



Service Instruction

ENGINE COMPONENTS, INC.

S.I. No.: 99-8-1

Page: 1 of 9

Title: ECI® TITAN® REPLACEMENT CYLINDERS FOR TCM 470/520/550 SERIES ENGINES

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Technical Portions are FAA DER Approved.

1.0 PURPOSE: Continued Airworthiness Instructions.

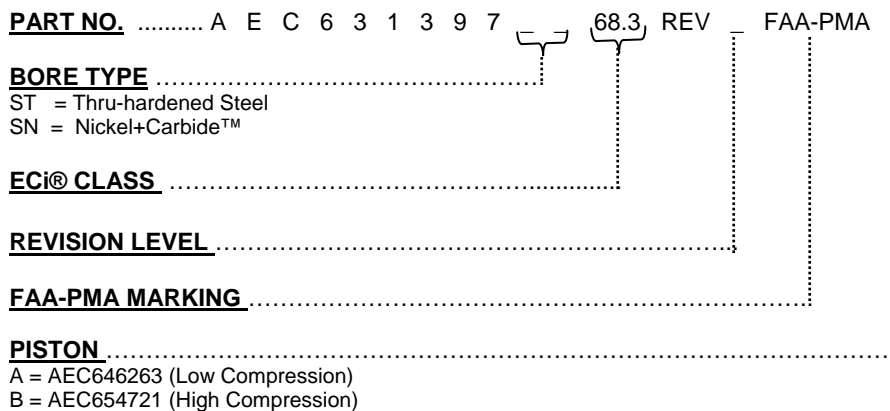
2.0 SCOPE: Engine Components, Inc. (ECi®) has obtained FAA Engineering Design Approval for new cylinders eligible for installation on TCM 470/520/550 series engines. This Service Instruction provides installation eligibility for PMA parts and assemblies and provides documentation required by the FAA under FAR Part 33.4 and Appendix A for continued airworthiness. If a specific procedure is not addressed in this Service Instruction, the applicable procedure in the OEM's current overhaul and/or Service Bulletin and Service Instruction applies.

3.0 COMPLIANCE: Anytime cylinders are installed or removed for overhaul or repair.

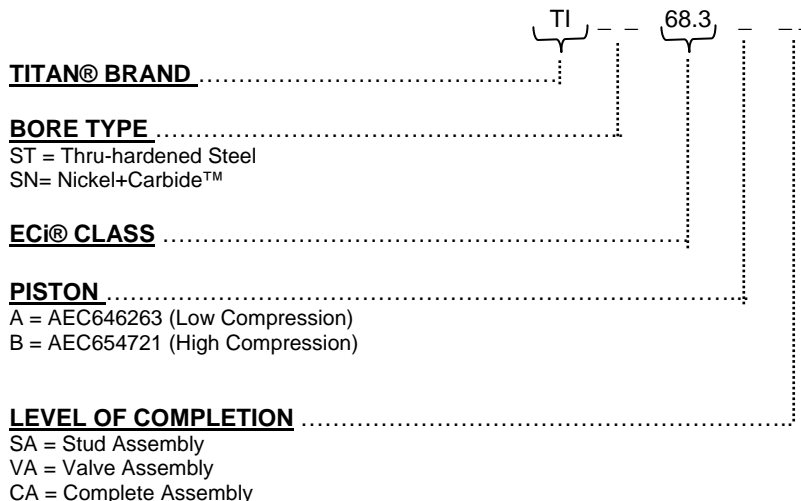
4.0 IDENTIFICATION:

