

**FLEXIBLE HOSE WITH A QR CODE****DESCRIPTION**Field of the invention

5 The present invention relates to the technical field of flexible hoses, for example irrigation hoses, and in particular it relates to a garden hose with QR code, as well as a method for the manufacturing thereof.

Definitions

10 In the present text, the expression "reinforcement textile layer" or its derivatives is used to indicate a layer consisting of at least one textile yarn arranged on the underlying layer. The "reinforcement textile layer" is arranged on the bearing layer so as to leave portions thereof free, generally square, rectangular or rhomboidal-shaped.

In the present document, the expression "cross-hatched textile layer" or "cross-hatching" or its derivatives is used to indicate a layer consisting of at least two yarns or groups of yarns spiral-wound on the bearing layer with opposite inclinations and mutually superimposed but not connected. Thus, a cross-hatching is made up of two or more superimposed spirallings.

20 In the present text, the expression "knitted textile layer" or "knitting" or derivatives is used to indicate a layer consisting of at least two yarns or groups of yarns deposited on the bearing layer and connected together to form a plurality of chain stitches, "stitches" of the tricot type.

In the present document, the expression "compatible materials" or derivatives is used to indicate materials which have mutual chemical and/or physical compatibility, that is materials which, once coupled, give rise to a joint suitable to withstand the transfer of tensile or shear forces through the contact surface. Thus, the maximum compatibility will be observed in identical materials or materials having matrices of the same base.

In the present document, the expression "matrix" of a polymer or its derivatives is used to indicate a polymeric material capable of providing the molecular structure of the finished product.

30 In the present document, the expression "providing" or its derivatives is used to indicate the preparation of an element of interest to a process step of interest, thus including any preventive treatment aimed at the optimal execution of the step of interest, from simple collection and possible storage to heat and/or chemical and/or physical pre-

treatments and the like.

#### State of the Art

It is known that garden hoses are sold in packages which include at least one decorative laminar element, generally a cardboard disc, on which various information is printed. These may also include a QR code which, suitably scanned by a special reader, traces back to a web address which contains various information.

A clear disadvantage of the above is that the decorative element is normally thrown away once the package is opened, thus when using the hose it is impossible to track the web address by means of the QR code.

On the other hand, flexible hoses for the transportation of fluids in the industrial field which include one or more QR codes, for example QR codes intended to be scanned by a specific reader, are known.

For example, patent application EP3061620 discloses a flexible hose for the transportation of fluids at industrial level made of elastomeric material which has - on the outer surface thereof - a two-dimensional barcode obtained by engraving the surface and filling the grooves thus formed with ink.

The two-dimensional barcode thus made has a high abrasion resistance. However, the hose is very slow and difficult to manufacture, particularly during the engraving step and subsequent filling of the engraved grooves with the ink. This makes this hose poorly cost-effective.

#### Summary of the invention

The object of the present invention is to overcome the drawbacks outlined above by providing a flexible hose with a QR code that is highly effective and relatively cost-effective.

A further object of the present invention is to provide a flexible hose with QR code that is simple to manufacture.

A further object of the present invention is to provide a flexible hose with QR code having a good abrasion resistance.

Another object of the present invention is to provide a flexible hose with QR code that can be easily read by a reader even should the hose be damaged or in case of obsolescence of the reader.

These and other objects which will be more apparent hereinafter, are attained by a flexible hose with QR code, as well as a method for the manufacturing thereof, as described

and/or claimed and/or illustrated herein.

Brief description of the drawings

Further characteristics and advantages of the invention will be more apparent in light of the detailed description of some preferred but non-exclusive embodiments of the invention, illustrated by way of non-limiting example with reference to the attached drawings, wherein:

**FIG. 1** is a schematic view of a line for the production of the hose **1**;

**FIG. 2** is a sectional view of the hose **1**;

**FIG. 3** is a lateral view of the hose **1**.

Detailed description of some preferred embodiments

With reference to the mentioned figures, herein described is a flexible garden hose **1** for irrigating flowers, plants or the like. Such hoses are, in a per se known manner, suitable to be connected to a domestic water mains by means of a special fitting, so that the hose transports drinking water from the appliance of the domestic water mains, for example a tap, to the point to be irrigated, for example a garden, a flowerbed or the like.

Although hereinafter reference will always be made to a garden hose, it is clear that the hose according to the invention may be used for any purpose without departing from the scope of protection of the attached claims.

For example, the hose of the present invention may be a technical hose which includes one or more layers, which may be reinforced with textile and/or metal threads or with a metal or plastic spiral embedded in the wall of the hose.

However, in a preferred but non-exclusive embodiment, the hose **1** may be a garden hose consisting of an outer layer **10**, an inner layer **20** designed to come into contact with the drinking water to be transported and a textile reinforcement layer **30** interposed between the outer layer **10** and the inner layer **20**.

