520B11B	176753, 176759
TSI0520B12B	176760
TSI0520BB9B	287592, 287598, 287600, 287607, 287611
TSI0520BB10B	287591, 287597, 287599, 287602, 287605, 287608
TSI0520BB17B	287593
TSI0520BB18B	287594
TSI0520BB21B	287595, 287606
TSI0520BB22B	287596
TSI0520BB23B	287610
TSI0520BB24B	287609
TSI0520BE2F	273809

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TSI0520BE2G	273810, 273813, 273814, 273815, 273816
TSI0520C2B	178534, 178543, 178545
TSI0520C3B	178541, 178546, 178549
TSI0520C5B	178542, 178553
TSI0520C6B	178552
TSI0520C7B	178528, 178530, 178535, 178538, 178539, 178551
TSI0520C8B	178540, 178544
TSI0520C9B	178536, 178547, 178550
TSI0520C11B	178548
TSI0520CE1F	268576, 530168
TSI0520CE2B	268575
TSI0520D3B	180109, 180110
TSI0520DB1B	242015
TSI0520E4B	812578, 812587, 812603, 812606
TSI0520E5B	812593, 812602, 812607, 812618
TSI0520E8B	812575, 812579, 812586, 812589, 812591, 812596, 812598, 812600, 812601, 812612, 812615, 812617, 812619
TSI0520E9B	812569 812574 812576 812577 812581 through 812585 812590 812592 812594 812597 812599 812608 812609 812611 812613 812614 812616
TSI0520E14B	812580
TSI0520E17B	812610
TSI0520E19B	812571
TSI0520E23B	812588
TSI0520EB2B	271498
TSI0520EB4B	815005
TSI0520EB5B	815004, 815006
TSI0520EB8B	271499, 815001, 815010, 815011, 815012, 815015, 815020, 815021, 815024, 815025, 815028, 815030, 815031
TSI0520EB9B	271496, 271497, 815007, 815009, 815013, 815014, 815016, 815017, 815018, 815019, 815022, 815026, 815027, 815029, 815032
TSI0520EB17B	815023
TSI0520G1B	216051
TSI0520G3B	216052, 216053
TSI0520H1B	217400, 217410
TSI0520H4B	217402, 217404, through 217409, 217411, through 217414, 217416

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TSI0520H6B	217401, 217403, 217415, 506894
TSI0520J1B	218988, 218990, 218991
TSI0520J2B	218989
TSI0520JB1B	237189, 237186, 237191
TSI0520JB2B	237187, 237188, 237190
TSI0520KB1B	245711
TSI0520KB2B	245712
TSI0520L1B	241970, 241971, 241972
TSI0520L4B	241969
TSI0520LB1B	237300
TSI0520LB4B	815502, 815503
TSI0520LB6B	237299, 815501
TSI0520M6B	291944, 291957, 291962, 291996
TSI0520M7B	291929 through 291929, 291931, 291934, 291938 through 291939, 291943, 291945, 291946, 291948, 291949, 291952 through 291956, 291958, 291959, 291960, 291963, 291964, 291965, 291970, 291971, 291973, 291976, 291979, 291980, 291981, 291982, 291985, through 291989, 291991, 291992, 291994, 291995, 291998, 291999, 292000, 532083 532085 532086, 532087, 532088,
TSI0520M8B	291961, 291984
TSI0520M9B	291932, 291967, 291968
TSI0520M10B	291937, 291947, 291975, 291977, 291978, 291983, 291990, 291993, 291997, 818001
TSI0520M11B	291969
TSI0520N1B	228639
TSI0520NB1B	521665, 813564, 813568, 813571, 813575, 813582, 813588, 813589, 813592, 813600, 813608, 813614, 813617, 813618, 813621, 813627, 813628
TSI0520NB2B	521666, 813565, 813572, 813573, 813576, 813585, 813601, 813615, 813619, 813622, 813623
TSI0520NB4B	813586, 813593, 813603, 813606, 813616, 813629, 813632
TSI0520NB5B	813578, 813594, 813607, 813610, 813611
TSI0520NB6B	813569, 813613, 813624
TSI0520NB8B	813583, 813605, 813620, 813631
TSI0520NB10B	813579, 813598, 813612
TSI0520NB12B	813595

ENGINE MODEL	ENGINE SERIAL NUMBER
TSI0520NB13B	813597
TSI0520NB14B	813626
TSI0520NB16B	813577
TSI0520NB17B	813566, 813567, 813581, 813584, 813630
TSI0520NB31B	813602
TSI0520NB32B	813599
TSI0520P5B	278818, 278825
TSI0520P6B	278812, 278815, 278816, 278819, 278820, 278823, 278826
TSI0520P7B	278810, 278813, 278824, 278828
TSI0520P8B	278814, 278817, 278821
TSI0520R7B	293992, 294016, 294025
TSI0520R9B	293950, 293955, 293956, 293959, 293961, 293964, 293965, 293969, 293970, 293972, 293975, 293976, 293977, 293979, 293984, 293985, 293987, 293991, 293993, 293994, 293995, 293997, 293998, 293999, 294004, 294007, 294008, 294011, 294014, 294018, 294022, 294023, 294024, 294026, 294027, 294029, 294031, 294032, 294036, through 294039, 522696, 522697, 522698, 522699, 522700
TSI0520R10B	293958, 294005, 294035
TSI0520R11B	293978, 294000, 294019
TSI0520R12B	293957, 293960, 293962, 293963, 293967, 293973, 293974, 293982, 293986, 293988, 293990, 294001, 294003, 294006, 294010, 294013, 294015, 294021, 294030, 294033, 294034
TSI0520R13B	293983
TSI0520T1B	239460 through 239462, 239464 through 239471, 515439 through 515442
TSI0520T3B	239463, 239472
TSI0520UB1B	809335, 809340
TSI0520UB2F	809327, 809331, 809333, 809339
TSI0520UB3F	527447, 809334, 809341, 809345, 809346
TSI0520UB4F	809330, 809347
TSI0520UB5F	809350
TSI0520UB6B	809328, 809329, 809332, 809336, 809337, 809344, 809349