4.1 470 Short Reach Spark Plug Applications

4.1.1 Cylinder Marking



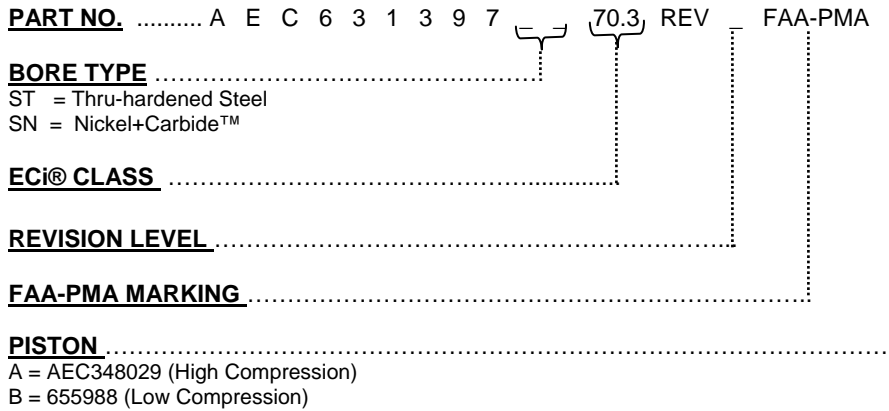
4.1.2 Price List Designation



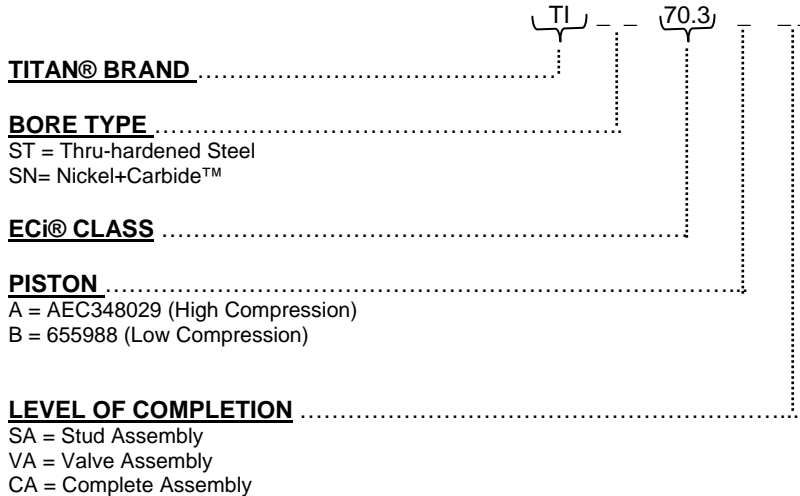


4.2 470 Long Reach Spark Plug Applications

4.2.1 Cylinder Marking



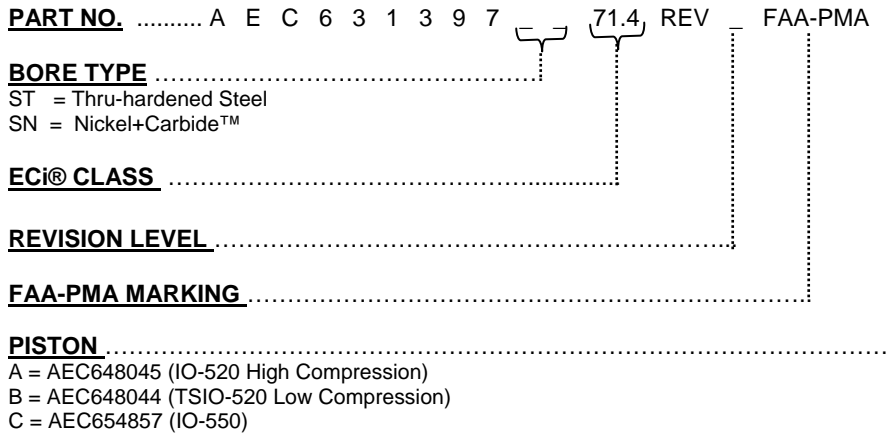
4.2.2 Price List Designation



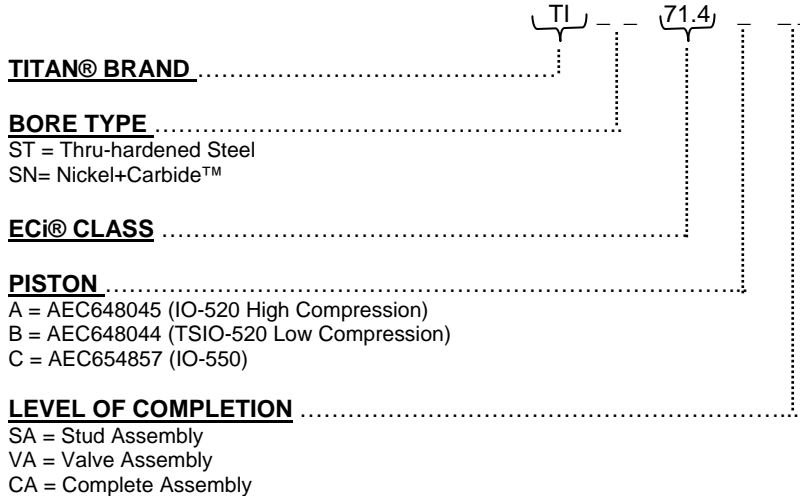


4.3 520 and 550 Series Straight Fin Barrel Applications

4.3.1 Cylinder Marking



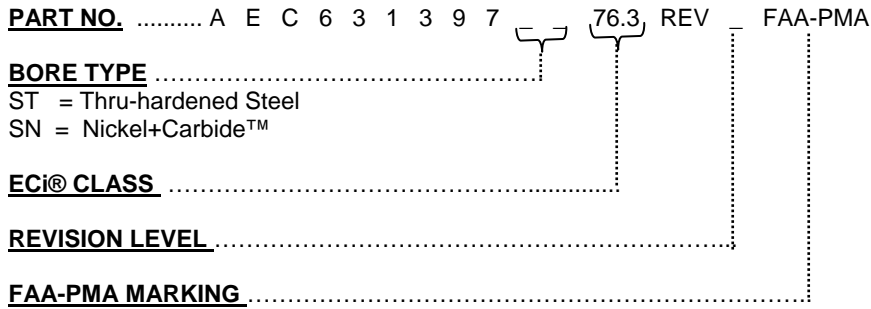
4.3.2 Price List Designation



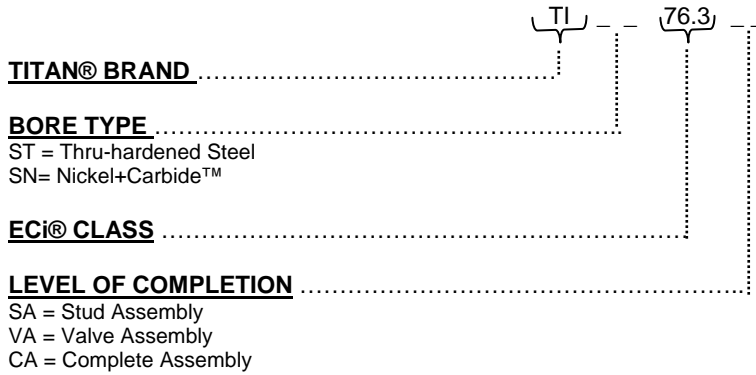


4.4 550 Series Tapered Fin Barrel Applications

4.4.1 Cylinder Marking



4.4.2 Price List Designation





5.0 MODELS AFFECTED

470 Series

| Complete Assembly Cylinder Class | Cylinder Stud Assembly No. | Bore Type | Intake Seat | Spark Plug Length | Piston P/N | C.R. | Installation Eligibility |
