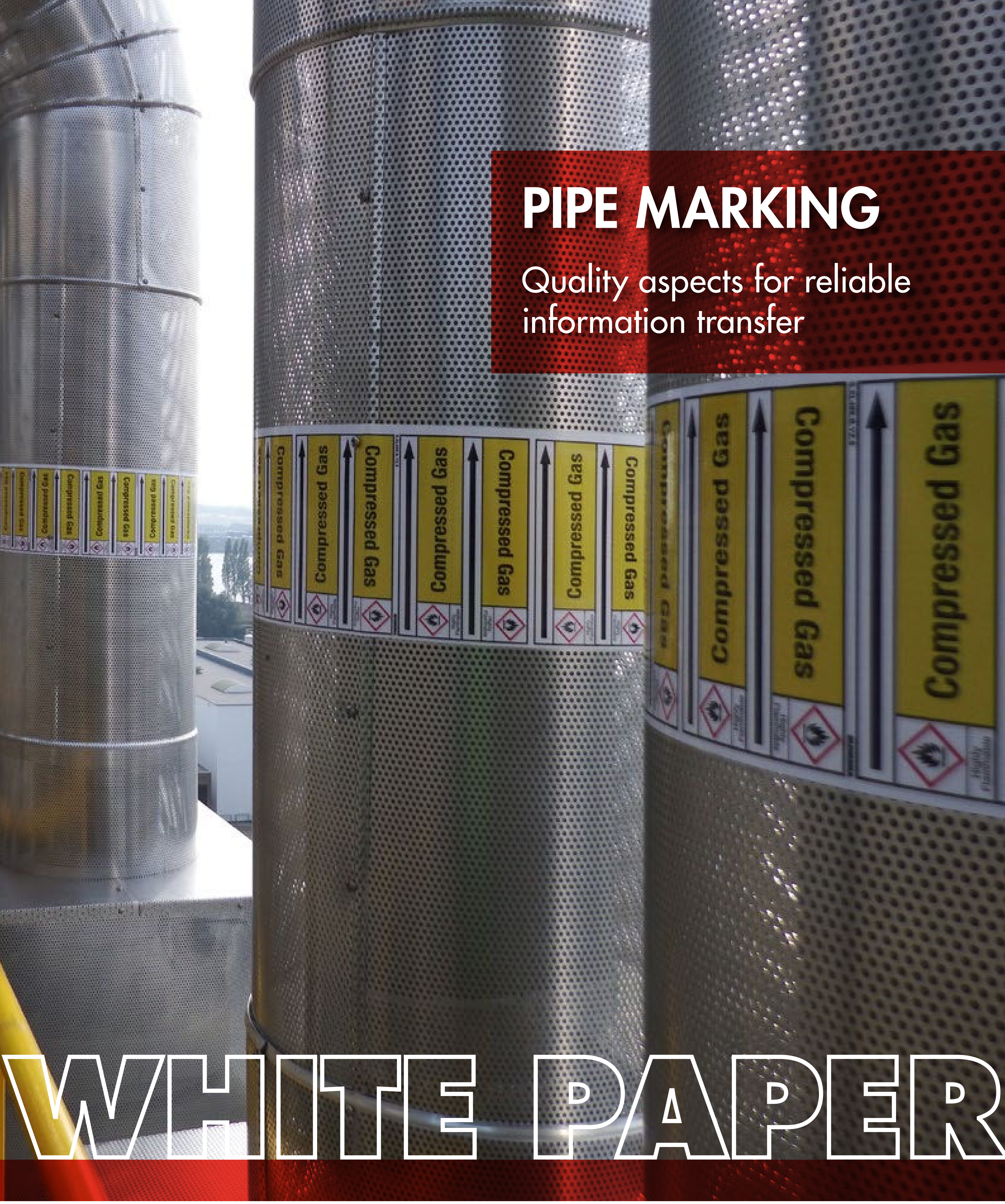

PIPE MARKING

Quality aspects for reliable information transfer

WHITE PAPER

BLOMSMA
SIGNS&SAFETY

BACKGROUND

There are legal European and national requirements that require pipelines carrying hazardous substances to be marked. Those markings are part of the health and safety signage that has to be present at any workplace. Those markings give information that helps keep employees, contractors and emergency services staff safe during normal operational situations, maintenance programmes and uncontrolled situations. You therefore have to be able to assume that such information will always be available – recognisable and legible.

