

TITLE:**HOSE BURST CONTAINMENT BLANKET****BACKGROUND OF THE INVENTION****Field of the Invention**

[0001] This invention relates generally to a protective blanket used to shield and contain fluid leaks from a hose under high internal pressure, more particularly to a blanket that can be coiled loosely around a pipe and secured in a tubular shape and wherein multiple blankets can be joined end-to-end.

Description of the Prior Art

[0002] In recent years, improved safety practices in the oil and gas industry have required oil rig operators to recertify critical equipment. There are now industry guidelines from organizations like 'Oil and Gas UK' which companies need to follow in order to demonstrate industry best practice. One part of these best practices relates to the recertification or revalidation of critical hoses. Current practice involves pressurizing the hose to be recertified to a specified pressure and duration determined by the manufacturer's guidelines. The hoses are held at pressure for a specified amount of time, which can be as short as under 20 minutes or as long as 24 hours or more. The hoses are monitored continuously while they are pressurized. Hoses are failed or taken out of service if they are not able to hold pressure for the amount of time specified by the manufacturer.

[0003] Current practices include laying pressurized hose on the ground for extended periods of time, which may expose personnel to unsafe conditions. Hose bursts and/or leaks may be dangerous to personnel or equipment. The hoses are also washed. The test fluids and/or wash fluids may be environmentally hazardous.

[0004] What is needed is hose test apparatus and methods with improved safety to personnel and the environment.

SUMMARY

[0005] The present invention is directed to systems and methods which provide improved safety to personnel and the environment by shielding a hose under pressure to block leaks and by containing fluid leaks, test fluids and cleaning fluids. The present invention is directed to a protective blanket which can be wrapped loosely around a hose, fastening the longitudinal edges together to form a protective cylindrical tube, and/or joined end-to-end with one or more additional blankets to extend the protective tube to a desired total length.

[0006] The blankets may include a longitudinal edge fastening system and an end-to-end, end fastening system. The edges and/or ends of the blanket may be reinforced and/or raised or thicker relative to the body of the blanket. Joining the edges to form the tube and joining the ends to form a longer tube are both preferably done with some overlap. The blanket may be reinforced throughout or at least in the main body portion with one or more fabric or sheet-type reinforcement materials. One end of each blanket may include a pocket, with the other end adapted to fit within the pocket.

[0007] The invention is also directed to a method of pressure testing a hose including wrapping a length of blanket material around the hose; overlapping the longitudinal edges; fastening the wrapped blanket securely; and pressurizing the hose. The wrapped blanket may have an inside diameter about or at least twice the hose outside diameter. The method may include joining two or more of said blankets end-to-end. The method may include wrapping two or more lengths of blanket material which are joined end-to-end around the hose.

[0008] The foregoing has outlined rather broadly the features and technical advantages of the present invention in order that the detailed description of the invention that follows may be better understood. Additional features and advantages of the invention will be described hereinafter which form the subject of the claims of the invention. It should be appreciated by those skilled in the art that the conception and specific embodiment disclosed may be readily utilized as a basis for modifying or designing other structures for carrying out the same purposes of the present invention. It should also be realized by those skilled in the art that such equivalent constructions do not depart from the scope of the invention as set forth in the appended claims. The novel features which are believed to be characteristic of

the invention, both as to its organization and method of operation, together with further objects and advantages will be better understood from the following description when considered in connection with the accompanying figures. It is to be expressly understood, however, that each of the figures is provided for the purpose of illustration and description only and is not intended as a definition of the limits of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The accompanying drawings, which are incorporated in and form part of the specification in which like numerals designate like parts, illustrate embodiments of the present invention and together with the description, serve to explain the principles of the invention. In the drawings:

[0010] FIG. 1 is a perspective view of an embodiment of the invention coiled up;

[0011] FIG. 2 is a perspective view of an embodiment of the invention laid flat;

[0012] FIG. 3 is a partially fragmented sectional view of an embodiment of the invention;

[0013] FIG. 4 is a top view of another embodiment of the invention;

[0014] FIG. 5 is a partially fragmented view of an embodiment of the invention;

[0015] FIG. 6 is a perspective view of an embodiment of the invention in use;

[0016] FIG. 7 is a perspective view of an embodiment of the invention in another use;
and

[0017] FIG. 8 is a partially fragmented perspective view showing another embodiment of the invention.