|----------------------------------|----------------------------|---------------------|-----------------------------|-------------------|------------|-------|--|
| TIST68.0ACA | AEC631397ST68.0 | Thru-hardened Steel | AEC642318 | Short | AEC646263 | 7:1 | 0-470-K, K-CI, L, L-CI, R, S |
| TISN68.0ACA | AEC631397SN68.0 | Nickel+Carbide™ | AEC642318 | Short | | | |
| TIST68.0BCA | AEC631397ST68.0 | Thru-hardened Steel | AEC642318 | Short | AEC654721 | 8:1 | 0-470-G, G-CI, M, M-CI, N, P IO-470-A, C, G, P, R, T LIO-470-A |
| TISN68.0BCA | AEC631397SN68.0 | Nickel+Carbide™ | AEC642318 | Short | | | |
| TIST68.3ACA | AEC631397ST68.3 | Thru-hardened Steel | AEC642318-1 | Short | AEC646263 | 7:1 | 0-470-K, K-CI, L, L-CI, R, S |
| TISN68.3ACA | AEC631397SN68.3 | Nickel+Carbide™ | AEC642318-1 | Short | | | |
| TIST68.3BCA | AEC631397ST68.3 | Thru-hardened Steel | AEC642318-1 | Short | AEC654721 | 8:1 | 0-470-G, G-CI, M, M-CI, N, P IO-470-A, C, G, P, R, T LIO-470-A |