The outer layer **10** may have an exposed surface **11**, which may be designed to be gripped by a user and therefore be the outermost surface of the hose **1** or it may be covered by a further layer configured to allow a user to view the surface **11**. For example, the further covering layer may be fully or partially transparent or translucent.

The aforementioned layers **10**, **20** may be made of a polymeric material with a plasticised PVC matrix, of the per se known type. For example, the layer **20** may have a Shore A hardness measured according to the ASTM D 2240 standard comprised in a range between

60 ShA and 90 ShA, and preferably comprised between 65 ShA and 85 ShA, whereas the layer **10** may have a Shore A hardness measured according to the ASTM D 2240 standard comprised in a range between 50 ShA and 80 ShA, and preferably comprised between 55 ShA and 75 ShA.

5           Although hereinafter reference will be made to a hose whose layers are made of plasticised PVC, it is clear that the hose according to the invention may be made of any material without departing from the scope of protection of the attached claims.

          The textile reinforcement layer **30** may be made of polyester yarn, and may be of the knitted, spiralled or cross-hatched type.

10           It is clear that the hose may also have only the layer **10** made of plasticised PVC matrix material or that, if present, the layer **20** may be made of any material without departing from the scope of protection of the attached claims.

          It is also clear that the outer layer **10** does not necessarily have to be entirely made of plasticised PVC. For example, only the exposed surface **11** thereof is made of the latter  
15           material, without departing from the scope of protection of the attached claims.

          It is also clear that above or below the aforementioned layers **10**, **20** or **30** other layers, both polymeric and textile reinforcement, made of any material may be present, without departing from the scope of protection of the attached claims.

          The outer layer **10** may comprise one or more QR codes **40** printed on at least one  
20           portion **12** of the exposed surface **11** thereof.

          The printing can be carried out with any technique, for example by ink jet.

          The QR code may be made according to the ISO/IEC 18004:2000(E) standard.

          In a per se known manner, the portion **12** may be designed to be scanned by a QR code reader **L**, for example a mobile telephone on which a special application is installed.

25           The QR code reader **L** may be programmed according to annex J of the ISO/IEC 18004:2000(E) standard.

          The above will allow to obtain a flexible garden hose with QR code which is particularly cost-effective, given the hose may be manufactured in production line just like a normal garden hose.

30           This will always allow to track back to the web address or in any case the information contained in the QR code **40** even when using the hose, given that it will be sufficient to scan the two-dimensional barcode present on the hose.

It is clear that the hose **1** may comprise any number of QR codes **40**, provided that at least one is provided, without departing from the scope of protection of the attached claims.

In the case of a hose **1** with several QR codes **40**, they may be arranged at a mutual distance **d** equal to or less than 2 metres, preferably equal to or less than 1 metre.

5 This allows to always have the possibility of tracking back to the web address or in any case the information contained in the QR code **40** even should the hose be cut during use and/or in the case of hose sold per metre and then cut into pieces of any length from a reel.

10 Preferably, the one or more QR codes **40** may be printed on the surface **11** by hot transfer of at least one respective ink layer **41** compatible with the material that the surface **11** is made of.

Hot transfer is preferred given that it allows the hose to be printed continuously, therefore at a low cost, but with a high print quality, so as to allow the reading of small QR codes.

15 Even more preferably, the one or more QR codes **40** may be printed on the surface **11** by hot transfer of the silk-screen type, so as to obtain the maximum printing flexibility, reducing the costs thereof.

20 In order to minimise the cost of manufacturing the hose, it is suitable to standardise a single QR code **40** which can be printed on a range of hoses with external radius **R** of various sizes, variable for example between a minimum of 4 mm and a maximum of 100 mm.

Therefore, to this end, the one or more QR codes **40** may be square-shaped with a maximum height **h** of 7 mm on the side, while the matrix thereof may have a maximum of 25 x 25 modules.

25 These dimensions ensure good readability even in hoses with minimum external radius **R** and also in the event of outdated readers.

The data contained in the one or more QR codes **40** may be of any type.

However, the one or more QR codes **40** may suitably contain one or more alphanumeric data including from 20 to 29 characters.

30 In this manner, the error correction level of the QR code **40** may be of level Q or H, that is it can be read even if the one or more QR codes **40** are damaged at 25% or 30%.

This ensures the possibility of tracking back to the web address or in any case to the information contained in the QR code **40** even after several years of use of the hose.

Preferably, the one or more alphanumeric data present in the one or more QR codes **40** may be a simplified web address connected to a web portal which traces back to an alphanumeric web address having at least 30 characters.

This allows to direct the user to a complex web address containing the size of the QR  
5 code **40** at most.