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TSI0520UB8B	809348
TSI0520UB11B	809338
TSI0520UB12B	809342
TSI0520UB16B	527365, 527366, 527367, 527369, 527370, 527372, 527373, 527374, 527393, 527408, 527412, through 527418
TSI0520UB17B	527420 through 527426
TSI0520VB1B	529113, 811197, through 811201, 811205, 811208, 811209, 811213, 811228, 811229, 811232, 811242, 811247, 811248, 811249, 816001, 816005, 816008, 816010, 816011, 816014, 816016, 816017, 816018, 816020, 816025, 816027, 816033
TSI0520VB2B	529112, 811202, 811206, 811236, 811238, 811244, 811250, 816007, 816030, 816031, 816032
TSI0520VB2F	811196, 811204, 811214, 811231, 811235, 816006, 816019, 816024, 816028, 816036, 816040

ENGINE MODEL	ENGINE SERIAL NUMBER
TSI0520VB4B	811194, 811237, 816012, 816026, 816039, 816041
TSI0520VB4F	811195, 811207, 811210, 811211, 811212, 811217, 811218, 811220, through 811227, 811230, 811233, 811234, 811239, 811240, 811241, 811243, 811245, 816002, 816003, 816004, 816009, 816013, 816021, 816022, 816034, 816035, 816037, 816038, 816044
TSI0520WB3F	274416 through 274427, 274430, through 274436, 274439
TSI0520WB5F	274428, 274429
TSI0550C1B	802576 through 802590, 814502, 814503, 814504, 814505 through 814509
TSI0550E1B	803057, 803059, 803061, 803062, 803065, 803067, 803069, 803070, 803079, 803080,
TSI0550E3B	803056, 803066, 803068
TSI0L550A1G	809259

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with 1998 manufactured crankshafts**

ENGINE MODEL	ENGINE SERIAL NUMBER
0470R15B	815843
0470R25B	815839, 815846, 815860
0470R25F	815838
0470R25U	815840
0470R44B	815842, 815844
0470R55B	815845
0470S2K	269489
0470U18B	813444, 813445
0470U25B	813448
I0470C8B	295556
I0470F27B	089928
I0470K18B	093000
I0470L15B	297856, 297857
I0470L21B	297848, 297850, 297851, 297852
I0470L23B	297854
I0470N11B	096727
I0470N14B	096724, 096726
I0470N20B	096725
I0470V15B	171208

ENGINE MODEL	ENGINE SERIAL NUMBER
I0520BA10B	814374, 814373, 814369
I0520BA22B	814372
I0520BA23B	814370, 814371
I0520BB15B	813918
I0520C15B	816791, 816799
I0520C7B	816792
I0520CB3B	299112
I0520CB7B	299091, 299096, 299097
I0520CB8B	299090
I0520CB8W	299093, 299094
I0520D13B	816570
I0520D142B	816569
I0520D56B	816572
I0520F21B	814960
I0520F47B	814959
I0520F64B	814957
I0520F70B	818766
I0520L27B	294955
I0520L7B	294956

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I0520MB1B	277730
I0550B13B	297133, 297134, 297136, 297137, 297138, 297153
I0550B15B	684113
I0550B39B	684023, 684024, 684025
I0550B4F	297131
I0550B5F	297130
I0550B6F	297128, 297129
I0550C2F	815316
I0550C31B	684266, 684267, 684268, 684273
I0550C6F	815314, 815315
I0550C8B	815319
I0550D13B	680019
I0550D14B	680018
I0550D15B	284311
I0550D18B	284312
I0550F5B	284898
I0550G6B	679378, 679382
I0550L3B	289147
LTSI0520AE2B	246675, 524343
TSI0520AE2B	523349
TSI0520BB10B	287616
TSI0520E19B	812621
TSI0520E4B	812622
TSI0520E5B	812623
TSI0520E8B	812630
TSI0520E9B	812620, 812626
TSI0520EB8B	815033
TSI0520M6B	818002, 818011
TSI0520M7B	818003, 818005, 818013
TSI0520NB9B	813634
TSI0520P6B	278830
TSI0520R10B	294044
TSI0520R11B	294043
TSI0520R12B	294050
TSI0520R9B	294046
TSI0520UB17B	527427
TSI0520UB1B	809352
TSI0520VB1B	816046
TSI0520VB2F	816047
TSI0520VB4B	816045
TSI0550C1B	802591
TSI0550E1B	803077

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## GENERAL INFORMATION:

**INSPECTION OF NEW AND REBUILT AFFECTED ENGINES AND ENGINES THAT HAVE BEEN OVERHAULED OR REPAIRED UTILIZING THE SERIAL NUMBERED CRANKSHAFTS SPECIFIED IN THIS CRITICAL SERVICE BULLETIN.**

### WARNING

**The inspection required by this service bulletin is intended to detect conditions which if present and left uncorrected can result in engine failure.**

#### PRE-INSPECTION:

1. a. Turn the master switch off.  
b. Turn magneto switches off.  
c. Close the throttle.  
d. Place mixture control in the idle cutoff position.
2. To gain access to the engine remove the engine cowling in accordance with the aircraft manufacturer's maintenance manual.
3. Disconnect all spark plug leads from spark plugs to prevent engine firing.
4. Remove engine baffling and engine mounted equipment, as required, to facilitate removal of cylinders number one and three.
5. Remove cylinders number one and three in accordance with the applicable engine maintenance manual, overhaul manual or aircraft manufacturer's maintenance manual. **Remove the cylinder only far enough to expose the piston pin. Push the piston pin out of the connecting rod bushing only far enough to release the piston and piston pin from the connecting rod, leaving the piston in the cylinder.**
6. The numbers one and three connecting rods and all counterweights will have to be removed to perform the inspection.