| TISN68.3BCA | AEC631397SN68.3 | Nickel+Carbide™ | AEC642318-1 | Short | | | |
| TIST70.0ACA | AEC631397ST70.0 | Thru-hardened Steel | AEC642318 | Long | AEC648029 | 8.6:1 | 0-470-T, U IO-470-D, E, F, H, L, LO, M, N, S, U, V, VO |
| TISN70.0ACA | AEC631397SN70.0 | Nickel+Carbide™ | AEC642318 | Long | | | |
| TIST70.0BCA | AEC631397ST70.0 | Thru-hardened Steel | AEC642318 | Long | 655988 | 7.5:1 | TSIO-470-B, C, D |
| TISN70.0BCA | AEC631397SN70.0 | Nickel+Carbide™ | AEC642318 | Long | | | |
| TIST70.3ACA | AEC631397ST70.3 | Thru-hardened Steel | AEC642318-1 | Long | AEC648029 | 8.6:1 | 0-470-T, U IO-470-D, E, F, H, L, LO, M, N, S, U, V, VO |
| TISN70.3ACA | AEC631397SN70.3 | Nickel+Carbide™ | AEC642318-1 | Long | | | |
| TIST70.3BCA | AEC631397ST70.3 | Thru-hardened Steel | AEC642318-1 | Long | 655988 | 7.5:1 | TSIO-470-B, C, D |
| TISN70.3BCA | AEC631397SN70.3 | Nickel+Carbide™ | AEC642318-1 | Long | | | |



