

## TECHNICAL BULLETIN

TB NO.1013

REV. 1

**SUBJECT: Reconditioning Power Cylinder Heads  
Superior Model 40, PTD - Diesel, Dual Fuel**

### "SHOP REPAIR PROCEDURES"

- A. Disassemble the cylinder head by removing the valve keepers, retainers, springs, valves, seats and guides. Inspect individual components.
1. If the valve keepers are to be reused, they should be retained as sets since distinctive wear or seating patterns exist. This will eliminate the possibility of one keeper supporting the spring load.
  2. If the spring side of the retainer is worn, it's an indication of insufficient hardness and the retainer should be replaced.
  3. Inspect the valves, seats, and the combustion chamber for excessive oil carbon and coolant deposits. It could be an indication of improper lube oil, fuel oil contamination, excessive valve stem to guide clearance, liquids in the fuel gas or possibly a cracked cylinder head.
  4. Inspect the inner and outer springs for rust pitting and excessive wear at the end of the coils. Check free standing height (outer = 5 21/32", inner = 5 7/32"). A spring comparison scale is recommended for checking tension. Questionable springs should be replaced.
  5. A special valve seat removing tool can be made by grinding the outer edge of an oil power valve. The tool can be installed in the guide, spot welded to seat for removal.
  6. The guides should be removed by using a special insertion/ removal tool.
  7. Remove air starting valve and air starting check valve. Inspect valves and valve seating area. Grind air start valves or replace if required.

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8. Remove copper injector sleeve for inspection or replacement of the o-rings or complete assembly.
  9. Inspect valve rotators (rotocaps) or spacers for wear. Questionable rotocaps should be replaced with P-003-514 spacers (reference Technical Bulletin No. 1025).
- B. The disassembled head casting and components should be placed into a hot caustic vat for six to eight hours depending on the overall condition of the head. This will allow ample time for removal of all carbon and scale from the combustion chamber and internal passages.
1. Remove the cylinder head and components from the vat. All parts are to be thoroughly steam cleaned including the internal passages of the head, then blown dry for protection against rust.
  2. Hydrostatically test the head casting by flanging the passages, filling with water and applying air pressure at 60 PSIG. Hold under pressure for 30 minutes and check for leaks.
- If a cylinder head is suspected of leaking when in operation on the engine and a leak was not detected during the 30 minute pressure test, heat may have to be applied to the head, while maintaining pressure.
- C. Perform a complete inspection of the cylinder head casting to determine if machining or other repairs are required to maintain tolerances and standards. Contact **EnDyn** for tolerances or standard dimensions if they do not appear in the instruction manual.
1. Inspect the combustion chamber surface (counterbore) for excessive pitting or any abnormal wear in the fire ring seating area. If either is evident, machining may be required to insure a good seal. If machining is required, you must machine or mill the bottom of the head surface to maintain proper depth of the counterbore (.225/.217"). Check for cracks on combustion surface near injector passages using dye penetrant.

NOTE: Do not remove more than 1/16" of metal from the surface of the combustion chamber.

The same amount of metal removed from the surface of the combustion chamber must be removed from the bottom of seat counterbores to maintain proper depth.

NOTE: The surface is to be machined perpendicular to the guide bores within .001" TIR.

2. Measure the inside diameter of the seat counterbores for egg-shaping and proper tolerance.

NOTE: If heads do not have seat counterbores machined, call **EnDyn** for machining instructions, tolerances, and seat part numbers.

If repair and machining is required, maintain concentricity with the guide bore. (Maximum: .001") Oversize seats are available.

3. Measure the inside diameter of the guide bores in the cylinder head for proper tolerance (1.251/1.250"). Service guides are .0015" larger on the outside diameter and are available upon request.
  4. Inspect the spring seating surfaces on the top of the cylinder head for excessive wear. If required counterbore for a 3/32" or 1/8" steel insert.
  5. Inspect jacket water port gasket surfaces for excessive pitting and cavitation. If required, remove the dead metal with a grinder, build-up with a ni-cast rod, and machine or mill to a smooth surface finish.
- D. Assembly of all the cylinder head components requires additional inspection and testing to ensure proper performance and reliability.

We do not recommend grinding or rebuilding power valves. Extended operating periods will create fatigue cracking in the base material in the head of the valve. We recommend new valves and seats at each overhaul.

1. The valve guides and seats are held into position or secured by an interference fit. Standards are:  
Guides: .001/.0015  
Seats: .0045/.0065

New guides and seats should be measured to verify proper interference fit. After verification, they should be frozen by placing into a freezer, dry ice or liquid nitrogen. The intent is to reduce the size of the part which reduces the amount of pressure required for installation. A press is recommended.

If the components are driven or pressed into position without freezing, you may experience cracking of the part and/or wear of the casting due to the extra force requirement.

2. The guides should be installed before the seats. Use a special mandrel or insertion tool and press into position. It is recommended to allow .005" - .010" clearance between the guide flange and the top of the cylinder head. This will eliminate the possibility of collapsing or distorting the inside diameter of the guide due to a warped head surface.

After installation check guide bore for proper dimension.

3. Use a special mandrel or a good power valve and press the seats into position. The stem of the mandrel or valve should fit the guide and will act as a pilot to prevent the seat from cocking.
4. Grinding is a standard requirement for all seats. The stone is piloted from the guide and the amount of grinding required is dependent on distortion of the cylinder head casting.

The stone should touch the seat lightly at first to verify the seat was installed correctly. If the stone contacts the seat in one small area, it could be cocked in the bore.

Do not attempt to grind too fast by applying extra force on the grinder and stone. Touch the seat lightly and back-off, and repeat until the stone has full contact with the seating surface.

5. Measure each valve stem for proper dimension to verify proper valve stem to guide clearance.

Each valve has to be lapped to the seats. Use a good brand of lapping compound such as Clover, grade E. Lap until you obtain 100% contact, approximately 1/4" in width around the complete circumference of the valve. Test for leakage with solvent or a hand type vacuum plunger pump.

6. Prepare all parts for assembly. They should be clean and lightly lubricated.

During assembly, note the inner and outer spring has a tighter coil on one end. This is called the dampening coil and fits against the cylinder head.

- E. Establish a cylinder head serial numbering system and maintain records. Suggest: Engine S/N -1 thru 8, etc.
  1. Record total operating hours since last repair and list new replacement parts.
  2. Record distance from the top of each valve stem to the machine surface on the cylinder head. Use this information for future reference. As the valve and seat wears, the distance will increase.
  3. If the heads are going to be stored, they should be protected from the elements by applying Tectyl 502-C or equal preservative.

For further information concerning reconditioning Superior Diesel or Dual Fuel power cylinder heads, please contact **EnDyn's** Technical Service Department or your local authorized **PowerParts**® Distributor.