

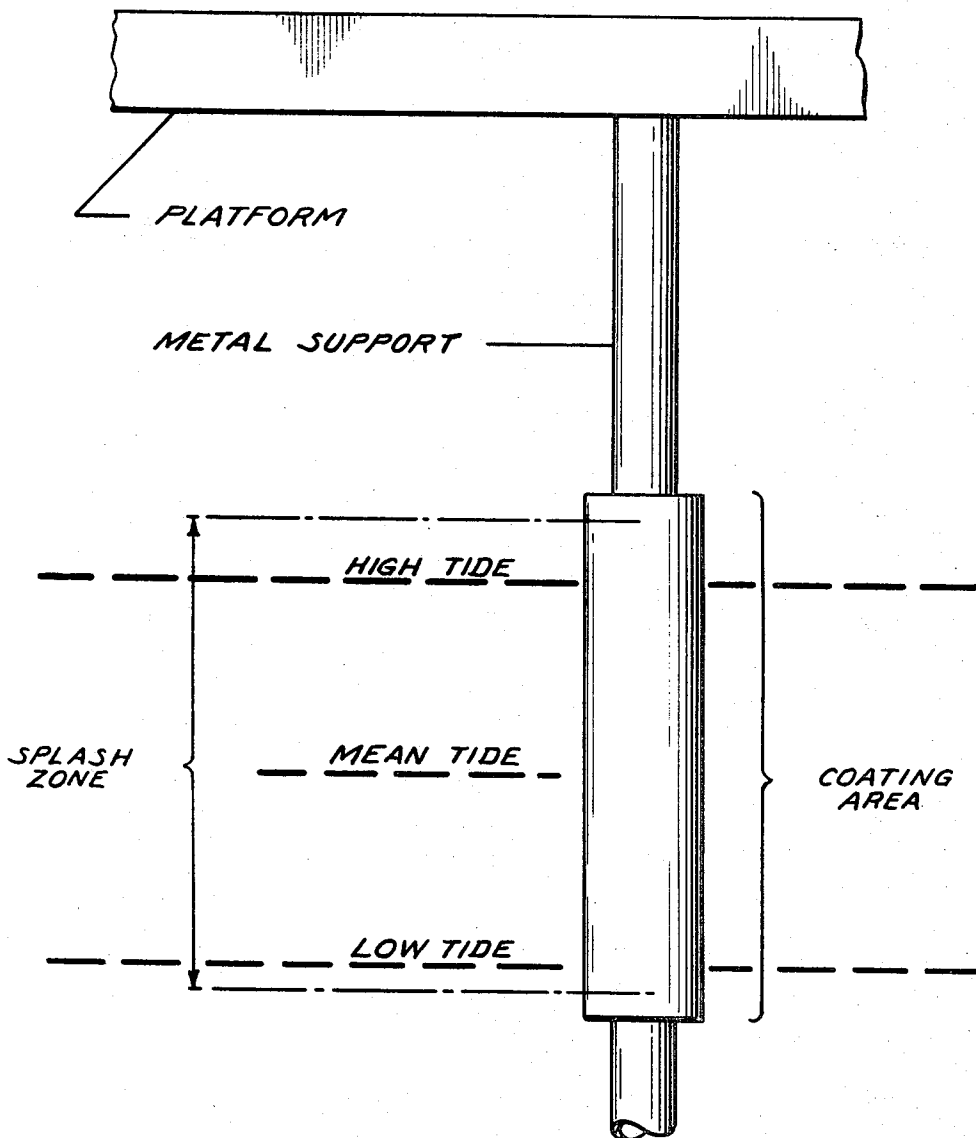
Dec. 24, 1968

W. N. LAUGHLIN

3,417,569

PROTECTIVE COATING AND METHOD

Filed Jan. 25, 1968



William N. Laughlin
INVENTOR

BY Arnold, Roylance,
Kruger & Durkee
ATTORNEYS

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PROTECTIVE COATING AND METHOD

William N. Laughlin, 129 Brentwood Blvd.,
Lafayette, La. 70501

Continuation-in-part of application Ser. No. 496,153,
Oct. 14, 1965. This application Jan. 25, 1968, Ser. No.
703,516

9 Claims. Cl. (61—46)

ABSTRACT OF THE DISCLOSURE

Supports for offshore platforms are provided which give effective and long-lasting protection to the corrosive forces existing in the splash zone adjacent the platform. Such supports comprise metal pipes which are covered over that portion thereof which is positioned in the splash zone with a corrosion-inhibiting coating of an elastomeric material. The coating is cured to the metal pipe to form a firm bond between coating and support. A process for coating the support in the splash zone is provided.

