Many defects are best found in-process and not at the end of the assembly line. To help illustrate these possibilities on your line, the chart below identifies the areas in engine manufacturing where in-process testing can be done and the probability of identifying certain issues within those sections.

<table>
<thead>
<tr>
<th>COMPONENT MACHINING AND ASSEMBLY TESTS</th>
<th>FINAL ASSEMBLY TESTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crank Machining</td>
<td>Cam Assembly</td>
</tr>
<tr>
<td>Con Rod &amp; Piston Rod Machining, Assembly</td>
<td>Block Machining</td>
</tr>
<tr>
<td>Block Machining</td>
<td>Head Machining</td>
</tr>
<tr>
<td>Block Assembly</td>
<td>Head Assembly</td>
</tr>
<tr>
<td>Short Block</td>
<td>Long Block</td>
</tr>
<tr>
<td>Hot Test</td>
<td>Cold Test</td>
</tr>
</tbody>
</table>

**Probability of finding the defect:**
- **L** Low
- **M** Medium
- **H** High

**TEST FINDINGS:**

- **Plugged or undrilled passages.**
  - **H**
  - **L**
  - **M**

- **Gaging of notches, improper notch length, depth, nicks, cracks.**
  - **M**

- **Improper connecting rod bearing halves, improper bushing press.**
  - **H**

- **Improper press force and position of lobe, cracked lobe.**
  - **H**

- **Critical TIR dimensions out of spec, porosity in block/casting, blocked ports.**
  - **H**
  - **L**

- **Press of dowels, bearing cap, liner (depth, loose/tight fit). Verify “O” ring.**
  - **H**

- **Valve seat missing, not bottomed out. Under/oversized valve journals.**
  - **H**
  - **H**

- **Correct valve seals, pressed to depth. Cup plug pressed to depth.**
  - **H**

- **Valve spring, keeper assemblies: valves, bent stems, debris, orientation, washers.**
  - **H**

- **Missing component, chain tension, timing. Bearing contamination.**
  - **H**

- **Upside-down valve seat. Improper valve guide.**
  - **H**
  - **L**

- **Crankshaft defects (bent, nicked, etc.). Missing main and con rod bearings.**
  - **H**
  - **L**
  - **M**

- **Tight bearings/wrong select fit.**
  - **M**
  - **L**

- **Reversed connecting rod caps. Missing piston ring(s).**
  - **L**

- **Plugged or undrilled oil passages. Missing, misaligned crankshaft seals. Gasket seal verification.**
  - **H**
  - **H**
  - **M**

- **Piston defects (wrong type, grade, etc.). Cylinder bore defects.**
  - **M**

- **Missing/damaged oil plugs.**
  - **H**
  - **H**
  - **H**
  - **H**

- **Tight timing chain, cam/crank timing, lash adjusters.**
  - **H**
  - **M**

- **Low compression, valve debris, valve rollers off-location.**
  - **H**
  - **M**

- **Bent valves, loose spark plug, engine sensors out of spec.**
  - **M**
  - **M**
  - **M**

- **Cam timing, oil pressure, oil level. Timing chain noise, valve train noise.**
  - **H**
  - **H**
  - **H**

- **Fuel system leaks, fuel injector defects (rich/lean, not closing, etc.).**
  - **H**
  - **H**
  - **H**

- **Missing/damaged gaskets, oil system leaks, water system leaks.**
  - **H**
  - **H**
  - **H**

- **EGR, IMCC malfunction, wiring harness shorts/opens.**
  - **H**
  - **H**
  - **M**