520/550 Series

| Complete Assembly Cylinder Class | Cylinder Stud Assembly No | Bore Type | Intake Seat | Piston P/N | C.R. | Installation Eligibility |
|-------------------------------------|------------------------------|---------------------|-----------------------------|------------|-------|--|
| TIST71.2ACA | AEC631397ST71.2 | Thru-hardened Steel | AEC642318 | AEC648045 | 8.5:1 | IO-520-A, B, BA, BB, C, CB, D, E, F, J, K, L, M, MB, N, NB, P LIO-520-P |
| TISN71.2ACA | AEC631397SN71.2 | Nickel+Carbide™ | AEC642318 | | | |
| TIST71.2BCA | AEC631397ST71.2 | Thru-hardened Steel | AEC642318 | AEC648044 | 7.5:1 | TSIO-520-A, AF, B, BB, C, CE, D, DB, E, EB, G, H, J, JB, K, KB, L, LB, M, N, NB, P, R, T, U, UB, VB, WB |
| TISN71.2BCA | AEC631397SN71.2 | Nickel+Carbide™ | AEC642318 | | | |
| TIST71.2CCA | AEC631397ST71.2 | Thru-hardened Steel | AEC642318 | AEC654857 | 8.5:1 | IO-550-A, B, C IOF-550-B, C |
| TISN71.2CCA | AEC631397SN71.2 | Nickel+Carbide™ | AEC642318 | | | |
| TIST71.4ACA | AEC631397ST71.4 | Thru-hardened Steel | AEC642318-1 | AEC648045 | 8.5:1 | IO-520-A, B, BA, BB, C, CB, D, E, F, J, K, L, M, MB, N, NB, P LIO-520-P |
| TISN71.4ACA | AEC631397SN71.4 | Nickel+Carbide™ | AEC642318-1 | | | |
| TIST71.4BCA | AEC631397ST71.4 | Thru-hardened Steel | AEC642318-1 | AEC648044 | 7.5:1 | TSIO-520-A, AF, B, BB, C, CE, D, DB, E, EB, G, H, J, JB, K, KB, L, LB, M, N, NB, P, R, T, U, UB, VB, WB |
| TISN71.4BCA | AEC631397SN71.4 | Nickel+Carbide™ | AEC642318-1 | | | |
| TIST71.4CCA | AEC631397ST71.4 | Thru-hardened Steel | AEC642318-1 | AEC654857 | 8.5:1 | IO-550-A, B, C IOF-550-B, C |
| TISN71.4CCA | AEC631397SN71.4 | Nickel+Carbide™ | AEC642318-1 | | | |
| TIST76.0CA | AEC631397ST76.0 | Thru-hardened Steel | AEC642318 | AEC654857 | 8.5:1 | IO-550-D, E, F, L IOF-550-D, E, F, L ¹ |
| TISN76.0CA | AEC631397SN76.0 | Nickel+Carbide™ | AEC642318 | | | |
| TIST76.3CA | AEC631397ST76.3 | Thru-hardened Steel | AEC642318-1 | AEC654857 | 8.5:1 | IO-550-D, E, F, L IOF-550-D, E, F, L |
| TISN76.3CA | AEC631397SN76.3 | Nickel+Carbide™ | AEC642318-1 | | | |

¹ The 76 classes use a tapered fin barrel instead of the standard straight fin typical for all other installations.



MARKING: (See Figure 1)

- 6.1 New head and new through-hardened steel barrel:
 - 6.1.1 Serial number stamped on head.
 - 6.1.2 Cylinder assembly number marked on barrel flange.
- 6.2 New head, new through-hardened steel barrel with Nickel+Carbide™ process coating:
 - 6.2.1 Serial number stamped on the head.
 - 6.2.2 Barrel PMA number vibropeened on barrel flange.
 - 6.2.3 Cylinder assembly number marked on barrel flange

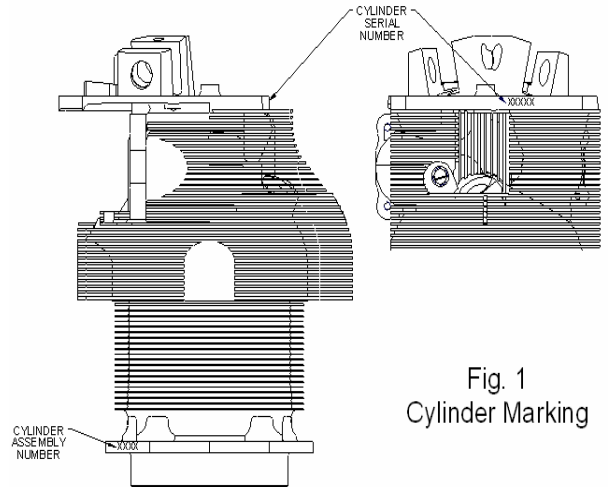


Fig. 1
Cylinder Marking

7.0 **CYLINDER REMOVAL AND INSTALLATION:** See ECi Service Instruction 92-9-6.

8.0 **COLOR CODES ON CYLINDERS:** See ECi Service Instruction 92-7-1.

9.0 **TIME BETWEEN OVERHAUL (TBO):** ECi has addressed the subject of TBO through test and computation, 150 hour certification testing and durability testing with extended test cell run time. From all of the data that has been acquired and analyzed, TBO recommendations that have been established for the latest OEM cylinders also apply to ECi cylinders in similar applications.