That recognisability is normally determined by the number of markings, their size, their visibility and the placement with respect to the field of vision. The colour is just as important: there are after all norms and company standards in use that associate specific pipeline systems and classes of substances to a colour in order to make them more recognisable, so that people do not have to depend exclusively on the distance a text can be read from (and thereby on its size).

In short, the quality of pipe markings is highly important for ensuring information about the contents of the marked line gets across reliably.

In this white paper, we want to give you a picture of the dos and don'ts of pipe marking.

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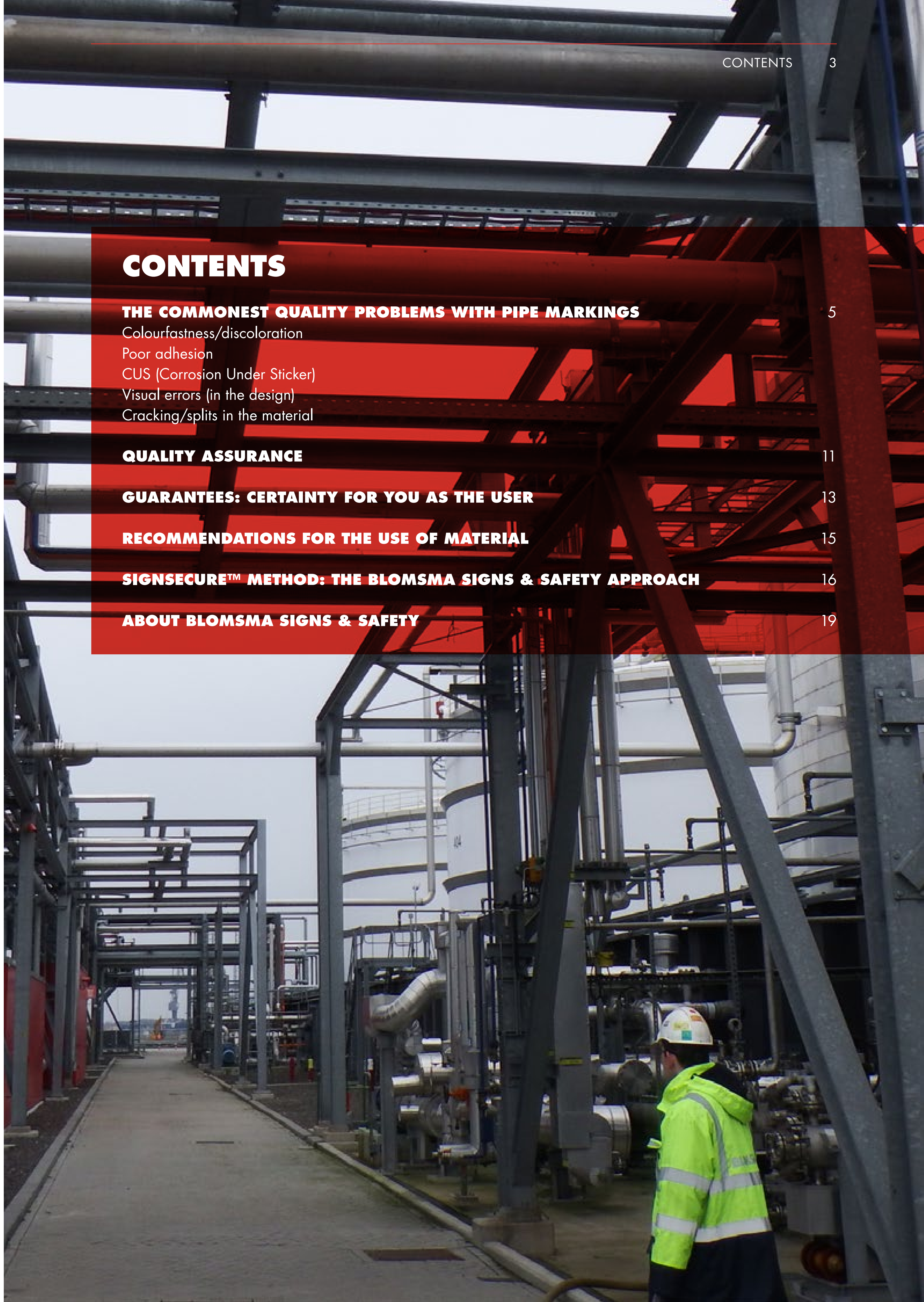