Reference to compending application

This application is a continuation-in-part of my earlier compending application Ser. No. 496,153, filed Oct. 14, 1965, and now abandoned.

Background of the invention

This application relates to protective coatings suitable for use in the so-called "splash zone," and to a method for applying such coatings. The invention finds particular utility in use on the supports and flow lines of an offshore drilling platform.

With the rapid increase in the last few years in offshore drilling for minerals such as oil and gas, the various problems relating to offshore structures have been greatly magnified. One such problem is that offshore platforms are generally necessary, and these platforms must be firmly supported to withstand the often violent weather conditions which prevail. Such supports usually take the form of large pipes which extend from the platform to a point beneath the surface of the water to the bottom of the lake or the ocean floor, etc. There are other pipes or "risers," flow lines, etc., which extend at least some distance beneath the surface of the water, and these metal members are also coated in accordance with the present invention.

One extremely difficult problem facing the offshore industry is that the metal members which extend from the offshore platform to a point beneath the surface of the water tend to corrode because of atmospheric conditions, especially in sea water. The corrosion is especially severe in the so-called "splash zone." The splash zone is the zone near the surface of the water, which is alternately exposed to water and air due both to the changing of the tide and the breaking of the spray from waves coming into contact with the structure. It is easily seen that the corrosive effects upon untreated metal members in this area would result in a very short life expectancy for such members and, consequently, greatly increased costs since the replacement of such members, especially platform supports, is a complex and expensive task.

Because of the severe corrosion problem encountered with offshore supports, flow lines, etc., it has been customary to protect such members in some way from this corrosion.

Conventional means for protecting the supports, flow lines, etc., have proved satisfactory in the zones other than the splash zone. But in the splash zone, such means have not proved satisfactory. It is to splash zone protection that the present invention is directed.

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One means of protection known to the prior art employs sacrificial anodes. Such anodes are inserted near the metal member, and a portion of the corrosion is thus transferred to the more readily corroded anode. While sacrificial anodes are satisfactory for the completely submerged zone, they have been found unsatisfactory for the splash zone.

Another means of protection known to the prior art employs a jacket of noncorrodible material around the support. Such a jacket must be applied to the metal member by welding before the member is installed. It has not been uncommon for such members to fail because of weakness of the perimeter seal, or because of mechanical damage to the thin-walled jacket.

Still another means of protection heretofore known employs a spray or brush-on coating. Such coatings, which may be applied on location, provide protection for a limited period, but require constant maintenance, and are penetrated by even the mildest mechanical bump or scrape.

It is thus seen that all the presently known means of protection suffer from serious disadvantages, and none have remedied the existing difficulties. Indeed, it has been found that some of the hoped-for "solutions" have, instead of solving the problems, actually compounded the difficulty by masking failure of the supports, etc.

The solution provided by this invention overcomes many of the shortcomings of the prior art by providing lasting, economical, and effective protection for metal members of offshore platforms in the splash zone. And routine maintenance is eliminated when the solution provided by this invention is employed. In addition, it is believed that the present invention also reduces the formation of undesired marine growth, scale and fungus on the metal members in the splash zone area.

Brief summary of the invention

Briefly, the invention comprises a metal member on an offshore platform which extends to a point below the surface of the water and which has bonded thereto throughout the length of the splash zone a corrosion-inhibiting coating of cured elastomeric material.

Further, the invention comprises a method of protecting a metal member of an offshore platform from corrosion, the method generally comprising (1) determining the splash zone area, (2) pretreating the metal member over a predetermined length, (3) applying a coating of an elastomeric material to the support over the length, (4) curing the coating at elevated conditions of temperature and pressure for a time sufficient to form a firm bond between the coating and the support over the entire area of the coating, and (5) allowing the coated support to cool and thence installing the member on an offshore platform in such a manner that the mid-point of the coated area is located at approximately the mid-point of the splash zone.

Brief description of the drawing

In order that the manner in which the foregoing and other objects are attained in accordance with this invention, the invention will be explained in terms of particularly advantageous embodiments.

The drawing illustrates one embodiment of the present invention, showing a metal support for an offshore platform protected in accordance with this invention, the drawing indicating the splash zone with relationship to the high, low and mean tide levels.

