LEAD INDUSTRIES ASSOCIATION

420 LEXINGTON AVENUE

NEW YORK 17, N. Y.

RED LEAD DIVISION

February 19, 1948

To Members of the Red Lead Division:

SUBJECT: EFFECTS OF RED LEAD PAINTS ON THE WELDING OF STRUCTURAL STEEL

You will find enclosed a reprint of the paper on the effect of red lead paints on the welding of structural steel. This paper contains the results of a project completed last year, sponsored by the Lead Industries Association, at Battelle Memorial Institute.

Very truly yours,

C. J. Vander Valk
Technical Director
Red Lead Division

Studies on the Effects of Red Lead Paints on the Quality of Metal-Arc Welds in Structural Steel*

By R. W. Bennett, R. D. Williams, and C. B. Voldrich†

Synopsis

This paper is based on a study of the effects of red lead base paints on the quality of metal-arc welds in structural steel. Commercially available red lead paints and several red lead mixed-pigment paints were investigated and their effects on welding compared with those of zinc chromate base paints and unpainted steel. The operating characteristics of the electrodes, the internal soundness of the weld me[illegible] and mechanical tests were used as criteria for evaluating the relative effects of the various paints on welding and weld quality. The tests indicated that, in general, satisfactory welds can be expected on steel with shop or field coats, of a nominal thickness of about 1 mil, of all the paints tested.

Introduction

IN THE past, specifications for the welding of steel generally required that all paint, zinc coatings, grease, oil, dirt and other surface coatings or contaminants be removed from the joint prior to welding. Recent experience has shown that within reasonable limits, thin films of paint, zinc or oil are not necessarily harmful. Consequently, some specifications now permit the limited application of protective films to steel prior to welding.

The consensus of the testimony on paints and other coatings is that bare, clean surfaces are still to be preferred where the utmost in weld-joint quality and reliability is desired. For those instances where paints are permitted, there is as yet no general agreement on the conditions which are acceptable. Owing to the discrepancies in available data, and the scarcity of information on the effect of various paints on metal-arc welds, the Lead Industries Association authorized Battelle Memorial Institute to study certain aspects of this question. The objective was to evaluate the comparative effects of selected types of priming paints on the strength, ductility and soundness of metal-arc welds. The effects of these paints on the operating characteristics of the electrodes commonly used in structural welding (predominantly A.W.S. Class E6010) were also to be studied.

After the few available reports on the effects of paints in welding[1-4] had been studied, the Battelle investigation was started with tests of a considerable number of red lead base and zinc chromate base paints, and slurries containing various proportions of different pigments. In general, the influence of the various paints on the strength of the welded joints was not very pronounced, except for extremely thick paint films. However, there was sometimes a noticeable adverse effect on the ease of welding, particularly when the pigmentation contained very large proportions of red lead.

On the basis of the initial tests, several red lead mixed-pigment paints, with reduced proportions of red lead in the pigment, were used for further investigation. Exploratory tests indicated that satisfactory welding could be done on plates coated with these paints. Following this, more comprehensive welding tests were then made with some of the red lead mixed-pigment paints and the results of these tests are described below. For comparison, companion tests were also made on unpainted plates, and on plates coated with zinc chromate base paints and high-lead-content red lead base paints.

Materials

Test Paints

The paints used in this investigation were supplied by the Red Lead Technical Committee of the Lead Industries Association, and are listed in Table 1.

For most of the tests, one-coat paints were sprayed on pickled or grit-blasted steel plates to a dry film thickness of 1 to 3 mils (0.001 to 0.003 in.). The film thickness was measured with a Magne-Gage, and spot checks were made with a micrometer. A limited number of tests was made with plates to which paint was applied in multiple coats to a thickness of about 10 mils. With few exceptions, all painted plates were allowed to dry thoroughly before being welded.

Steel

The steel used throughout this investigation was $^{3}/_{8}$ and $^{3}/_{4}$-in. medium-carbon steel plate, conforming to Navy Department Specification 46S3, Grade M. The back-up material used for single-V butt joints was $^{1}/_{4}$-in. hot-rolled medium-carbon strip of welding quality. The test plates were cut to size and beveled, where required, by flame cutting. The surface condition of the plates prior to painting was either: (1) as received, with mill scale intact, (2) pickled in a 5% sulphuric acid solution containing an inhibitor, followed by a rinse in a 1% phosphoric acid solution or (3) grit blasted.

Welding Electrodes

The electrodes used for the tests were commercial brands of the following types and sizes:

A.W.S. Class	Diameter, In.
E6010	$^{5}/_{32}$ and $^{3}/_{16}$
E6011	$^{5}/_{32}$ and $^{3}/_{16}$
E6012	$^{3}/_{16}$
E6020	$^{5}/_{32}$ and $^{3}/_{16}$

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† Welding Research Division, Battelle Memorial Institute.

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