CONTENTS

THE COMMONEST QUALITY PROBLEMS WITH PIPE MARKINGS

In this section we will list some of the most frequently occurring quality issues with pipe markings, ranging from the materials used through to the product as applied:

- Colourfastness/discoloration
- Poor adhesion
- CUS (Corrosion Under Sticker)
- Visual errors (in the design)
- Cracking/splits in the material

Colourfastness/discoloration

The quality of the pipe marking material can often be seen from how quickly it discolours. Discoloration is caused for instance by weathering influences (UV, salt water), exposure to substances such as chemicals and solvents, specialist cleaning (high-pressure jets, cleaning agents) and the temperature of the pipes.

The commonest cause of discoloration is UV radiation. Ultraviolet from sunlight is the main energy source responsible for breaking down the binding agents and pigments in the print (inks) on the material. Combined with high temperatures and elevated humidity, this process is accelerated further. The type of binding agent determines the properties and durability of the printing. Pigments are responsible for the colour and the covering performance; solvents are present to allow an ink to be processed. The solvents evaporate after production. As the markings age, discoloration is always going to occur. The degree of discoloration depends on the quality of the binding agents used, the quality of the pigments, the thickness of the printed layer, processing during the production process (can be relevant for evaporation of solvents) and any UV-blocking protective layer such as a laminate or varnish.

Poor adhesion

The majority of pipe markings are made as self-adhesive sheets, in other words a deformable sheet that has a layer of glue on. If a glued material loses its adhesion, an adhesive failure mechanism must be in play, i.e. circumstances that result in the adhesive bonding failing. The commonest adhesive failure mechanisms in pipe markings are the following:

Adhesive rupture
The adhesion is the force between the glue and the substrate. Van der Waals forces have the greatest effect on the strength of an adhesive bond. The optimum contact surface that results in the greatest adhesion forces varies with the type of glue. For a polyurethane adhesive, for example, this is about 100 nanometres. For that reason, there must be sufficient contact between the surface of the substrate and the glue mass. That allows the optimum fluid contact between the glue and the substrate. Suboptimal contact is (generally) the result of dirty substrates or substrates that have a surface tension that is too low. Various treatments can improve the adhesion of the markings.

An insufficiently clean or unprepared surface (dirty substrate)
Proper cleaning plus the use of primers or other pre-treatments if necessary is important for optimum adhesion; this is where the adhesion process starts. Thorough pre-treatment is also needed if the materials are oxidised. Glues adhere poorly to oxidised substrates.

Humidity
Moisture between the glue layer and the surface can lead to failure of the adhesive system because water can turn into ice at low temperatures. The volume of the moisture increases by about 10% during that transition. Porous and static adhesive bonds are the most susceptible to moisture. An adhesive backing with fluid properties and a sufficiently thick layer of glue will reduce the risk of moisture penetrating.

Incorrect choice of adhesive
Every type of glue has characteristics that mean it is unsuitable for certain surfaces. There are also types of glue incorporating components that damage certain materials. Examples of these are chlorides and halogens, which must not be used on stainless steel materials.