Detailed description of preferred embodiment

In accordance with the invention the length of the splash zone in the area in which the support is to be installed is determined. For example, the splash zone

ranges generally from about 40 feet in Cook Inlet, Alaska, to about 15 feet in the waters of the Gulf of Mexico off the coast of Louisiana and Texas to about 6 feet in certain inland waters.

A metal member such as a length of pipe, suitable in size for use as a support, flow line, etc., as desired, is provided, and such member is desirably pretreated through a length thereof at least as great as the splash zone, for example by sandblasting with dry grit, to prepare it for coating. After pretreating the sandblasted area is desirably washed with clean solvent.

A suitable bonding agent may then if desired be applied to the metal member over the pretreated area thereof, and allowed to dry at ambient conditions. In some contexts, it has been found that the use of such a bonding agent (or even a plurality of bonding agents), provides for better adhesion between an elastomeric material and the metal member. Any suitable bonding agent may be used, it being known in the art that such agents may be employed when adhering elastomeric material to a metal member. One example of such a bonding agent is a thermo-setting resin such as a phenol-formaldehyde resin. Specific examples of bonding agents useful in conjunction with a neoprene elastomer are Chemlock 203 and Chemlock 220, each products of Hughson Chemical Company, Erie, Pennsylvania. A bonding agent such as Chemlock 203 is brushed onto the metal member in the pretreated area, and allowed to dry. The thickness of the bonding agent on the metal member is desirably on the order of one mil.

An elastomeric material, such as a suitably compounded neoprene (an elastomeric polymeric of chloroprene) is then affixed to the predetermined area of the metal member to be coated, as by wrapping with nylon tape. The elastomer is then subjected to elevated temperature and pressure conditions for a period of time sufficient to cure the polymer and the bonding agent to establish a firm bond between the polymer and the metal member. The bond formed between the elastomer and metal member is such that the strength of the bond between metal and elastomer is greater than the strength of the elastomer.

The coated member is then cooled to ambient conditions, and thereafter is installed at an offshore platform in such a manner that the mid-point of its coated area is approximately at the midpoint of the splash zone.

While various conditions of pressure, temperature and time might be advantageously employed, it has been discovered that certain conditions are distinctly advantageous. Specifically, it is desired to employ pressures on the order of 65–100 p.s.i., with about 80 p.s.i. being particularly preferred; it is preferred to cure the coating at temperatures on the order of 240–350° F., with about 312° F. being particularly preferred. It has been found that with the desired coatings, when the temperature is below about 240° F. sufficient strength of bond cannot be achieved, and above about 350° F. the coating begins to deteriorate. It has been found advantageous to cure the elastomeric coating for approximately 2 to 4 hours, with about 3 hours found to be the optimum curing time in many contexts. Longer curing times (e.g. 8 hours) are employed for very large members because of the difficulty in getting proper heat transfer to the coating itself. Likewise, if very small pipe is used, shorter curing times (e.g. 1 hour) may be sufficient.

While various elastomeric polymeric materials might be employed with varying degrees of success, it has been found that Type W Neoprene (which is a product of the E. I. du Pont de Nemours Company of Wilmington, Del.) is of distinctly significant utility. Neoprene is a polymer of chloroprene (2-chloro-butadiene 1,3).

As is very well known in the elastomer art, suitable additives are desirably compounded with the elastomer to give to the elastomer desired properties. For example, additives such as curing agents, anti-oxidants and reinforcing

agents may be compounded with the neoprene. Specific agents of this type and methods of compounding are quite well known in the art and form no part of this invention. Information on specific additives and compounding methods is available from the E. I. du Pont de Nemours Company, Wilmington, Del., and from the McGraw-Hill Encyclopedia of Science and Technology (1960), vol. 11, pages 635–644, and numerous other sources known to those skilled in the art.

In order that the invention may be more clearly understood, reference is had to the following examples.

EXAMPLE I

A section of steel pipe of 2½ inch outside diameter is sandblasted over a length of 20 feet. An elastomer composition comprising Type W Neoprene is then applied to the sandblasted area to a thickness of 1 inch, by wrapping the elastomer onto the pipe with nylon tape. The pipe is then placed in an oven which is operating at 80 p.s.i. and 312° F., where the coating is cured for 3 hours. The pipe is then removed from the oven, cooled, and later installed in the splash zone at an offshore platform, with the mid-point of the coating corresponding to the mid-point of the splash zone.