**Note:** Place a clean shop towel through the cylinder opening below the crankshaft to catch any items that may be dropped.

### WARNING

**Anything dropped in the engine must be removed.**

7. Position the connecting rod to be removed (number one or number three) at or near top center. See Figure 1.  
**Note:** The 470, 520 and 550 series engines may have connecting rod nuts secured with cotter pins or they may have Spiralock nuts which do not have cotter pins. When removing Spiralock nuts, you may find it necessary to tighten the nut slightly to release the self-locking feature.
8. Remove, if utilized, the connecting rod nut cotter pins and discard them. Remove the connecting rod nuts.
9. Carefully separate the connecting rod from the connecting rod cap. Support the connecting rod cap while removing the connecting rod from the crankshaft. Repeat this procedure for the other connecting rod.
10. Position the crankshaft so that the rearward retaining rings and plates of a counterweight on the number two crankshaft cheek can be removed. Using a pair of snap ring pliers, remove and discard two retaining rings. Using a long, blunted tip awl and ball peen hammer tap the retaining plates to loosen them. Remove retaining plates with a pair of 90° offset snap ring pliers, a scribe with a hook fashioned into its end or a retrieval magnet. See Figure 2. Discard the retaining plates. Using a retrieval magnet, remove the counterweight pins. See Figure 3. Document the pin positions. They must be placed back in the same position from which they were removed.

Counterweight and counterweight blade positions are identified as leading or trailing based on the position of the number one connecting rod journal. With the number one connecting rod journal at the 6 o'clock position (as viewed from the rear of the engine), the number two crankshaft cheek counterweight and blade at the 3 o'clock position and the number 5 crankshaft cheek counterweight and blade at the 2 o'clock position are identified as the trailing

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counterweight and blade. The opposite counterweight and blade are identified as the leading counterweight and blade. When removing counterweights and counterweight pins identify the counterweights as leading or trailing and the counterweight pins leading (first pin in the direction of engine rotation) or trailing (second pin in the direction of engine rotation). Again, the counterweights and counterweight pins must be reinstalled in same location from which they were removed.

11. Looking from the rear of the engine forward, turn the crankshaft in the counterclockwise direction far enough that the lower end of the counterweight can be started out through the cylinder opening by hand. See Figure 4. Now turn the crankshaft in the clockwise direction and remove the counterweight. See Figures 4, 5, 6 and 7.
12. Using the procedure in steps 10 and 11 remove the remaining counterweight on the number two crankshaft cheek and remove the two counterweights on the number five crankcheek.
13. Some counterweights may not clear the crankcase and cannot be removed. If so, position as shown in Figure 8 for the inspection.

**CAUTION**

*Be careful when turning crankshaft with a loose counterweight.*

**Note:** Document positions of counterweights so they are returned to the original positions.

**DETAILED INSPECTION:**

**A. VISUAL INSPECTION:**

1. Using a soft shop towel dampened with solvent, remove any surface residue from the aft side of the number two and five crankshaft cheeks. The outboard area at the edge of crankshaft cheek next to the counterweight is the area to be inspected. See Figures 9, 10 and 11.

2. Using a flashlight and mirror or a borescope visually inspect the aft side of the number two and five crankshaft cheek for indications of a crack or mechanical damage. The inspection area is between the counterweight blade bushing holes at the chamfered edge of blade shoulder on both sides of the crankshaft cheek. See Figure 10 and Figure 11.
3. If the visual inspection does not clearly reveal a crack, perform an ultrasonic inspection of the aft side of number two and five crankshaft cheek in accordance with Section "B" ULTRASONIC INSPECTION.
4. If visual inspection reveals a crack the engine must be removed from service until repaired or replaced.

**B. ULTRASONIC INSPECTION:**

An ultrasonic inspection must be performed in accordance with TCM procedure MHS 244.

This procedure must be done with the equipment and trained personnel as indicated in MHS 244. Deviations from this procedure must be approved in writing from TCM.

If a crack or a crack indication is detected during this inspection, the engine must be removed from service until repaired or replaced.

**C. SERVICE SPARE CRANKSHAFTS:**

1. Uninstalled service spare crankshafts must have the visual and ultrasonic inspections performed in accordance with sections A and B. Additionally, perform a magnaflux inspection in accordance with ASTM E 1444. The wet continuous method utilizing full wave rectified alternating current and fluorescent particles is required.

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2. Crankshafts meeting the inspection criteria in "C" part 1 must be identified by vibropeening 99-3 after the crankshaft serial number i.e. AXX98XXN 99-3.

**RETURN TO SERVICE:**

1. Ensure that no debris is left in the engine interior.

**WARNING**

**Failure to remove all debris from the engine interior can result in engine damage and possible failure.**

2. Drain the engine oil into an approved container.
3. Install the counterweights and pins in the exact locations from which they were removed in accordance with the following:

**Note:** The counterweight plates have a small extruded point which provides an interference fit of .001 to .007. Before installation, check the counterweight plates for an actual interference fit in the bushing bore. An interference fit is required.