10.0 **CYLINDER HEAD:**

- 10.1 **Material:** The cylinder heads are sand castings manufactured from the TITAN™ Advanced™ Aluminum Alloy. This alloy incorporates a composition derived from both AMS 4220 and RR350 alloys. The casting is solution heat-treated and overaged before assembly.
- 10.2 **Thread Design:** The cylinder head is machined in the barrel attachment area to make it compatible with the OEM barrel thread design as well as ECi barrel threads.
- 10.3 **Head Inspection:** Head inspection shall be performed in accordance with the OEM overhaul manual. Minor cooling fin cracks that do not extend into the cylinder head structure and heat checks in the exhaust port less than 1/8” in length are acceptable for return to service. All other cracks make the cylinder unairworthy without major repair.
- 10.4 **Disassembly and Reassembly:** Disassembly and reassembly of the cylinder head and barrel is deemed to be a major repair and must be accomplished in accordance with FAA approved procedures. The preload (interference fit), alignment and compression height between head and barrel must be approved by FAA engineering.
- 10.5 **Exhaust Studs:** The cylinder head is fitted with stainless steel, Rosan type studs, P/N AEC638125-2.
- 10.6 **Parts Installation:** OEM and FAA-PMA approved replacement parts may be installed in ECi cylinder heads using interference fit data and installation procedures contained in the OEM’s current overhaul manual. (See ECi Class Reference Manual for parts eligibility and paragraph 10.7 below, “Injector Boss Bushing”.)
- 10.7 **Injector Boss Bushing:**
 - 10.7.1 **Description:** The injector boss bushing, P/N AEC65389, is a stainless steel bushing that has a ½-20 UNF thread on the O.D. and a 1/8-27 NPTF on the I.D. to accept the injector. The bushing is held in place with Loctite 620 or equivalent.
 - 10.7.2 **Inspection:** The bushing does not have to be removed when using NDT methods for detection of cracks. However, if leakage or a crack running into the boss is evident or suspected, the bushing should be removed.



10.7.3 Repair: If inspection of the torqued thread in the bushing reveals thread damage, the threads can be chased with a 1/8-27 NPTF tap. BEFORE inserting the tap, check the size of the threaded hole to insure that the bushing has not been previously tapped beyond service limits. This check can be made by inserting a 3/8-24 UNF bolt into the pipe tapped bushing and noting the number of turns required to bottom the bolt. The number of turns cannot exceed seven (7) AFTER chasing. Proceed with the thread chasing operation if sufficient material is present but do not exceed the limits set forth above. Remove and replace the bushing if the chasing operation does not remove thread damage or if the size of the threads exceeds service limits.

10.7.4 Removal and Replacement: Remove the damaged bushing with an Eze-Out. If required, make weld repairs in accordance with paragraph 10.8.2 below and remachine the threads in the head. Clean boss and bushing with alcohol; blow dry with compressed air. Spray injector boss with primer and allow to dry 3-5 minutes. Then, apply 620 Loc-tite generously to bushing and on first thread of cylinder boss. Install bushing until flange is in contact with injector boss. Check with a torque wrench set at 75-85 in-lbs. Remove excess Loc-tite with alcohol and a shop towel.

10.7.5 Injector Torque: The injector must be torqued to 55-65 in-lbs (4.6-5.4 ft/lbs) to insure no leakage.

10.8 Weld Repairs:

10.8.1 Minor welds are defined as welds to the following areas:

- (a) Intake and exhaust port faces.
- (b) Rocker cover flange and threaded holes.
- (c) Cooling fins.

10.8.1.1 The welding process must be based on FAA acceptable data and must be performed by a properly rated FAA Certified Repair Station or foreign equivalent. Filler rod AA 4043 or equivalent, correctly work hardened, is approved for minor repairs.