DETAILED DESCRIPTION

[0018] The present invention provides a protective blanket useful for proof testing of the high-pressure, long-length, large-diameter hoses in the field environment for the purpose of recertification or revalidation of the hose assembly. Currently, hoses used on oil rigs or similar applications are proof tested before being put back into service. If there is no enclosure to protect the operator or equipment in the vicinity performing this task, then if

hose failure occurs during proof testing, the operators could be in danger of exposure to high pressure test fluid or debris released.

[0019] FIG. 1 shows a first embodiment of the inventive fluid containment blanket. In FIG. 1, fluid containment blanket 10 is in the form of a rectangular sheet partially coiled in the longitudinal direction. Blanket 10 has two longitudinal edges 12a and 12b, and two end edges, or ends 14a and 14b. Blanket 10 is adapted to coil around a hose or other tubular object in a tubular or cylindrical form, and is adapted so one edge 12a overlaps the other edge 12b, defining an overlap portion 16 of overlap distance 17. Blanket 10 includes longitudinal edge fastener system 18. The edge fastener system may be comprised of buckles, hooks, loops and eyes, ties, chains and locks or other fastening mechanisms or systems. Edge fastener system 18 as shown comprises a number of buckles with male buckle portions 21 and female buckle portions 22. FIG. 2 shows containment blanket 10 in a flat configuration. At least one edge of ends 14 and edges 12 may be reinforced. All peripheral edges 14 and 12 of the blanket may be reinforced.

[0020] FIG. 3 shows a partially fragmented section including an edge 12 of containment blanket 10. The edge is reinforced with a cord 32, which may be any type of suitable reinforcing material or construction such as a multi- or mono-filament strand, yarn, wire, rope or cable made of metal wire, carbon or glass or other inorganic fiber, natural or synthetic organic fibers or filaments, or composites or hybrids thereof. Blanket 10 has a body 36 which is formed of an impervious polymeric (either plastic or elastomeric, and either thermoplastic or thermoset) material and includes sheet-like reinforcement 34. The body 34 may, for example, be of PVC (polyvinylchloride), polyurethane, polyolefin, rubber, or the like. The reinforcement could be any suitable textile reinforcement such as a woven fabric, nonwoven fabric, knit fabric or the like. In one embodiment the fabric is square woven and may include polyamide and/or aramid fibers. Aramid fibers include for example, para-aramid fibers, meta-aramid fibers and aramid copolymer fibers. The reinforcement may result in edge 12 being thicker than body 36. One or more edges may include reinforcement 32. Preferably the two longitudinal edges are reinforced and thicker than the body.

[0021] The body material may penetrate the reinforcing fabric. The thickness of the blanket body may be substantially thicker than the reinforcing fabric as indicated in FIG. 3,

or about the thickness of the reinforcing fabric, or anywhere in between. The reinforcement in the blanket may include just one layer or may be multiple layers of similar or different materials depending on the performance needs of the application. The blanket may include just one or multiple layers of fabric, wire strand or mesh reinforcement, including layers of different materials. The fabric may be treated with an adhesive composition if needed for improved bonding to the body material. The textile reinforcement material could be a high-performance polymeric material such as of para-aramid, ultra-high molecular weight polyethylene (UHMWPE), a liquid crystalline polymer (LCP), Nylon, Polyester, or the like, or blends thereof. More, stronger reinforcement would be used for blankets to be used for testing very high pressure hoses in order to contain the energy should the hose burst. Thus, the blanket size, thickness, strength, and the like can be selected to suit a particular hose-test or protective application.

[0022] As an example of a particular embodiment, consider a blanket suitable for fluid containment when testing critical hoses used in off-shore oil-drilling operations. These hoses may be nominally three to six inches in inside diameter and up to 200 feet long or more. Hose assemblies tested using with blanket are typically composed of 2 couplings and a free length of hose. The blankets do not need to be quite as long as the whole hose assembly provided they are longer then the length of free hose. The blankets may be of differing lengths and widths depending upon what is practical for each situation. The blanket width is sized to wrap loosely around a hose or pipe. A single blanket could be used on a short hose (under 10 feet), and could, for example, be approximately 8-foot by 4-foot, and it could have multiple layers of high performance textile. The blanket could thus wrap around the hose, coiling up in the 4-foot direction, covering an 8-foot length of hose. Blanket longitudinal edges may be secured around the hose with buckles, zipper, hooks, hook-and-loop fasteners, etc. to prevent uncoiling in case of a hose failure. Significant overlap in the longitudinal edges is desirable in order to create a reasonably liquid tight cover for fluid containment. According to one embodiment, the loosely wrapped blanket may have an inside diameter that is about, or at least, twice the hose outside diameter. Such a proportion is advantageous for containing a high-volume surge of fluid from a total rupture of the hose. Preferably the buckles are on straps that completely encircle the coiled blanket tube for additional reinforcement of the blanket. The straps may be stitched or otherwise fastened permanently