4. Install the two counterweights removed from the number two crankshaft cheek hanger blades in their original position and install the counterweight pins in their original position. Install new plates and retaining rings with sharp edge outboard. If new pins are installed, pins with the same part number and dash number must be installed in each counterweight. Repeat the above process for the counterweights on the number five crankshaft cheek.

**CAUTION**

*The retaining rings, plates and pins must be installed as shown in Figure 12. "Counterweight Inspection, and Installation."*

**WARNING**

**Do not use plates that have a loose fit. Failure to properly install counterweight retaining plates and snap rings may result in engine damage and possible failure.**

5. Apply 50-weight Aviation grade oil to the number one and three crankshaft connecting rod journals.

6. Position the number one and three connecting rod caps with bearing insert and bolts installed (position number facing up) on the respective crankshaft connecting rod journals.
7. Install the number one and three connecting rods, with bearing insert in place, on the respective crankshaft connecting rod journal while supporting the connecting rod cap and bolts.
8. Lubricate the threads of the connecting rod bolts and nuts with clean 50-weight aviation grade oil and thread the nuts onto the bolts.

**NOTE:** Spirallock nuts are self locking fasteners and thread freely onto the connecting rod bolt.

9. Torque connecting rod nuts to the torque value specified in Table 1 as follows.

For connecting rods using either P/N 643215 or P/N 654490 self-locking connecting rod nut (Spirallock nut), torque to the value specified in Table 1. See Figure 13.

For connecting rods using P/N 628109 castellated nuts and P/N629340 bolt, initially torque nut to the specified low limit in Table 1 or TCM Service Bulletin SB96-7B. If the cotter pin hole in the bolt and the castellations of the nut do not align, set the torque wrench to the specified maximum torque limit and continue to torque the nut until the castellations align or the specified maximum torque limit is reached. If the specified maximum torque limit is reached before the castellations align with the cotter pin hole in the bolt, the nut will have to be removed and a new nut installed and torqued as specified above.

10. Install new cotter pin in each nut and secure by seating the cotter pin head in nut castellations and bending one leg of the cotter pin up over the con-rod bolt and back toward the head of the cotter pin. Trim leg so that its end is centered with the center of the bolt diameter. Bend the other leg down and trim it so that its end is mid way between the nut base and the nut castellation. See Figure 14.

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11. Prior to installing number one and three cylinders, ensure that the engine interior is free of any debris and tools.
12. Install a new cylinder base “O” ring on each cylinder.
13. Lubricate the exposed portion of the piston and piston pin on each cylinder with clean 50-weight aviation oil.
14. With the aid of an assistant, install number one and three cylinders in accordance with the TCM Maintenance Manual, Overhaul Manual and Service Bulletins.
15. Lubricate all cylinder deck stud threads, through bolt threads and nuts with clean 50 weight engine oil prior to installation and torquing.
16. Torque cylinder deck stud nuts and through bolt nuts to the value specified in Table 2.

**CAUTION**

*Proper cylinder installation requires a multiple step torquing process. Cylinder base stud threads, through bolt threads and nuts must be lubricated with clean 50-weight aviation oil.*

- a. Torque cylinder base nuts to 1/2 of the specified torque value for the fastener.
- b. Torque the cylinder through bolt nuts and cylinder base stud nuts to the specified torque value for the **cylinder base stud nuts**. Through bolt nuts must be torqued on both sides of the engine.

**WARNING**

**Failure to torque through bolt nuts on both sides of the engine can result in a loss of main bearing crush, main bearing shift and engine failure.**

- c. Torque through bolt nuts on both sides of the engine to the specified value for the fastener.
- d. On engines which incorporate the 7<sup>th</sup> cylinder deck stud, lubricate threads and install the 7<sup>th</sup> stud cylinder bracket and

conical stud nut. Torque the stud nut to the value specified for the fastener.

**NOTE:** Through bolt nuts P/N’s 634505 and 649496 have been superseded by nut P/N 652541. Nut P/N 634505 is a flanged 6 point (hex) nut requiring a torque value of 690-710 inch pounds. Nut P/N 649496 is a flanged 6 point (hex) nut requiring a torque value of 790-810. Nut P/N 652541 is a flanged 12-point nut requiring a torque value of 790-810 inch lbs. At engine overhaul all P/N 634505 and 649496 flanged through bolt nuts must be replaced with P/N 652541 flanged 12 point nuts. If replacing P/N 634505 or 649496 nuts in less than a complete set prior to engine overhaul torque nut P/N 652541 to the required value of the original fastener (P/N 634505 or 649496).

17. Reinstall all engine components and baffles removed to facilitate this inspection in accordance with the aircraft manufacturer’s maintenance manual.
18. Remove and replace the engine oil filter.
19. Reinstall the oil sump drain plug with a new gasket; torque to the specified torque and safety wire. On engines equipped with an oil sump quick drain, close and secure the quick drain in accordance with the applicable instructions.
20. Service the engine with the correct type and grade of oil.
21. Install ignition leads on the proper spark plugs and screw on. Torque the ignition lead coupling nuts to 110 to 120 inch pounds.
22. Perform a complete engine ground run up and ensure the engine meets the manufacturer’s specified operations limits.
23. Thoroughly inspect the engine for oil and fuel leaks, broken, missing or loose hardware.
24. Correct all discrepancies prior to returning the engine and aircraft to service.
25. Make a logbook entry indicating compliance with this inspection. The entry must include the crankshaft serial number.