EXAMPLE II

A section of steel pipe is wrapped with an elastomer composition comprising Type W Neoprene over a 6 foot section thereof, to a coating thickness of ½ inch. The pipe is then inserted in an oven which is operating at 65 p.s.i. and 315° F., where it is allowed to remain for 3½ hours. The pipe is then removed from the oven, cooled, and later is installed on a drill platform operating in inland waters in such a manner that a length of about 3 feet of the coating extends above the water, and about 3 feet extends below the surface of the water.

EXAMPLE III

A pipe which is to be used as a support on an offshore platform is sandblasted over a 40 foot length. Onto the sandblasted area is wrapped a sheet of an elastomer composition comprising Type W Neoprene of a thickness of about ¼ inch. This coating is then cured at about 325° F. and 75 p.s.i. for about 3 hours. At the end of this time, the support is cooled, and later it is installed on an offshore platform operating in the Gulf of Mexico a considerable distance off the coastline. The mid-point of the coating is placed at the mid-point of the splash zone.

EXAMPLE IV

A pipe which has been sandblasted over a 25 foot length is wrapped with an elastomer composition comprising Type W Neoprene to a thickness of about ½ inch in the general manner described in Example III above. The coated area of the pipe is then heated to about 300° F. while maintaining it at 85 p.s.i. pressure, for about 4 hours. Upon completion of this period, the pipe is cooled; it is later installed on an offshore drill platform in such a manner that the coated area of the pipe occupies the complete length of the splash zone.

EXAMPLE V

Example IV is repeated except that the temperature is increased to 345° F., and the curing time is reduced to 2½ hours. The coated support is used in the same manner as the support of Example IV.

EXAMPLE VI

Example IV is again repeated, except that in this instance the pressure is increased to 90 p.s.i., the temperature is increased to 325° F., and the curing time is reduced to 3 hours. The resultant coated support is used in the same manner as that of Example IV.

EXAMPLE VII

A pipe to be used as a support for an offshore drill

platform is sandblasted over a 28 foot length. Onto the sandblasted area is wrapped a coating of an elastomer composition comprising Type W Neoprene, about $\frac{3}{4}$ inch in thickness. The pipe is then heated to about 290° F. for 4 hours in an oven operating at 80 p.s.i. After the pipe is cooled, it is taken to an offshore platform where it is installed so that about 14 feet of the coated area is above, and about 14 feet is below, the mean tide level of the water.

EXAMPLE VIII

A metal pipe (8 inches O.D.) to be used as a support for an offshore platform is provided. It is determined that the splash zone in the area wherein the offshore platform will be located is approximately 17 feet in length.

An 18-foot length of the metal pipe is sandblasted. A bonding agent, Chemlock 203, is brushed onto the sandblasted area to a thickness of about 1 mil, at ambient temperature and pressure and allowed to dry. A sheet of suitably compounded Type W Neoprene about one-half inch in thickness is then wrapped around this 18-foot length of the pipe in the general manner described in Example III above, the pressure on the coating being about 65 p.s.i. The coated area of the pipe is then heated in an oven to a temperature of about 300° F. for 3 hours. The pipe is then allowed to cool at ambient temperature for 8 hours. After cooling, the support is installed on the offshore platform in a manner such that approximately a 9 foot length of the coated area is above the mid-point of the splash zone and approximately a 9 foot length of the coated area is below the mid-point of the splash zone. In this manner, the complete area of the splash zone is fully protected by the coating, with a slight extra margin of protection at each end thereof.

EXAMPLE IX

Example VIII was repeated except that the temperature of the oven was 255° F. rather than 300° F. Satisfactory results were obtained, but it was found desirable to use a longer curing time.

EXAMPLE X

Example VIII was repeated except that the bonding agent employed was Chemlock 220. Satisfactory results were again obtained.

EXAMPLE XI

39.5-inch metal pipe to be used as a platform support is provided. The splash zone is determined to be 15 feet.

A 16-foot length of the pipe is sandblasted, and a bonding agent is applied in the manner described in Example VIII above. A sheet of suitably compounded Type W Neoprene is affixed to the sandblasted area by use of a cylindrical mold. The coated area of the pipe is then heated to about 330° F. for 3 hours and cooled. The pipe was then installed in a manner such that about 8 feet of the coated area is above and 8 feet below the mid-point of the splash zone.

