



PROCESS

GE Transportation Systems
"Dedicated to Customer Success"

9/16/05 Rev. 0

SUBJECT:

**INHIBITED SULPHURIC ACID PICKLE FOR LOW CARBON STEEL FOR
OUTSOURCED VENDORS (GE EVO STANDARD)**

PROCESS NO:

P4D-EP9

1. ACKNOWLEDGEMENT:

Sections 2 through 7 of this document have been pulled from SSPC-SP 8, Surface Preparation Specification No. 8 (Pickling), dated November 1, 1982 by the SSPC (The Society for Protective Coatings). This is an industry standard reference document for the pickling process.

2. SCOPE

2.1 This specification covers the requirements for the pickling of steel surfaces.

3. DEFINITION

3.1 Pickling is a method of preparing steel surfaces by chemical reaction, electrolysis, or both. The surfaces when viewed without magnification shall be free of all visible mill scale and rust.

4. APPEARANCE OF THE COMPLETED SURFACE

4.1 The surface shall be etched to a degree that meets the GEVO Diesel Engine Component Cleanliness Standard, 84A214647.

4.2 Uniformity of color may be affected by the grade, original surface condition, and configuration of the material being cleaned, as well as by discolorations from mill or fabrication marks, and the shadowing from etching patterns.

4.3 Visual standards of surface preparation agreed upon by the contracting parties may be used to further define the surface.

5. REFERENCE STANDARDS

5.1 The standards referenced in this specification are listed in Section 5.4 and form a part of the specification.

5.2 The latest issue, revision, or amendment of the reference standards in effect on the date of invitation to bid shall govern unless otherwise specified.

5.3 If there is a conflict between the requirements of any of the cited reference standards and the specification, the requirements of the specification shall prevail.

5.4 SSPC SPECIFICATIONS:

SP 1 Solvent Cleaning
SP 2 Hand Tool Cleaning
SP 3 Power Tool Cleaning
SP 6 Commercial Blast Cleaning
SP 7 Brush-Off Blast Cleaning
SP 11 Power Tool Cleaning to Bare Metal

5.5 Refer to EMPIS P4D2 as another process document for pickling as well.

6. PICKLING METHODS AND OPERATION

6.1 BEFORE PICKLING, PERFORM THE FOLLOWING:

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- 6.1.1 Remove heavy deposits of oil, grease, soil, drawing compounds, and foreign matter other than rust, scale, or oxide by any of the methods specified in SSPC-SP 1. Small quantities of such foreign matter may be removed in the pickling tanks provided no detrimental residue remains on the surface.
- 6.1.2 Remove heavy deposits of rust, rust scale, and all paint by any one of the methods specified in SSPC-SP 2, SP 3, SP 6, SP 7, or SP 11. Rust deposits which can be removed without unduly prolonging the pickling time may be removed in the pickling tanks.
- 6.2 **REMOVE ALL MILL SCALE AND RUST BY ANY OF THE FOLLOWING PICKLING METHODS:**
 - 6.2.1 Pickling in hot or cold solutions of sulfuric, hydrochloric (muriatic), or phosphoric acid to which sufficient inhibitor has been added to minimize attack on the base metal, followed by adequate rinsing in hot water above 140 °F (60 °C).
 - 6.2.2 Pickling in 5%-10% (by weight) sulfuric acid, containing an inhibitor, at a minimum of 140 °F (60 °C) until all rust and scale is removed; then thorough rinsing in clean water, then immersion for one to five minutes in 1%-2% (by weight) phosphoric acid containing about 0.3%-0.5% iron phosphate, at a temperature of about 180 °F (82 °C).
 - 6.2.3 Pickling in 5% (by volume) sulfuric acid at 170-180 °F (77-82 °C), with sufficient inhibitor added to minimize attack on the base metal, until all rust and scale is removed, followed by a two minute rinse in hot water at 170-180 °F (77-82 °C),. Next, immerse the pickled and rinsed steel for at least two minutes in a hot, inhibitive solution maintained above 190 °F (88 °C) and containing about 0.75% sodium dichromate and about 0.5% orthophosphoric acid.
 - 6.2.4 Electrolytic pickling in an acid or an alkaline bath using alternating or direct current. If (when using direct current) the work-piece is made the cathode, hydrogen embrittlement must be prevented or minimized by adequate treatment. If carried out in an alkaline bath, the electrolytic pickling must be followed by a thorough rinse in hot water; then followed by a dip in a dilute solution of phosphoric acid, or chromic acid, or solution of dichromate until no trace of alkali remains on the surface.
 - 6.2.5 "Hydride" descaling, pickling in baths of acid salts, pickling in baths of molten salts, or pickling in any other manner than outlined in the preceding sections shall be permitted only when specified, since their details are beyond the scope of this specification.
- 6.3 Do not exceed a dissolved iron content of 6% in sulfuric acid baths, or 10% in hydrochloric (muriatic) acid baths.
- 6.4 Use only clean water or steam condensate for solutions and rinses. Supply rinse tanks continuously with new water. Do not permit the total amount of acid or dissolved salts due to carry-over to exceed two grams per liter (0.2% by weight).
- 6.5 To minimize carry-over, suspend all steel briefly over the acid tank from which it has been withdrawn and permit the major portion of the acid to drain.
- 6.6 Remove deleterious smut, unreacted acid or alkali, metal deposits, or other contaminants.
- 6.7 Do not stack pickled steel surfaces in contact with one another until completely dry.

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- 6.8 Apply proper packaging (Section 8) before visible rusting occurs.

7. NOTES

- 7.1 While every precaution is taken to insure that all information furnished in SSPC specifications is as accurate, complete, and useful as possible, SSPC cannot assume responsibility or incur any obligation resulting from the use of any materials, paints, or methods specified therein, or of the specification itself.
- 7.2 A Commentary Section is available and contains additional information and data relevant to this specification. The Surface Preparation Commentary, SSPC-SP COM, is not part of this specification. The table below lists the subjects discussed relevant to pickling and appropriate Commentary Section.

Subject	SSPC-SP COM Section
Film Thickness.....	10
Inhibitors.....	8.3
Rust Back.....	4.5
Weld Spatter.....	4.4.1
Visual Standards.....	11

*Notes are not requirements of this specification.

8. PACKAGING

- 8.1 Upon completion of the pickling process, the parts should be sealed in 6 mil Armor Poly VCI-LDPE bags/sleeves or engineering approved equivalent. Additional packaging (FME covers – plastic end caps) should be added to prevent damage to the machined ends. Excess oil should be removed from the parts prior to bagging. Refer to the GEVO Diesel Engine Component Cleanliness Standard, 84A214647, for details on the cleanliness requirements of the parts.
- 8.2 The supplier shall ensure adequate measures are taken to prevent corrosion from the point of pickling until the time when the packaging is removed for assembly.

9. RESPONSIBILITIES

- 9.1 Steps 6.1.1 and 6.1.2 in Section 6 above are the responsibility of the supplier that GE contracts with on the purchase order for the parts and not the finishing house.

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