CUS (Corrosion under sticker)

One worrying effect is CUS (Corrosion Under Sticker), where a marking that has been applied to improve safety causes a potential integrity risk in a pipeline. Two causes of CUS can be distinguished:

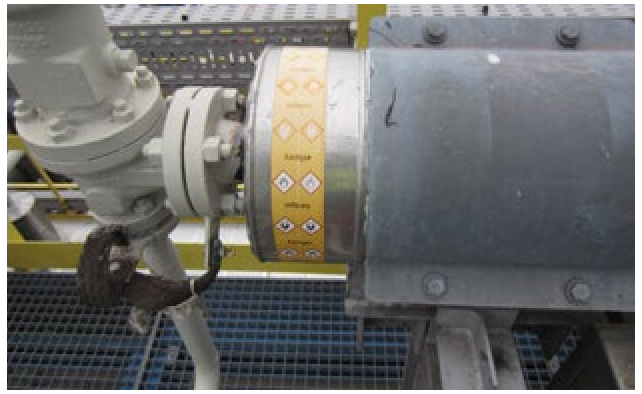
1. Corrosion when the adhesive layer reacts with the substrate
When incorrect choices of adhesive were discussed, it was noted that halogens and chlorides can react with stainless steel This reaction corrodes the stainless steel. In saline conditions (coastal areas and offshore), sodium ions from the salt in seawater can even accelerate this process.

2. Corrosion due to moisture accumulation
If moisture accumulates underneath the marking, this can cause corrosion. This type of CUS occurs principally beneath markings that are applied to vertical pipes. The moisture can get underneath the marking if the material has a porous, non-flowing adhesive backing. Another variant occurs when vinyl materials are used. Vinyl is relatively likely to shrink. When the material shrinks and the adhesive remains in place on the pipe, the edge of the marking will start to come loose.
Moisture can accumulate at the edges as a result, causing corrosion. Finally, the structure of the substrate (i.e. the pipe) needs attention if CUS is to be prevented. If the pipe has a significant surface structure, it is important that a thick adhesive layer with fluid properties is used.

Visual mistakes

The design of markings has a significant influence on their comprehensibility, recognisability and the transfer of information: the visual quality. Pipe markings must meet a number of simple criteria for successfully transferring what has to be communicated:

- Clear use of colour (preferably in line with existing norms)
- Clear contrasts between the various information sections
- Uniform layout
- Variants in different sizes and layouts to allow markings to be read at greater distances
- Avoid duplication of information

Cracking/splits

Cracks or splits in the material are caused by stresses within it and by the lifespan of the material used. Films and coatings can be affected by UV radiation; the UV light can degrade the structure of the molecules in the foil. Various forms of vinyl crack more quickly than polyester or PET foils. Materials that do not have a protective laminate will therefore dry out more quickly and lose their elasticity under the influence of UV light.



QUALITY ASSURANCE

There are various recommendations for ensuring the quality of pipe markings, centred on the choice of material and the method of application.

Polyester or PET foils are multifunctional materials. The strength and lifespan of these types of foil exceed those of other types of material that are currently available on the market. In addition, polyester does not contain chlorides, unlike vinyl. Polyester also has a greater range in terms of its temperature resistance.

The first line of defence for preventing discoloration and optimising the lifespan is using laminates that inhibit the action of UV. If specific types of polyester are used for this, the marking will in principle also be resistant to the majority of standard chemicals. The production process is at least equally important: using inks with solvents – ecologically friendly ones – and sufficient coverage will make sure that the colours are retained for longer.

The adhesive backing must be free of halogens and chlorides, at least 65 microns thick (preferably a lot more), a with appropriate viscous flow characteristics.

GUARANTEES: CERTAINTY FOR YOU AS THE USER

Guarantees are a useful way of estimating the quality of pipe markings. There has to be substance to the guarantee, though; a description such as 'sufficiently recognisable' or 'sufficiently legible' can be a very broad church. What a guarantee means (in the case of pipe markings) is that the colour and adhesion are guaranteed for a specific period and that the product will be replaced if it does not perform as per the specifications. An expected lifespan will also be described. The expected lifespan is derived from experience – placement in similar situations and surroundings.
High-quality materials will have been extensively tested. Examples of such checks are adhesion tests (for the glue), UV ageing tests and saltwater spray tests.