Pipe actually coated in accordance with this invention has been tested for prolonged periods in the waters of Timbalier Bay, Louisiana, and Lake Washington, Louisiana. These tests revealed that there was no change in the coated material, and likewise no change in the condition of the support protected by the coating. Further, there was no marine growth on the coating. Adjacent unprotected supports were found to be severely corroded.

With the thickness of the coating applied in accordance with this invention may be varied considerably, it has been found that coating thicknesses in the range of $\frac{1}{8}$ inch to about 1 inch are preferred. Of course, it will be recognized that the thicker the coating, the greater will be the resistance to mechanical damage, such as buffeting or scraping by a docking craft. Coating of the desired thickness may be provided by providing sheets of elastomer of the desired thickness.

Similarly, the length of the coating may be varied, but it is assumed that it will be desired to at least cover the complete splash zone. It is understood, of course, that the coated support is installed on the platform in such a manner that the (vertical) mid-point of the coated area will be located approximately at the mid-point of the splash zone.

The curing process as above described has been found to produce a very firm bond which is securely bound to the support over its entire area.

It has been found that, in addition to the above-mentioned advantages of this invention, certain other advantages are obtained which make the present invention distinctly superior to the prior art. For example, the coatings applied in accordance with this invention are serviceable at temperatures of from about -45° F. to about 300° F.; they have excellent electrical and thermal insulating properties; they possess a relatively high specific gravity of about 1.25; they eliminate routine maintenance; and they are tough and light in weight. Further, it is believed that they inhibit the formation of undesired marine growth, scale and fungus.

The invention is thus seen to solve a long existing problem, and yield distinctly advantageous results to the offshore industry.

While the invention has been described in terms of preferred embodiments, it will be obvious to those skilled in the art that various modifications might be made without departing from the scope of this invention.

What is claimed is:

1. A method of protecting a metal member of an offshore platform from corrosion which comprises: sandblasting said metal member over a predetermined length thereof

applying a coating of an elastomeric material to a predetermined thickness over said length of said metal member;

curing said coating at about 240-350° F. and about 65-100 p.s.i. for about 2 to 4 hours, whereby a coated member is formed;

allowing the coated member to cool to ambient conditions; and,

thence installing said member on an offshore platform in such a manner that the vertical mid-point of the coated area is located at approximately the mid-point of the splash zone.

2. The invention according to claim 1 wherein said elastomeric material comprises a polymer of chloroprene.

3. The invention according to claim 2 wherein said thickness of said coating is from about $\frac{1}{8}$ inch to about one inch.

4. The invention according to claim 3 wherein said coating is applied by means of wrapping it onto the metal member with nylon tape.

5. A method of protecting a metal member of an offshore platform from corrosion which comprises:

pretreating said metal member over a predetermined length thereof;

applying a bonding agent to said pretreated area to facilitate bonding of an elastomer to said metal member;

applying a coating of an elastomeric material to a predetermined thickness over said length of said metal member;

curing said coating at about 240-350° F. for a time sufficient to form a strong bond between said elastomer and said metal member, whereby a coated member is formed;

allowing the coated member to cool to ambient conditions; and,

thence installing said member on an offshore platform in such a manner that the vertical mid-point of the coated area is located at approximately the mid-point of the splash zone.

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6. The invention according to claim 5 wherein said elastomeric material comprises a polymer of chloroprene.

7. A method of protecting a metal member of an offshore platform from corrosion which comprises:

determining the length of the splash zone in the area in which the metal member is to be used;

pretreating said metal member over a length at least as great as said length of the splash zone;

applying a bonding agent to said pretreated area to facilitate bonding of an elastomer to said metal member;

providing a sheet of elastomer having a thickness of about $\frac{1}{8}$ inch to about one inch, and having a length at least as great as said length of said splash zone;

applying said sheet of elastomer to said metal member over said bonding agent;

heating said member to a temperature sufficient and for a time sufficient to form a firm bond between said elastomer and said metal member, thereby forming a coated member;

allowing said coated member to cool to ambient conditions; and,

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thence installing said member on an offshore platform in a manner such that the vertical mid-point of the coated area is located at approximately the mid-point of the splash zone.

8. The invention according to claim 7 wherein said elastomer comprises a polymer of chloroprene.

9. The invention according to claim 7 wherein said temperature is between about 240° F. and about 350° F.

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JACOB SHAPIRO, *Primary Examiner*.

U.S. Cl. X.R.

61—54; 117—49, 94, 132; 138—141, 145