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## WARRANTY

Warranty claims for labor and material used to comply with this Critical Service Bulletin must be submitted to:

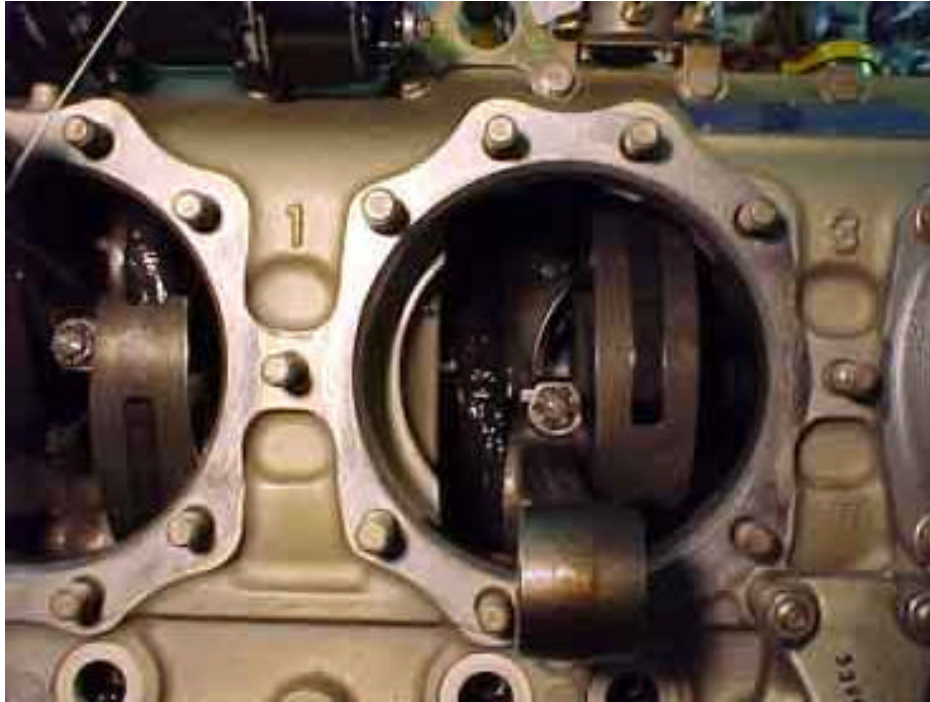
Teledyne Continental Motors  
P.O. Box 90  
Mobile, Al. 36601  
Attn.: Warranty Administration  
CSB99-3

All warranty claims must have a copy of the repair work order attached. Failure to attach a copy of the repair work order will delay the processing of your warranty claim.

TCM will allow a labor allowance up to \$700.00 for naturally aspirated engines and \$900.00 for turbocharged engines to comply with this Critical Service Bulletin.

TCM reserves the right to audit and review any claim beyond the stated allowances.

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**FIGURE 1. CONNECTING ROD IN POSITION FOR REMOVAL**



**FIGURE 2. REMOVING COUNTERWEIGHT RETAINING PLATES**

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**FIGURE 3. REMOVING COUNTERWEIGHT PINS**