to the blanket. The buckle position and strap fastening to the blanket may be adapted to require a suitable degree of overlap of the edges when the blanket is coiled. Likewise, the buckle position and strap fastening to the blanket may be adapted to prevent too much overlap and thereby prevent too tight a fit about a hose when the blanket is coiled. If the blanket were to tightly enclose the hose, there would be insufficient space to accommodate or contain fluid. Thus, the embodiment of FIG. 1 shows female buckle portions 22 located a distance 17 from an edge, thus forcing an overlap distance 17 when fastened to male buckle portions 21. This buckle arrangement prevents the blanket from being fastened if the hose is too large to permit the required overlap. A significant overlap distance 17 may be on the order of the diameter of the hose the blanket is adapted for, or about half the inside diameter of the coiled blanket tube. If the overlap is only minimal, slight or not present, then a high pressure leak could easily escape the containment blanket and endanger a person nearby.

[0023] Multiple such blankets may be joined together end-to-end in order to cover hoses longer than one blanket (i.e. longer than 8 feet in this example.) FIG's 4 and 5 illustrate one possible end-to-end fastening system. In FIG. 4, blanket 40 has pocket 42 formed on one end and insert portion 44 in the form of a tapered tab on the other end. Thus, as illustrated in FIG. 5, tab 44b of second blanket 40b may be inserted into pocket 42a of first blanket 40a. In addition, FIG. 5 shows the end fastening system includes three buckles 48 to secure the blankets together end-to-end. Multiple blankets could be attached together this way, for example, enough to cover a 200-foot hose or more. Other end fastening systems could be used besides pocket and buckles, such as overlaps or pockets with buckles, zippers, hooks, hook-and-loop closure, or the like. Overlaps are desirable in order to create a reasonably liquid tight length of multiple containment blankets. Then any liquid resulting from a leak or burst of the test hose can be directed to one end or the other for safe collection and/or disposal. In this example, an overlap of ½ foot or one foot up to two feet may be desirable to prevent spill-overs. This example blanket is expected to be able to contain fluid from hose bursts or leaks at pressures up to 30,000 psi. The temperature of the test fluid as well as the area surrounding the test hose could reach as high as 175°F, and suitable materials with this thermal resistance are available.

[0024] It may also be noted that blanket 40 in FIG. 4 is shown with only the two longer edges reinforced with a cord and/or made thicker than the blanket body. This and other

variations or options are considered within the scope of the invention. The embodiment(s) discussed above have a cohesive blanket body which may be considered a single, cohesive structure although possibly a built up laminate. If there are multiple layers in the laminate, they are firmly attached together and bonded, preferably all penetrated with body material or adhesive or both. The embodiment(s) presented next includes loose, unattached, intermediate layers within the blanket.

[0025] FIG. 8 illustrates a second embodiment of the inventive blankets 80a and 80b, showing a partially fragmented cross section of blanket 80a having multiple, loose layers of sheet materials, including impervious outer and inner cover layers and internal reinforcing fabric layers. In FIG. 8, there are two impervious layers, outer cover layer 82 and inner cover layer 84, along with a number of pervious layers of fabric 86 sandwiched in between. Buckles 88 are attached to reinforcing webbings 87 which then encircle the coiled blanket completely, increasing the hoop strength of the blanket. Similar buckles 89 are used to join blankets end-to-end. Pervious layers 86 may help to contain fluid that happens to penetrate an impervious layer. Edge-cord reinforcement 32 is present on the two long edges of each blanket. Webbings 87 are fastened to outer layer 82 only. In other words, the webbings are not stitched in a way that anchors the fabric layers 86 to the outer layer 82 or to the inner layer 84. The internal fabric layers 86 are thus not anchored to the cover layers except at the edges, i.e. around the periphery, of the blanket, where all the layers are joined together. The blankets 80 may also have a pocket for end-to-end joining as illustrated in FIG's 4 and 5.

