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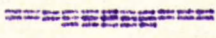
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O T T A W A June 12, 1945.

R E P O R T
of the
ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1888.

Corrosion Resistance of Small Steel Parts
(Nuts and Bolts) Coated With a Removable
Organic Protective Coating.



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Background:

A letter dated May 18, 1945, (File No. 79-4-/P-5), from Mr. H. B. Percival of the Office of the Transport Controller, Department of Transport, 261 St. Sacramento Street, Montreal, Canada, requested that a test be made of the corrosion resistance of seven bright finished stove bolts and accompanying nuts which had been treated with a corrosion-proofing material known as Shell Ensis Fluid No. 207, produced by the Shell Oil Co. of Canada.

(Continued on next page)

(Background, cont'd) -

The letter stated in part:

"The samples were cleaned in the vapour degreasing equipment at R.C.O.C. Depot, Longue Pointe, Quebec, under special supervision. Solvent used was trichlorethylene.

These samples were then cold dipped in Shell Oil Co. Shell Ensis Fluid No. 207 at a temperature of approximately 72° F. Up to time of shipment they were allowed to dry at temperatures varying from 68° F. to 80° F. for a period of 96 hours.

These bolts are materials that will eventually be used in Pacific areas and will be subject to the following conditions through transporting and stowage:

1. In transit and storage fresh air conditions 20° F. below zero to 95° F. above. Humidity up to 80 per cent. Average time of outside storage, 3 months.
2. In transit and storage salt air conditions 20° F. below zero to 110° F. above. Humidity up to 95 per cent. Average time of outside storage, 6 months.
3. Under conditions cited in Items 1 and 2, changes in temperatures and humidity will often be rapid and frequent.

These parts will all be packed in interior containers sealed and such interior containers will be packed in outside wooden containers with use of so-called water-proof paper crate liners."

TESTS PERFORMED:

In order to obtain information regarding the effect of various factors mentioned above on the coated steel nuts and bolts, the following tests were performed:

1. Weather-Ometer Test.

Two coated bolts and nuts were placed in the Weather-Ometer for 15 days at a temperature of 130° F. For three minutes out of every twenty the samples were sprayed

(Tests Performed, cont'd) -

with unheated tap water. The samples were subjected continually to light resembling sunlight which was produced by an electric arc.

Result -

Considerable deterioration took place on the areas which were exposed to the spray and light (see Figure 1). Most if not all of the protective coating was removed from the bolt threads. The smooth part between threads and head had a "dried out" appearance. Some of the coating had been removed from the exterior of the nuts. Considerable rusting had occurred on the threads of the nuts.

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2. Total Immersion Test.

One coated bolt and nut were totally immersed in 5 per cent salt (sodium chloride) solution at 95° F. for 14 days.

Result -

A number of rust spots appeared. Part of the coating peeled off while being photographed. See Figure 2.

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3. Intermittent Immersion Test.

Two coated bolts and nuts were given the Intermittent Immersion Test in 5 per cent salt (sodium chloride) solution at 95° F. for 15 days.

Result -

A considerable amount of rusting took place, especially on the threads and bolt heads. During the photographing a considerable amount of coating peeled off. The coating which remained was duller in appearance than it was previous to the test. The results are shown in Figure 3.

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(Continued on next page)

(Tests Performed, cont'd) -

4. Salt Spray Test.

Two coated bolts and nuts were given the Salt Spray Test in 20 per cent salt (sodium chloride) solution at 95° F. for 3 days.

Result -

After 17
hours:

Slight rust observed on edges of bolts and nuts and on the threads of the bolts.

After 3
days:

All of the threads on the bolts were corroded.

External surfaces of the nuts were corroded and some of the coating peeled off during the photographing.

See Figure 4.

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Conclusions:

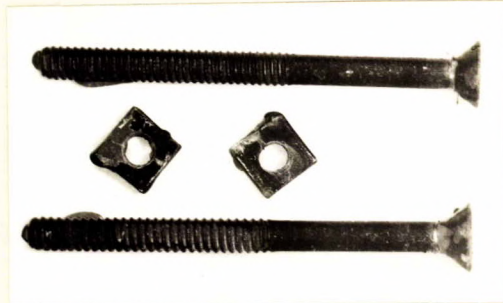
Coatings of Shell Ensis Fluid No. 207, such as those used in these tests, when applied to steel parts cannot be expected to resist the effect of any of the following conditions for a long period of time:

1. Sunlight, ordinary water, fairly high temperature.
2. Total immersion in water containing salt at fairly high temperature.
3. Intermittent immersion in water containing salt at fairly high temperature.
4. Exposure to salt spray at fairly high temperature.

It is suggested that great care should be taken in the application of this Fluid to the metal surface if best results are desired.

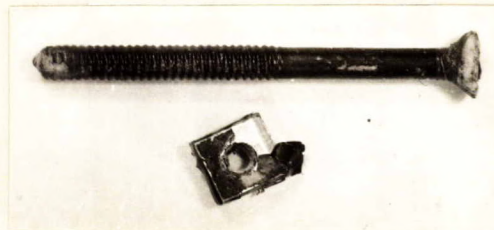
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Figure 1.



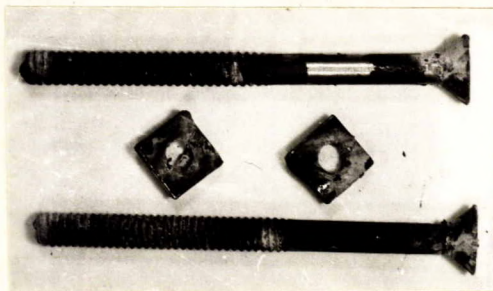
STEEL NUTS AND BOLTS COATED WITH SHELL
ENSIS FLUID NO. 207, AFTER 15 DAYS IN
THE WEATHER-OMETER.

Figure 2.



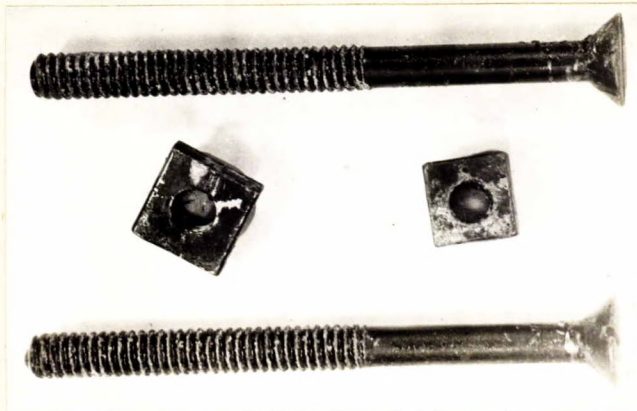
STEEL NUT AND BOLT COATED WITH SHELL ENNIS FLUID
NO. 207, AFTER 14 DAYS OF TOTAL IMMERSION IN
5 PER CENT SALT (SODIUM CHLORIDE) SOLUTION.

Figure 3.



STEEL NUTS AND BOLTS COATED WITH SHELL ENSIS
FLUID NO. 207, AFTER 15 DAYS IN THE INTERMIT-
TENT IMMERSION CORROSION TEST USING 5 PER CENT
SALT (SODIUM CHLORIDE) SOLUTION AT 95° F.

Figure 4.



STEEL NUTS AND BOLTS COATED WITH SHELL ENSIS
FLUID NO. 207, AFTER 3 DAYS IN THE 20 PER
CENT SALT (SODIUM CHLORIDE) SPRAY AT 95° F.