

# ENGINEERING STANDARDS

COMPILED AND ISSUED BY THE STANDARDS COMMITTEE OF THE ENGINEERING DEPARTMENT  
ATLAS IMPERIAL DIESEL ENGINE COMPANY  
OAKLAND, CALIFORNIA

NUMBER  
MS 9

SHEET 1  
OF 2 SHEETS

## CRANKSHAFT & CONNECTING ROD FORGINGS - SAE 1040

This specification is intended to cover press or hammer forgings and not die forgings.

### Material:

When ordered to this specification, steel shall be made by open hearth process, and shall otherwise conform to the specification of the Society of Automotive Engineers for S.A.E. No. 1040 steel, except that the silicon content shall be between 0.15 and 0.30 and the carbon and manganese shall be on the high side of the range.

### Preferred analysis:

Carbon	0.38 to 0.43
Manganese	0.60 to 0.80
Sul. & Phos.	0.040 Max.
Silicon	0.15 to 0.30

### Billets:

Forging billets shall be made from ingots of such size that the sectional area of the body of the forging (as forged) is not to exceed 1/3 of the sectional area of the original ingot, and no one part of the finished forging is to have more than 2/3 of the sectional area of the original ingot. Billets shall either be rolled or forged, except that rolled billets shall have a 25% reduction under press or hammer before the above shall apply.

### Deep Etch Test of Billets:

10% of the billets from each heat shall be inspected by the forging company for internal defects by cutting a piece 3/4" in length from the end of the billet to be inspected and etched in a 50% hydrochloric acid solution, at a temperature of approximately 180°. The length of time in the etching solution shall depend on the activity of the solution, but it must be sufficient to bring out defects, if present. (Approximate time - 45 minutes). Bars that show pipes, shrinkage cracks, segregation and other internal defects shall be rejected. Billets which show surface seams or laps shall be chipped before forging. Etched test pieces shall be prepared to prevent corrosion, and sent to the vendee, if requested.

### Forging Temperatures:

All forging shall be done between the following temperatures:

Max. Temp.	Min. Temp.
2300°F	1550°F

### Twisting:

The crank throws shall be offset, where possible, so that a minimum of twist is required. If greater than 90° twist is required written permission shall be obtained from the vendee. Forging shall be reheated before twisting.

### Finished Forging:

The finished forging shall show no "rags", cold shuts or hollows, due to chipping, and no welding shall be permitted.

APPROVED BY  
JST

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SHEET 2  
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## CRANKSHAFT & CONNECTING ROD FORGINGS - SAE 1040

### Cutting and Burning:

No burning shall be done where any forging is afterward done on the burned surface. When throws are burned out sufficient stock shall be left so that all burned metal is machined off.

### Heat Treatment:

After forging all crankshafts shall be heat treated, each complete at one heat, as follows:

- 1 Heat slowly to: 1450°F
- 1A Hold to saturate.
- 2 Continue heat to: 1625°F
- 2A Hold 15 minutes.
- 3 Cool in still air to: 400°F
- 4 Draw at: 950°F
- 4A Cool in furnace

*S. J. H. H.*  
*No 7076*

### Test Coupon:

A test coupon shall be forged on each separate forging, the size of which shall be equivalent to the average cross section of the finished article, and shall be left attached throughout all subsequent heat treatment, to be cut off by the Atlas Imperial Diesel Engine Company.

### Physical Properties:

The physical properties of the finished, heat treated forging shall be as follows:

Min. Tens. Strength	Min. Yield Point	Min. Elong.	Min. Red. Area	Hardness
80,000	50,000	18%	34%	Rockwell "C" 6 to 10 Brinell 163 to 179 (ASTM E10-27)

### General:

*Also Check Part as per Rules*

Each finished forging shall be stamped with the heat number and the A.I.D.E. Co., shall be advised in writing of the heat number, manufacturer's name and manufacturer's analysis of each billet used. The A.I.D.E. Co., shall be allowed to inspect original invoices upon request. Each finished forging shall also be stamped with the A.I.D.E. Co., purchase order number. In the event that more than one shaft is specified on the order each shaft shall be stamped with the purchase order number, a dash, and numbered serially beginning at one in order as forged, thus:

P017387-1

P017387-2 Etc.



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