10.8.2 Major welds are defined as welds to structural areas of the cylinder and may be performed if all of the following criteria are met:

- (a) The welding process must be based on FAA approved data and meet all of the requirements of FAA advisory Circular No. 33-6 dated December 20, 1994.
- (b) The welding must be performed by a properly rated FAA Certificated Repair Station.
- (c) The filler rod must be heat treatable and approximate the casting alloy.
- (d) After welding, the repaired casting must be solution heat treated and overaged.
- (e) After machining and parts installation, the hardness of the weldment will be Brinell 60-75 (500 kg load, 10mm ball).

11.0 CYLINDER BARREL:

11.1 **Material:** A cylinder barrel manufactured by ECI is made from AISI 4140 steel. The barrel will be through-hardened and the bore may be coated with a corrosion and wear resistant coating.

11.2 **Disassembly and Reassembly:** (See Cylinder Heads)

11.3 **Weld Repairs:** No weld repairs of any kind are permitted on any surface of the barrel.

11.4 **Oversizing:** ECI through-hardened barrels may be oversized to 0.015" to accommodate oversize pistons and rings or to 0.020" prior to applying a metal additive process.

11.5 **Plating:** ECI through-hardened barrels may be plated back to standard using FAA approved data. Consult the plating source for the proper ring material to be used with the bore coating.

11.6 **Bore Inspection:** Whenever a cylinder is removed from an engine, the diameter and out-of-round condition of the bore should be measured as well as visual checks made for scoring, galling, low spots and ring breakage.



Inspection results should be compared to the dimensions in Figures 2 and 3 below and in the OEM's current overhaul manual (ECi data will prevail in the event of conflict). Affix a repairable or rejected part tag, as appropriate, to any cylinder that does not meet the service limit (or properly oversized) bore criteria.

12.0 PISTON RINGS: See ECi Service Instruction No. 94-4-1, *ECi Piston Ring Sets Application, Fitting instructions and Reference* for proper fitting of piston rings.

Figure 2
 Typical Cross Section of
 470/520/550 Cylinder Bore

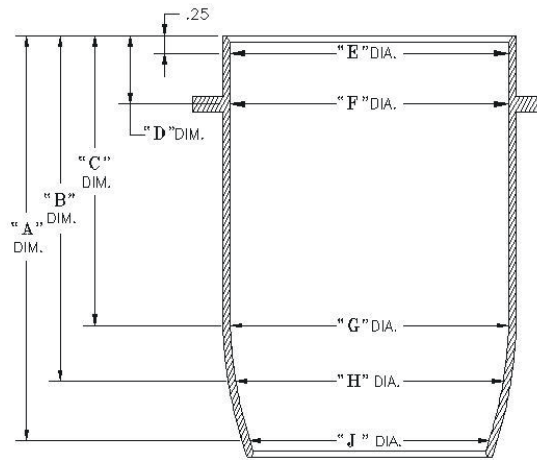


FIGURE 3
 Bore Dimensions

| Engine Type | "A" DIM. | "B" DIM. | "C" DIM. | "D" DIM. | "E" DIA. | STANDARD | | MAX SERVICEABLE STANDARD | | ALLOWABLE TAPER FROM "F" TO "G" | AMOUNT OF CHOKE FROM | | TOTAL CHOKE "G" TO "J" |
|-------------|----------|----------|----------|----------|---------------|---------------|--------------------|--------------------------|--------------------|---------------------------------|----------------------|-------------|------------------------|
| | | | | | | "F" DIA. | CIRCULARITY T.I.R. | "F" DIA. | CIRCULARITY T.I.R. | | "G" to "H" | "H" to "J" | |
| 470 | 6.500 | 5.750 | 4.500 | 1.150 | 5.0040/5.0010 | 5.0030/5.0010 | .002 | 5.006 | .004 | -.000/-.001 | -.001/-.003 | -.003/-.006 | -.004/-.009 |
| 520/550 | 6.500 | 5.750 | 4.500 | 1.150 | 5.2540/5.2510 | 5.2530/5.2510 | .002 | 5.256 | .004 | -.000/-.001 | -.001/-.003 | -.003/-.006 | -.004/-.009 |