[0026] In the embodiment of FIG. 8, inner and outer layers 82 and 84 may be constructed in the manner described above for the first embodiment, namely of impervious material and fabric reinforcement. On the other hand, the internal fabric layers 86 are preferably of a high-elongation, pervious, fibrous material such as low to medium tenacity nylon. The internal fabric layers 86 are preferably of a fiber material having more than 5% tensile elongation, or at least 6% elongation, or an elongation at break of 10% or more or 15% or more. Examples of such high-elongation fibers include medium-tenacity polyester, and medium- or high-tenacity nylon. A preferred fiber is medium-tenacity nylon. The fabric layers 86 are preferably not high-modulus, low-elongation fibers such as aramid fibers. The fabric layers 86 are preferably not of brittle or friable fiber materials such as glass. The fabric layers 86 may be woven, non-woven, or knit fabric. The fabric layers 86 may be

woven of medium-tenacity nylon 6-6 fibers, and these fibers may be continuous filaments with no texturizing of the fibers. The high-elongation fibers may be characterized by elongation at break in the range of 10% to 30% or from 15% to 25%.

[0027] Blankets made according to either embodiment of the invention, offer a relatively light weight protective solution that also provides flexibility and maneuverability during a hose test procedure or during installation of the blanket(s). Multiple blankets could be attached together to accommodate any reasonable length of hose. The blankets may also be provided with a lengthwise hose placement indicator, which is shown in the form of a colored stripe 46 in FIG. 4. Stripe 46 is indicated as red in FIG. 4, but any suitable color or pattern may be used. The placement indicator facilitates alignment and use of the blanket or of the hose with the blanket.

[0028] FIG's 6 and 7 illustrate two uses of the inventive blankets.

[0029] FIG. 6 illustrates a first use of the inventive blankets laid open under a hose, for example for hose cleaning. The edge reinforcement of either embodiment of the invention may result in the reinforced, peripheral edges of the blanket being thicker or raised relative to the body of a blanket when a blanket is laid flat. As a result of the raised edge, the blanket will hold a limited amount of water or test fluid when laid flat. The raised edge thus allows for the hose to be cleaned or washed while collecting or containing the runoff of wash fluid, thus preventing contamination of the immediate vicinity. Doing this on a slope will result in the wash fluid being channeled to one end of the blanket, or to the end of a series of blankets where the fluid can be safely collected. In FIG. 6, two blankets 10 are joined end-to-end and laid under test hose 52. The natural curvature of the blankets as well as the raised edges help to channel wash fluids or other runoff downhill toward an end of the blankets. Any number of blankets in the open, flat position can be joined end-to-end as needed for cleaning a hose or pipe of given length.

[0030] FIG. 7 illustrates a hose test system incorporating a number of blankets 10 which are joined end-to-end and coiled and fastened loosely around a long length of hose 52. Hose 52 is filled and pressurized by high-pressure pump 54 at one end and capped at the other end. The other end may also be arranged to be lower than the first end so that spent test fluid may be drained to the collection reservoir 56 located at that end. Likewise, any fluid

collecting inside the blankets from leaks, bursts or the like can be drained to the end of the line into collection reservoir 56. Either embodiment of the invention may be utilized in such a test system. Any number of blankets in the coiled, tubular position can be joined end-to-end as needed for shielding and/or containing a test hose or pipe of given length.

[0031] Co-pending provisional application with serial number 61/709,983 filed Oct. 4, 2012, with first inventor Kim Henderson, assigned to The Gates Corporation, and titled “Transportable Hose-Test Containers, Systems and Methods” is hereby incorporated herein by reference in its entirety. The transportable test system described in that application may include a fluid containment subsystem which may include fluid collection apparatus, reservoir, etc. The collection apparatus may include hose test stands, blanket (flexible channel), drain, etc. Stands may be of varying and/or adjustable height and/or shape to facilitate flow of fluid runoff toward the fluid collection apparatus and collection reservoir located in one of the IMR test modules described therein. An embodiment of the present invention may suitably be used as the blanket(s) for the fluid containment subsystem of that provisional patent application. The blanket(s) when laid flat or slightly curved concave upwards to form an open channel under the hose being tested, and possibly in conjunction with the hose stands, may collect wash water and then facilitate draining of the external wash water back to one of the reservoirs contained in the test modules. The blanket(s) in a wrapped configuration may also contain leaks or surges of fluid during the hose testing and again facilitate draining of the leaked test fluid or water back to one of the reservoirs contained in the test modules.

[0032] According to an embodiment of the invention, there is described now a method of pressure testing a hose including loosely wrapping a length of blanket material around the hose; overlapping the longitudinal edges; fastening the wrapped blanket securely; and pressurizing the hose. The wrapped blanket may have an inside diameter about or at least twice the hose outside diameter. The method may include joining two or more of said blankets end-to-end. The method may include wrapping two or more lengths of blanket material which are joined end-to-end around the hose. These and other aspects of the method are illustrated in FIG's 6 and 7 and described in provisional application 61/709,983.