The web address may correspond to a website of any content. For example, the website may contain technical information about the hose, or use instructions and instructions on the proper maintenance thereof. Furthermore, the website may allow to purchase a new hose or spare parts thereof.

10 The garden hose **1** may be manufactured by firstly providing a semi-finished product on which the one or more QR codes **40** are to be printed and then printing the latter on the former.

The semi-finished product may be manufactured by extruding the layer **10** by means of an extrusion head **60** in the case of a single-layer hose, or, in the case of a three-layer  
15 hose, by firstly extruding the layer **20** by means of the extrusion head **62**, subsequently knitting, spiralling or cross-hatching the textile reinforcement layer **30** on the layer **20** by means of the machine **63** and then extruding the outer layer **10** on the reinforcement layer **30**.

It is clear that in the case of a hose with more than three layers further steps for  
20 extruding or manufacturing further textile layers may be provided for, without departing from the scope of protection of the attached claims.

Subsequently, at least one strip made of polymeric material **50**, which may include a plurality of QR codes **40** arranged between them at a predetermined distance **d**, will be provided.

25 The strip **50** may be made of a material incompatible with the plasticised PVC of the layer **10**, for example polyethylene.

Such strip **50** may be coupled with the exposed surface **11** of the layer **10** at the outlet **61** of the extrusion head **60**, so as to hot transfer the QR code **40** onto the portions  
12.

30 Subsequently, there may be a step for cooling the layer **10** – strip **50** assembly and then, subsequently, a step for removing the strip **50** by coiling it into as reel.

Suitably, at the end of the line there may be an optical control for verifying whether

the QR codes 40 have been correctly transferred onto the exposed surface 11.

Advantageously, the compatibility between the ink of the QR codes 40 and the polymeric material of the exposed surface 11 may be such that after having subjected a certain number of portions 12 to a durability test according to the EN 16436-1:2014+A3:2020 standard (*"Rubber and plastics hoses, Tubing and assemblies for use with bread and butane and their mixtures in the vapor phase - part 1: Hoses and tubes"*), and more precisely with the test described in paragraph A.11 of annex A of the aforementioned standard, the QR codes 40 or most of them can still be read using the QR code reader L.

This characteristic will be better illustrated in the following examples.

#### Examples

##### Example 1

10 samples of 1-metre plasticised PVC single-layer hose were manufactured. This plasticised PVC has the following composition:

| Component                 | % by weight |
|---------------------------|-------------|
| PVC K70 RESIN             | 57.66       |
| PLASTICIZER DOTP          | 38.84       |
| EPOXIDIZED SOYBEAN OIL    | 2.88        |
| CA – Zn STABILISING AGENT | 0.61        |
| DYE                       | 0.02        |

A respective QR code made using acrylic ink was hot transferred onto these samples. The QR code traced back to the website [www.fitt.com/it](http://www.fitt.com/it).

Each of the samples thus made was subjected to the durability test according to the test described in paragraph A.11 of annex A of the EN 16436-1:2014+A3:2020 standard.

Based on this test, the printed surface of the hose sample is contacted 10 times in 10 seconds - by means of a suitable device - with a cotton fabric (chosen according to the ISO 105-A02 standard) soaked in demineralised water, with a dry one and with one soaked in peanut oil (CAS 8002-03-7).

After the test was carried out on all the samples, the QR code was read with a reader having the characteristics specified in annex J of the ISO/IEC 18004:2000(E) standard, in this case a smartphone with a special app.

It was therefore found that the reader was able to read the QR code successfully in 9  
5 out of 10 samples.

### Example 2

The procedure of example 1 was repeated for a single-layer hose made of Santoprene® 201-73 marketed by ExxonMobil® and acrylic ink.

10 It was found that the reader (the same of example 1) was able to read the QR code successfully in 3 out of 10 samples.

### Example 3

The procedure of examples 1 and 2 for single-layer hoses and inks was repeated  
15 according to the following table. The QR code reading test was carried out on each of the samples obtained.

| Hose material   | Ink          | Successful readings |
|-----------------|--------------|---------------------|
| Plasticised PVC | Polyester    | 9/10                |
| Plasticised PVC | Polyurethane | 8/10                |
| Plasticised PVC | Silicone     | 3/10                |
| Plasticised PVC | Epoxy        | 1/10                |
| Santoprene®     | Polyester    | 3/10                |
| Santoprene®     | Polyurethane | 2/10                |
| Santoprene®     | Silicone     | 8/10                |
| Santoprene®     | Epoxy        | 9/10                |

### Conclusions

It was found that the compatibility between ink and the basic material of the hose varies according to the nature thereof. This compatibility affects the durability of the QR code printed on the hose, that is the readability thereof over time following surface abrasion.