**FIGURE 4. STARTING COUNTERWEIGHT THROUGH CYLINDER OPENING**

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**FIGURE 5. GUIDING COUNTERWEIGHT THROUGH CYLINDER OPENING**

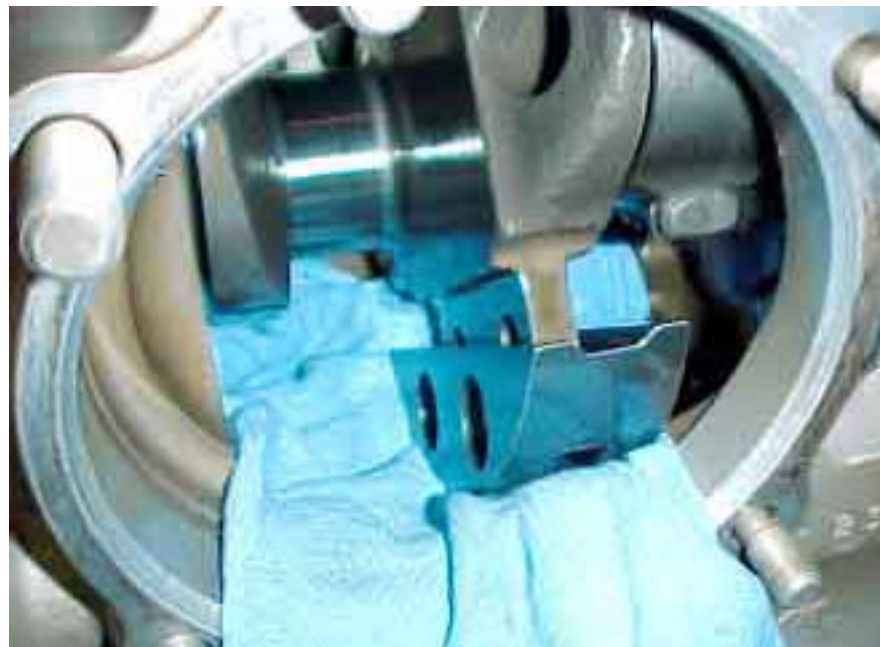


**FIGURE 6. COUNTERWEIGHT REMOVED**

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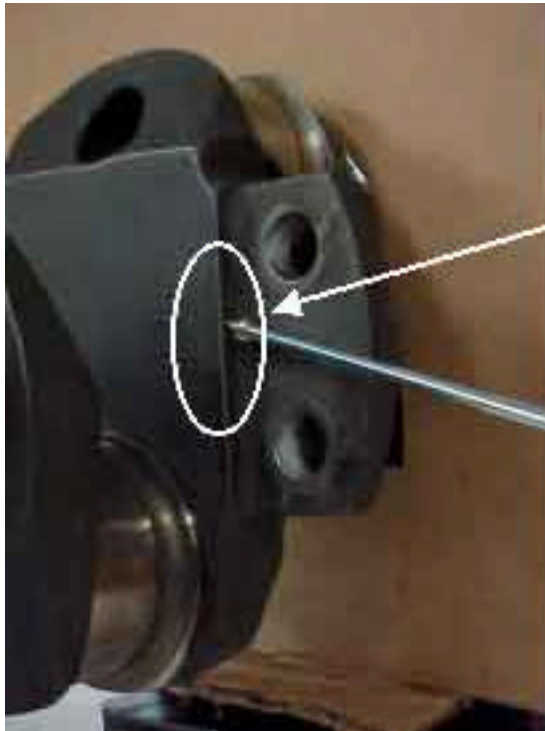


**FIGURE 7. CRANKSHAFT COUNTERWEIGHT BLADE**



**FIGURE 8. CRANKSHAFT COUNTERWEIGHT PARTIALLY REMOVED**

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Chamfered edge of the aft side of number two and five crankshaft cheek centered between counterweight blade bushing holes on both sides

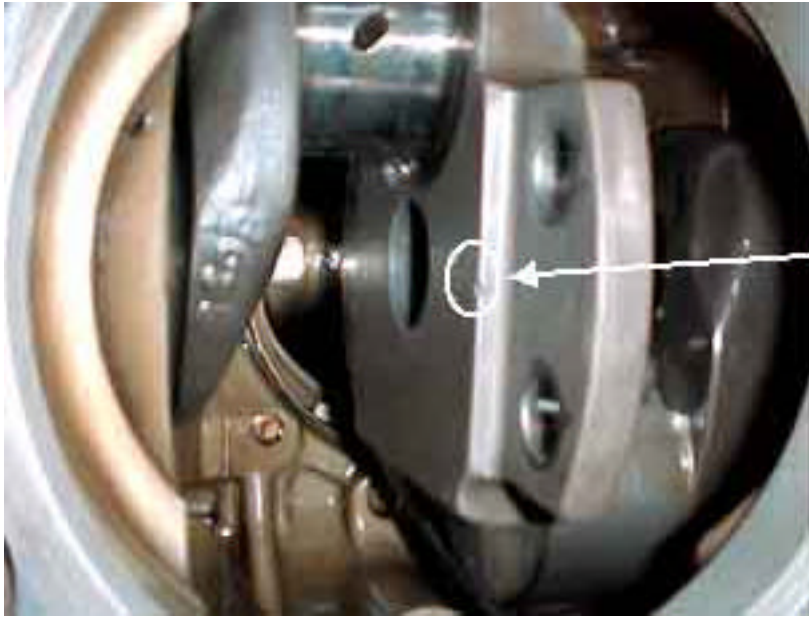
**FIGURE 9. FOCUS INSPECTION IN THIS AREA**



Inspect area of aft side of cheek between counterweight bushing holes at chamfered edge of blade shoulder on both sides

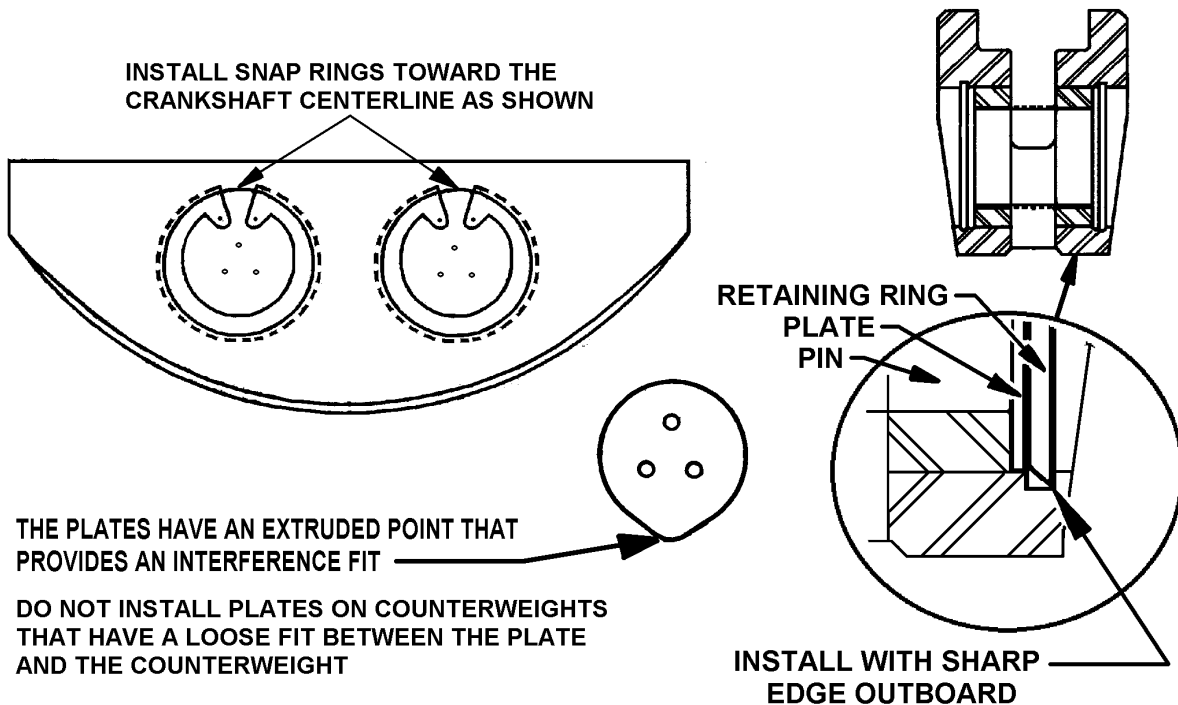
**FIGURE 10. CRANKSHAFT IN INSPECTION POSITION #2 CRANKCHEEK CONNECTING ROD REMOVED**

