Reprinted from *Skinned Knuckles* magazine, Vol. 20 - No. 9

VIEWPOINT

BILL CANNON — TECHNICAL EDITOR

PYRO-PUTTY 2400

Pyro-Putty 2400 is a new product from Aremco Products, Inc. of Ossining, New York. [See Figure 1.] It has been recommended for repairing cracks, holes, or pits in exhaust manifolds, mufflers, tailpipes, and similar systems exposed to high temperatures in service. It affords the restorer an alternative to replacement of parts that are difficult or impossible to find. Pyro-Putty 2400 is a single-part ceramic and stainless steel-filled putty that bonds tenaciously to cast iron, steel, or stainless steels and is resistant to fuels, oils, and corrosive materials. In the cured state it will withstand temperatures as high as 2000 °F. Pyro-Putty may be applied to any roughened or sandblasted steel, cast iron, or stainless steel surface using a spatula, putty knife, or caulking gun.

The February/March 1995 issue of *Musclecar Review* published a report authored by Greg Donahue showing the application to repair a cracked Fairlane GT exhaust manifold using the Pyro-Putty material. Less than a day was required to complete the repair and the manifold was made to look just like new. The only equipment needed in addition to the Pyro-Putty kit was sandpaper, file, lacquer thinner (to degrease the part being repaired), and access to a sandblaster, wire brush, or wire wheel.

A number of users of the product have reported success in building up warped exhaust manifolds to provide a better seal to the cylinder head. Others have been reported successful repairs of exhaust headers and mufflers.

The *Musclecar Review* article cited above did not include any report on exposure of the repaired manifold to working temperatures, so I was encouraged to perform some limited testing myself. Not having a cracked manifold to experiment with, I did the testing on simulated exhaust system parts. For a cast iron test piece a tube two inches in length, 1-3/8 inches ID, with a wall thickness of 3/16 inch, was machined from a solid billet of gray cast iron. A second stainless steel test piece two inches long was cut from a length of 410 martensitic stainless steel, 1-1/4 inches ID with a wall thickness of 5/64 inch. The 410 stainless is a common 12 percent chromium and zero nickel type often used for machine parts and exhaust system components.

Saw cuts (approximately 0.035 wide) were made one-third around the circumference of the test pieces. These cuts, designed to simulate cracks, were V-eed out slightly with a course file. See Figure 2. After degreasing the parts the simulated cracks were covered with the Pyro-Putty repair compound using a spatula, forcing the material down into the crack and feathering it out to a distance of about 1/4 inch on each side of the crack. The compound was allowed to air dry

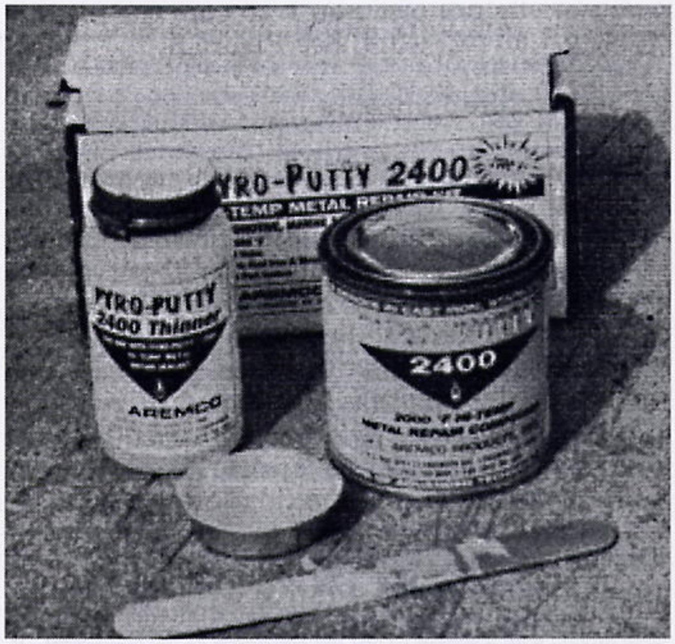

FIGURE 1 – Pyro-Putty 2400 kit contains 8-ounce can of repair material, 4-ounce bottle of thinner, mixing cup, wood spatula, and instructions for use.

for 24 hours. Then the test pieces were heated in a furnace for one hour at 250 °F to cure the material and drive off all moisture. See Figure 3.

High Temperature Exposure

Although the Pyro-Putty 2400 is rated for exposure to 2000 °F, it is unlikely that manifolds or exhaust system components will ever be exposed to temperatures that high in normal service. In fact, according to *Metals Handbook,* Vol. 1, 8th Edition, Properties and Selection of Metals, the usual upper temperature limit of gray cast iron for continuous exposure is 900 °F, and there is considerable susceptibility to creep above 700 °F with stresses greater than 10,000 psi. The 410 stainless steel resists excessive oxidation at temperatures up to 1250 °F according to data supplied by the Crucible Steel Company. Therefore, maximum exposures of 900 °F and 1250 °F were selected for the cast iron and stainless specimens, respectively.

