Pen-88™ is a nonionic blend of solvents and surfactants that forms a microemulsion, a stable dispersion that will not separate into mutually insoluble phases, when added to an acid or non-acid fluid. As a microemulsion additive, Pen-88 enables aqueous stimulation fluids, such as acids, to penetrate the formation by increasing the formation’s relative permeability.

**Features**

Pen-88 forms a microemulsion of dispersed spherical droplets less than 0.14 µm, creating a translucent solution. The maximum temperature recommended for Pen-88 applications is 225°F (107°C). It is used at concentrations between 1 and 5 gal/Mgal of inhibited acid; a concentration of 2 gal/Mgal is most common. Pen-88 will water-wet both sand and limestone.

**Applications**

Pen-88 can be used with or without nonemulsifiers like Losurf-259™, Losurf-300™, and Losurf-357™. It can be used in the following applications:

- as a penetrating aid for HCl and organic acids in systems up to 225°F (107°C)
- in breakdown acid before a fracture-acidizing treatment or a hydraulic fracturing treatment
- as a treatment to increase near-wellbore permeability in wells damaged by acid-soluble mineral scales
- as a mud-penetrating agent for both oil and water-based mud systems

**Pen-88™ Surfactant—Product Specifications**

<table>
<thead>
<tr>
<th>Part No. (55-gal drum)</th>
<th>516.00473</th>
<th>Bulk Density</th>
<th>7.90 lb/gal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part No. (5-gal can)</td>
<td>516.00474</td>
<td>pH</td>
<td>5.1</td>
</tr>
<tr>
<td>Form</td>
<td>Clear, white liquid</td>
<td>Pour Point</td>
<td>&lt;-25°F (-31.7°C)</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>0.93 at 60°F (15.6°C)</td>
<td>Flash Point</td>
<td>138°F (58.9°C)</td>
</tr>
</tbody>
</table>
**Benefits**

Pen-88™ has the following benefits:

- It enables acid to penetrate into the formation and displace oil at lower pump pressures.
- It increases matrix penetration of breakdown acids used before fracture-acidizing and hydraulic fracturing treatments, allowing energy to be transmitted more readily from the wellbore to the formation rock.
- In two-phase flow systems containing oil and aqueous treating fluids, it improves regain permeabilities.
- It increases acid penetration into wells with low bottomhole temperature and low-gravity crude oil, and it disperses both oil- and water-based muds.

For more information on the benefits of Pen-88™ Surfactant, contact your local Halliburton representative.