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February 1, 1945.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1786.

Investigation of Corrosion Resistance and
Mechanical Properties of Steel Strapping.

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Mechanical Properties of Steel Strapping.

Origin of Material:

Samples of uncoated and enamelled steel strapping were submitted at different times since November 1, 1944, by the Signals Production Branch, Department of Munitions and Supply, Ottawa, Ontario. It was requested that mechanical tests be carried out on all samples and that the enamelled strapping be subjected to the salt spray test to determine its corrosion resistance.

Tests Performed:

1. A piece of enamelled steel strapping, coated on one side with wax, was subjected to the salt spray test to determine its corrosion resistance.
2. A piece of enamelled steel strapping was subjected to the bend test to determine the adherence of the enamel to the steel.
3. Four uncoated samples and one enamelled sample of steel were tested for tensile strength and elongation.

Salt Spray Test:

The sample of enamelled steel strapping was subjected to the action of spray from a 20 per cent salt (sodium chloride) solution at a temperature of 95° F. (35° C.). The sample was photographed before testing (see Figure 1).

Results:

After 18 hours. Edges of sample were badly corroded. The remainder continued to be in good condition.

After 42 hours. About two-thirds of the unwaxed side was badly corroded (see Figure 2). The waxed surface remained uncorroded.

After 120 hours. Traces of corrosion appeared on the waxed surface.

No tensile strength measurement was made on the corroded sample, because the part of the sample which was corroded most would have been cut away in making the tensile specimen. In other words, the tensile strength result would have made the corrosion resistance appear greater than it really was.

Bend Test:

A sample of the enamelled steel was bent cold through 180° over two thicknesses of the material. No cracking or flaking was observed in the coating.

Tensile Strength and Elongation Tests:

Tensile strength and elongation tests were performed on:

1. One sample of uncoated steel strapping received about November 1, 1944, from the Canadian Steel Strapping Co., Montreal.
2. One sample of uncoated steel strapping received about November 1, 1944, from the Acme Steel Co., Montreal.
3. Two samples of uncoated steel strapping received about January 5, 1945, from the Acme Steel Co.
4. One sample of enamelled steel strapping from the Acme Steel Co.

The results were as follows:

		Maximum stress, p.s.i.	Elongation, per cent in 2 inches
Canadian Steel Strapping Co.	-	93,300	4.0
		93,300	4.0
		94,600	4.0
		93,300	4.0
Acme Steel Co., Nov. 1, 1944	-	87,700	1.5
		85,500	1.0
		87,700	1.5
		85,500	1.5
Acme Steel Co., Jan. 5, 1945 (A)	-	121,300	1.0
		123,200	1.0
		120,600	0.5
		120,600	0.5
Acme Steel Co., Jan. 5, 1945 (B)	-	118,000	1.0
		120,000	1.0
		122,800	1.0
		118,000	1.5
Enamelled strapping, Acme Steel Co.		83,333	6.0
		85,900	6.0

Conclusions:

1. The enamel is not sufficient protection for the steel against corrosion.
2. The enamel + wax is much more satisfactory from the standpoint of resistance to corrosion.
3. The adherence of the enamel to the steel is satisfactory.
4. All of the samples of strapping possess a tensile strength greater than the minimum of 80,000 p.s.i. mentioned in the specifications.
5. The specification limit, of 100,000 p.s.i., is exceeded by the two most recent uncoated samples from the Acme Steel Co. It is suggested that such a limit in the specifications probably serves no useful purpose.

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Figure 1.



ENAMELLED STEEL STRAP BEFORE CORROSION TEST.

Figure 2.



ENAMELLED STEEL STRAP AFTER 42 HOURS IN THE
20 PER CENT SALT SPRAY AT 95° F. (35° C.).

(Approximately $\frac{1}{2}$ actual size).

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