Test Procedure

The specimens were placed separately in an electric muffle furnace and taken up to the test temperature, then allowed to cool down in the furnace. Initially it was planned to run each test specimen through

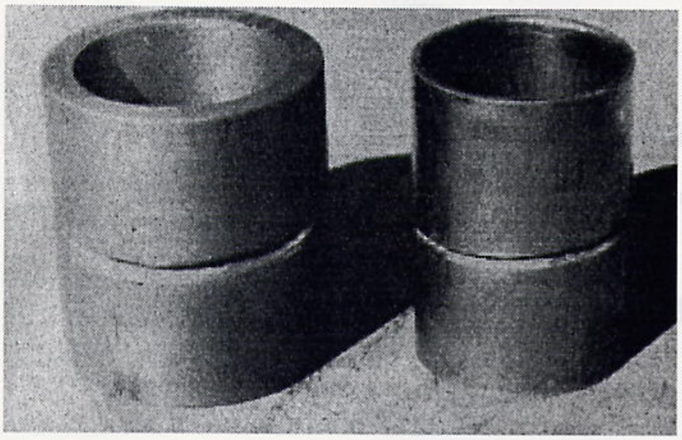

FIGURE 2 – Test specimens. Cast iron at left and 410 stainless steel at right. Vee'd out saw cuts simulate cracks.

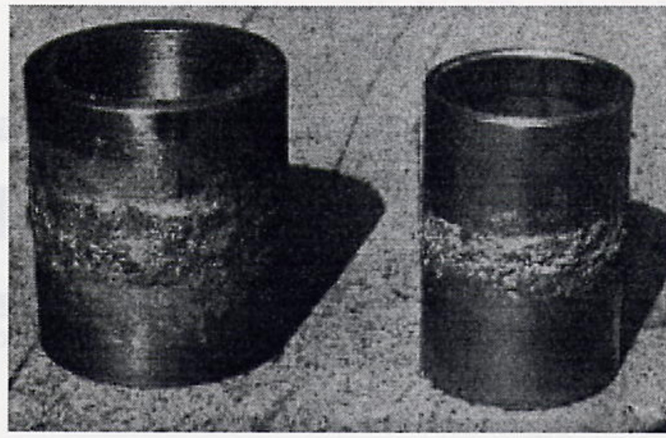

FIGURE 3 – Pyro-Putty after application to simulated cracks and feathered out on both sides of cracks.

ten cycles of heating and cooling, but it was decided that since the furnace heats and cools so slowly the tests would be too time consuming for the limited objectives being sought. After one cycle of heating and cooling for each specimen, the samples were simply inserted into the furnace at the maximum test temperature, left for 30 minutes, then removed from the furnace and allowed to air cool for 30 minutes. This regimen was repeated nine times for each sample.

Test Results

There was little or no change in appearance of the test pieces or repaired areas after the first exposure cycles. The cast iron specimen was oxidized to a very dark gray, almost black, color, while the stainless specimen tarnished to a grayish green color without any excessive scaling. The repaired areas were very dark, almost black in color.

The repair compound did not spontaneously flake off or separate during the test in spite of the fairly rapid temperature fluctuations during the test procedure. At the conclusion of the test the repaired areas were probed with a scriber to test the adherence of the compound. It was quite adherent to the cast iron specimen but was easily flaked off the smooth surface of the stainless piece in the region outside of the crack. Adherence was firm in the immediate vicinity of the crack in both test pieces. Obviously, the stainless test would have benefited by sandblasting or roughening the entire surface of the test piece.

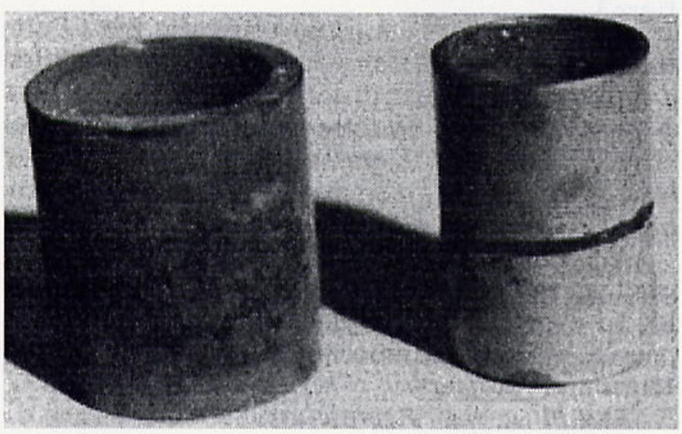

FIGURE 4 – Test specimens after conclusion of test and following probing of repair areas with sharp steel scriber to pry off any loosely adherent material. Material was firmly adherent to cast iron specimen at left but readily flaked off smooth parts of stainless steel piece at right. Repair remained intact in cracked area of part, however.

Conclusions

1. The Pyro-Putty repair of simulated cracks in cast iron and stainless steel survived temperature cycling to 900 °F and 1250 °F, respectively, for a total of five hours at the test temperature.

2. Adhesion of the repair material to the machined cast iron was reasonably good in both the crack area and surrounding surface. Adhesion to the smooth area of the stainless steel was poor but reasonably good in the crack area where the surface was roughened by filing.

3. Since the bond between the ceramic repair material and metal is purely mechanical, adhesion of the cured ceramic will be greatly improved by roughening the surface preferably by sand or grit blasting.

4. Repair of parts should be limited to cracks, small holes, or pits where there is sufficient sound metal left to resist strains in the part. The bond between ceramics and metal is too weak to provide any significant strengthening of the repaired part.

NOTES

Pyro-Putty is a registered trademark of Aremco Products, Inc.

Pyro-Putty 2400 is for use on cast iron and steels and is not compatible with aluminum alloys. Aremco offers Pyro-Putty 1000 for use on aluminum and its alloys.

Introductory kits of Pyro-Putty 2400 and 1000 are available from the address given below. Price of each kit $24.95 plus $4.95 shipping and handling. For additional information on ordering see the display ad on page 42 of this issue.

Aremco Products, Inc.
P. O. Box 429
Ossining, NY 10562
Telephone (914) 762-0685

User reports or comments on Pyro-Putty products are welcome and should be addressed to the Editor, 175 May Avenue, Monrovia, CA 91016.