[0033] Although the present invention and its advantages have been described in detail, it should be understood that various changes, substitutions, and alterations can be made herein without departing from the scope of the invention as defined by the appended claims. Moreover, the scope of the present application is not intended to be limited to the particular embodiments of the process, machine, manufacture, composition of matter, means, methods, and steps described in the specification. As one of ordinary skill in the art will readily appreciate from the disclosure of the present invention, processes, machines, manufacture, compositions of matter, means, methods, or steps, presently existing or later to be developed that perform substantially the same function or achieve substantially the same result as the corresponding embodiments described herein may be utilized according to the present invention. Accordingly, the appended claims are intended to include within their scope such processes, machines, manufacture, compositions of matter, means, methods, or steps. The invention disclosed herein may suitably be practiced in the absence of any element that is not specifically disclosed herein.

CLAIMS

What is claimed is:

1. A burst containment blanket comprising:
an impervious flexible sheet of fabric-reinforced material adapted to coil into a cylindrical tube and having two opposing cord-reinforced longitudinal edges;
and
a longitudinal fastener system adapted to retain the coiled shape of said cylindrical tube.
2. The burst containment blanket of claim 1 wherein said longitudinal edges of the coiled blanket overlap significantly when fastened.
3. The burst containment blanket of claim 1 further comprising an end fastener system adapted so that two or more of the blankets can be joined together end-to-end to make a longer blanket.
4. The burst containment blanket of claim 3 wherein the blankets joined end-to-end are adapted to form a longer length cylindrical tube when coiled and longitudinally fastened.
5. The burst containment blanket of claim 3 wherein the ends of the blanket are adapted to overlap when two or more are joined together end-to-end.
6. The burst containment blanket of claim 1 wherein the body of said blanket consists of said impervious flexible sheet material reinforced with one layer of fabric.
7. The burst containment blanket of claim 1 wherein the blanket has a lengthwise hose placement indicator on at least one side.
8. The burst containment blanket of claim 7 wherein the indicator is a contrasting colored stripe located on the inside of the blanket.
9. The burst containment blanket of claim 1 further comprising a pocket on one end, with the other end adapted to fit into said pocket on a second said blanket.

10. The burst containment blanket of claim 1 wherein said two cord-reinforced longitudinal edges of the blanket are thicker than the rest of the blanket.
11. The burst containment blanket of claim 1 wherein all blanket peripheral edges are reinforced.
12. The burst containment blanket of claim 1 wherein the body of said blanket comprises at least one layer of pervious fabric that is only attached to said impervious flexible sheet at the peripheral edges of said blanket.
13. The burst containment blanket of claim 12 comprising two outer cover layers of said impervious flexible sheet material and at least one intermediate layer of said pervious fabric.
14. The burst containment blanket of claim 12 comprising two outer cover layers of said impervious flexible sheet material and a plurality of intermediate layers of said pervious fabric, said cover layers and said intermediate layers only anchored to each other at the periphery of the blanket.
15. The burst containment blanket of claim 14 wherein the longitudinal fastener system comprises a strap attached only to one of said outer cover layers so as not to anchor said intermediate layers to said cover layers.
16. The burst containment blanket of claim 13 wherein said pervious fabric comprises high-elongation fiber material.
17. The burst containment blanket of claim 16 wherein said high-elongation fiber material has elongation at break of 10% to 30%.
18. The burst containment blanket of claim 16 wherein said high-elongation fiber material comprises nylon.
19. A burst containment blanket adapted to coil into a cylindrical tube comprising:
 - an impervious flexible sheet material;
 - a longitudinal fastener system adapted to retain the coiled shape of said cylindrical tube; and
 - an end fastener system adapted so that two or more of the blankets can be joined together end-to-end to make a longer blanket or longer cylindrical tube.

20. A method of pressure testing a hose comprising:
 - wrapping a length of blanket material loosely around the hose;
 - overlapping the longitudinal edges;
 - fastening the wrapped blanket securely; and
 - pressurizing the hose.
21. The method of claim 20 wherein the wrapped blanket has an inside diameter at least about twice the hose outside diameter.
22. The method of claim 20 further comprising joining two or more of said blankets end-to-end.
23. The method of claim 20 wherein said wrapping comprises wrapping two or more lengths of blanket material which are joined end-to-end around the hose.