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Inspect area of aft side of cheek between counterweight bushing holes at edge of blade shoulder on both sides

**FIGURE 11. CRANKSHAFT IN INSPECTION POSITION #5 CRANKCHEEK CONNECTING ROD REMOVED**



**FIGURE 12. COUNTERWEIGHT INSTALLATION**

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**TABLE 1  
CONNECTING ROD TORQUE  
(FROM SB 96-7B)**

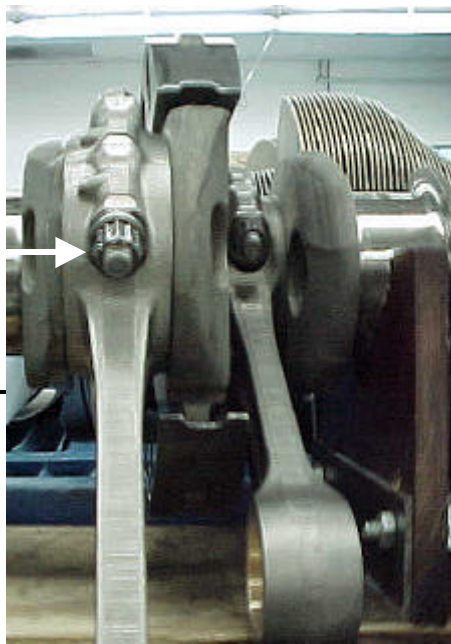
SIZE	FASTENER	IN/LBS.	FT/LBS.	MODELS AFFECTED
.44-20 7/16-20	Nut-Connecting rod-Spirallock (Nut hex P/N 643215 with bolt P/N 643112)	550-600	45.8-50.0	L & IO-520-P, L & TSIO-520 AE & CE, IO-550, TSIO-550, TSIOL-550
.44-20 7/16-20	Nut-Connecting rod Spirallock (12 Point Nut P/N 654490 with bolt P/N 643112)	690-710	57.5-59.2	FOR SPECIFIC APPLICATION BY ROD PART NUMBER AND ENGINE SEE BELOW
.44-20 7/16-20	Nut-Connecting rod Spirallock (12 Point Nut P/N 654490 with bolt P/N 654068)	690-710	57.5-59.2	FOR SPECIFIC APPLICATION BY ROD PART NUMBER AND ENGINE SEE BELOW
.44-28 7/16-28	Nut-Connecting Rod (rod P/N 646476, bolt P/N 629340 nut-P/N 628109)	475-525	39.6-43.8	IO-346, O-470, IO-470, TSIO-470, IO-520, TSIO-520 (except L/TSIO-520 AE & CE)

<p align="center"><b>ROD P/N 655000</b> (Nut 654490 &amp; Bolt 643112) IO-520-P LIO-520-P</p> <p align="center">TSIO-520-AE LTSIO-520-AE</p>	<p align="center"><b>ROD P/N 655001</b> (Nut 654490 &amp; Bolt 643112) IO-550-A, B, C, D, E, F, G, L, N</p> <p align="center">TSIOL-550-A, B, C TSIO-520-CE TSIO-550A, B, C, E</p>	<p align="center"><b>ROD P/N 655003</b> (SET OF 6 BALANCED P/N 655001 Con-rods) (Nut 654490 &amp; Bolt 643112)</p> <p align="center">IO-550-B29, B33, B37, B39 B44 IO-550-C25, C29, C30, C31</p>
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<p align="center"><b>ROD P/N 655004</b> (Nut 654490 &amp; Bolt 654068)</p> <p align="center">O-470-J, R, S, U IO-470-C, D, E, F, K, L, M, N, S, U, V, IO-520-A, BA, C, D, E, F, J, K, L, M, TSIO-520-A, B, C, D, E, G, H, J, L, M, N, P, R, T</p>	<p align="center"><b>ROD P/N 655005</b> (Nut 654490 &amp; Bolt 654068)</p> <p align="center">IO-520-BB, CB, MB, TSIO-520-BB, BE, DB, EB, JB, KB, LB, NB, UB, VB, WB</p>	<p align="center"><b>ROD P/N 655007</b> (SET OF 6 BALANCED P/N 655005 Con-rods) (Nut 654490 &amp; Bolt 654068)</p> <p align="center">TSIO-520-UB SPEC.13, 16, 17</p>
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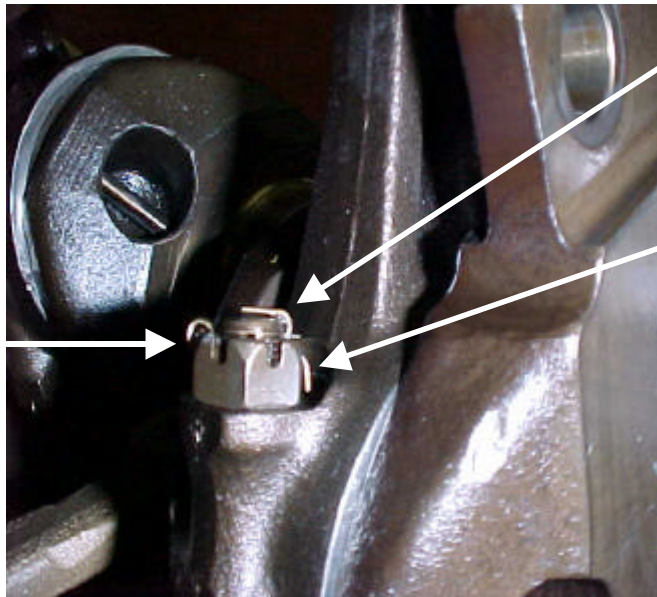
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12 point spirallock nut.