30 Without being too bound to theory, it can be established that the basic material of the hose and the ink of the QR code are compatible with each other for the purposes of the

present invention if the latter is can be read in at least 70% of the prepared samples.

## CLAIMS

1. A flexible hose for the transportation of liquids or fluids, in particular a garden hose for the transportation of drinking water, which can be used with a QR code reader (L), the hose comprising at least one layer (10) with an exposed surface (11) made of a first polymeric material, wherein said at least one layer (10) comprises at least one QR code (40), said at least one QR code (40) consisting of at least one ink layer (41) printed on at least one portion (12) of said exposed surface (11) designed to be scanned by the QR code reader (L), said ink being compatible with said first polymeric material.
2. Hose according to claim 1, wherein said at least one QR code (40) is printed by hot transfer of said at least one ink layer (41).
3. Hose according to claim 1 or 2, wherein said exposed surface (11) includes a plurality of portions (12) on each of which there is printed a respective QR code (40) consisting of a respective at least one ink layer (41).
4. Hose according to the preceding claim, wherein said QR codes (40) are printed by hot transfer of the respective ink layers (41) by coupling said exposed surface (11) and at least one strip made of polymeric material (50) which includes said QR codes (40) arranged between them at a predetermined distance (d), wherein the polymeric material of said strip (50) is incompatible with said first polymeric material, the latter being compatible with said ink.
5. Hose according to one or more of the preceding claims, wherein said at least one layer (10) is the outermost one of the hose which can be gripped by a user.
6. Hose according to the preceding claim, wherein the compatibility between said ink and said first polymeric material is such that said at least one QR code (40), respectively said QR codes (40) are abrasion resistant.
7. Hose according to the preceding claim, wherein the compatibility between said ink and said first polymeric material is such that after subjecting said at least one portion (12) of said exposed surface (11) to a durability test according to the EN 16436-1:2014+A3:2020 standard, said at least one QR code (40) can be read through the QR code reader (L).
8. Hose according to the preceding claim, wherein the durability test according to the EN 16436-1:2014+A3:2020 standard is carried out on at least 10 identical samples of said hose, said at least one QR code (40) being readable by means of the QR code reader (L) in at least 70 % of said samples.

9. Hose according to one or more of the preceding claims, wherein the hose has a minimum external radius (**R**) of 4 mm, the QR code (**40**) being square-shaped with a maximum height (**h**) of 7 mm on the side, the matrix of the QR code (**40**) having a maximum of 25 x 25 modules.

5 10. Hose according to the preceding claim, wherein said QR code (**40**) has at least one datum of the alphanumeric or kanji type which includes from 20 to 29 characters, so that the error correction level of the QR code (**40**) is of level Q or H.

11. Hose according to the preceding claim, wherein at least one datum of alphanumeric or kanji type is a simplified web address connected to a web portal which traces back to an alphanumeric type web address having at least 30 characters.

12. Hose according to one or more of the preceding claims, wherein said at least one layer (**10**) comprises a plurality of QR codes (**40**) each printed on at least one respective portion (**12**) of said exposed surface (**11**), each QR code (**40**) having a distance (**d**) from the subsequent QR code (**40**) equal to or less than 2 metres, preferably equal to or less than 1 metre.

13. Hose according to one or more of the preceding claims, wherein said at least one layer (**10**) is a first layer, the hose further comprising at least one second layer (**20**) arranged inside said first layer (**10**) made of a second polymeric material, the hose further comprising at least one textile reinforcement layer (**30**) interposed between said first layer (**10**) and at least one second layer (**20**).

14. Hose according to one or more of the preceding claims, wherein said first polymeric material is, respectively said first and second polymeric materials are of the plasticised PVC matrix type.

15. A method for manufacturing a flexible hose for the transportation of liquids or fluids, in particular a garden hose for the transportation of drinking water, which can be used with a QR code reader (**L**) suitably programmed according to annex J of the ISO/IEC 18004:2000(E) standard, the method comprising the steps of:

- providing at least one strip made of polymeric material (**50**) which includes a plurality of QR codes (**40**) according to the ISO/IEC 18004:2000(E) standard arranged between them at a predetermined distance (**d**), each of said QR codes (**40**) consisting of a respective at least one ink layer (**41**);
- extruding a first polymeric material by means of an extrusion head (**60**) to

obtain at least one layer (10) with an exposed surface (11);

- coupling said at least one strip made of polymeric material (50) and said exposed surface (11) at the outlet (61) of said extrusion head (60), so as to hot transfer said QR codes (40) onto respective portions (12) of said exposed surface (11);

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- removing said at least one strip made of polymeric material (50);

wherein the polymeric material of said strip (50) is incompatible with said first polymeric material, the latter being compatible with said ink.