**FIGURE 13. TWELVE POINT SPIRALLOCK NUT**

Seat head of cotter pin into nut castellations



Bend one leg of cotter pin up and back toward cotter pin head. Trim leg so that it ends in the center of the bolts diameter.

Bend the other leg down toward the nuts base and trim leg so that it ends half the distance between the bottom of the nut castellation and nut base.

**WARNING**

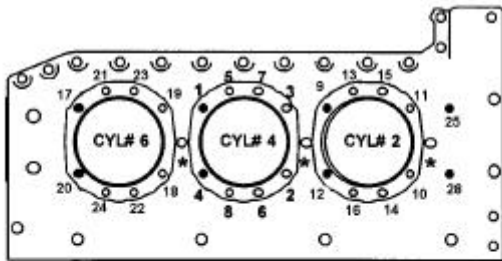
**ANYTHING DROPPED INTO THE ENGINE MUST BE REMOVED.**

**FIGURE 14. CASTELLATED NUT WITH COTTER PIN INSTALLED**

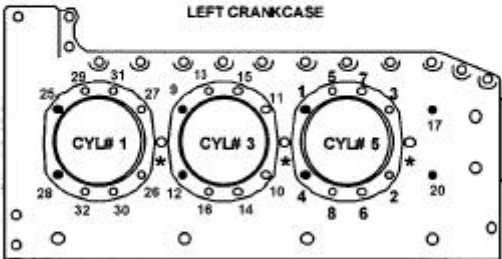
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**TABLE 2  
CYLINDER STUD NUT AND THROUGH BOLT NUT TORQUE**

SIZE	FASTENER	IN/LBS.	FT/LBS.	MODELS AFFECTED
.44-20	Nut-Cyl. to crankcase studs.(includes 7th stud)	490-510	40.8-42.5	All models (except TSIOL-550)
.44-20	Nut-Cyl. To crankcase studs.	590-610	49.2-50.8	TSIOL-550
.44-20	Nut-Thru bolts at cad plated washer	440-460	36.6-38.3	All models (AR)
.50-20	Nut-Thru bolt at cad plated washer	615-635	51.2-52.9	IO-520, L/TSIO-520, IO-550, TSIO-550
.50-20	Nut-6 Point-Thru bolt at cylinder flange (P/N 634505 .33 in. high)	690-710	57.5-59.2	All 520, 550, (Except TSIOL-550)
.50-20	Nut-Thru bolt at plated washers	690-710	57.5-59.2	TSIOL-550
.50-20	Nut-12 Point-Thru bolt at cylinder flange (P/N 652541)	790-810	65.8-67.5	All 520 & 550.
.50-20	Nut-Tall 6 point-thru bolt at cylinder flange. (P/N 649496 .43 inch high)	790-810	65.8-67.5	TSIOL-550.
.50-20	Nut-Crankcase tie bolts-nose	640-660	53.3-55.0	All models(AR)

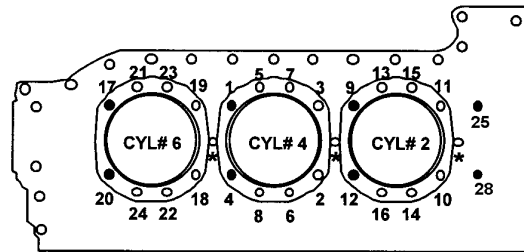


LEFT CRANKCASE

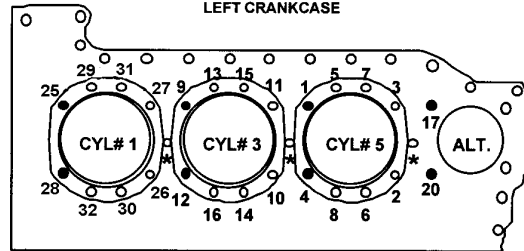


RIGHT CRANKCASE

- DESIGNATES CRANKCASE CYLINDER HOLD DOWN THROUGH BOLTS. THREADS & NUTS MUST BE LUBRICATED WITH CLEAN 50 WEIGHT AVIATION OIL AND TORQUED SIMULTANEOUSLY
  - \* TORQUE 7TH STUD NUT LAST
- 470, 520 & 550 SANDCAST SERIES CYLINDER TORQUE SEQUENCE**



LEFT CRANKCASE



RIGHT CRANKCASE

- DESIGNATES CRANKCASE CYLINDER HOLD DOWN THROUGH BOLTS. THREADS & NUTS MUST BE LUBRICATED WITH CLEAN 50 WEIGHT AVIATION OIL AND TORQUED SIMULTANEOUSLY
- \* TORQUE 7TH STUD NUT LAST

**520/550 PERMOLD & LIQUID COOLED CYLINDER TORQUE SEQUENCE**

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