It must also be possible to make a claim against the guarantees if the producer is capable of meeting its obligations in the event of a warranty claim.

RECOMMENDED MATERIALS

For pipe marking applications, we recommend materials that meet the criteria that have been set and are therefore also used by Blomsma Signs & Safety.

3M™ has developed and combined materials and adhesives for this application. A production process has also been developed that ensures the composition of a product: the Matched Component System (3M™ MCS™). Purely for pipe marking applications, a special product line has been developed together with Blomsma Signs & Safety: PolyesPro® pipe marking.

PolyesPro® pipe markings have an acrylic-based adhesive backing that is 65 or even 130 microns thick (latest development) with viscous flow characteristics. The polyester base material has 3M™ Eco solvent inks applied and is then laminated with UV-blocking polyester.

A training course has even been developed by 3M™ in order to get the optimum placement and ensure compliance with the maximum guaranteed values. This training course covers various aspects that are important when applying pipe markings: materials knowledge, preparing the substrate, the application method, applying at a slope for drainage, and many other aspects.

All Blomsma Signs & Safety technicians are 3M™ Certified Safety Sign Installers™.

POLYESPRO® PIPE MARKING

De PolyesPro® has been tested extensively, both in laboratories and in field tests (practical testing). The quality of the material is underlined by a factory warranty from 3M™. Production is done internally at Blomsma Signs & Safety. The lifespan of the product is estimated to be about 15 to 20 years. The warranty period is 5 years.

SIGNSECURE™ METHOD: THE BLOMSMA SIGNS & SAFETY APPROACH

Blomsma Signs & Safety has many years of experience implementing pipe markings in the chemicals and petrochemicals industries and the offshore sector as well as heavy industry and wastewater purification plants. Our skilled workers can make their own determinations of what marking is required and where using the piping diagrams. We can also check the piping and installation diagrams (PIDs) supplied during the work, so that you have the current as-built information available immediately after completion.

Our many years of experience with pipe marking projects (and other safety signage projects) have led to our working method being raised as a standard that is known as the SignSecure™ method. The diagram on the right shows you the steps that we run through in order to deliver projects that not only comply with all the applicable legislation and norms, but in which the quality and the content also meet the wish lists of our customers and other interested parties.

SIGNSECURE™ METHOD

STEP	DESCRIPTION	EXPLANATION	RESULT
01. SCAN	Recording the quantities and determining the requirements	The Blomsma engineer records this data, together with the client's project lead if desired	Budget and a picture of the scope
02. LIST OF MEDIA	Draw up a list of media	The media are determined using P&IDs, information from a survey and input from the client	An overview list that is the basis for the implementation
03. PRE-CODING	Initial pre-coding of the system	The Blomsma engineer does the preliminary coding of the plant, using P&IDs plus information provided by the client	The planned locations are clear and the details of the materials to be produced have been recorded
04. PRODUCTION	Production of the materials required	Production of the required materials (in batches if necessary) using the 3M™ production process	Delivery of materials
05. WORK-PREPARATION	Planning the actual installation work	Planning, list of staff doing the work, Risk Analyses and work permits	Work package for the staff doing the actual installation work
06. SIGN	Assembly on site	Application of markings by Blomsma 3M™ Certified Safety Sign Installers™	Markings are applied at the site
07. QC TAKE-OFF	Quality inspection	Inspection by the client of the markings that have been applied	Handover as implemented, with a punch list of remarks if needed
08. REWORKS	Residual points are handled and the comments dealt with	Any punch list items and comments from the QC are handled	Completed application of the markings
09. SECURE (Optional)	Recording the markings as installed	An engineer makes a record of the markings as installed	Photographic manual for maintenance and upkeep
10. CLOSE-OUT	Closing down the project	(Optional - see Step 09) The project is closed once the documentation and manuals have been handed over	Completed project

BLOMSMA SIGNS & SAFETY

Blomsma Signs & Safety specialises in carrying out health and safety signage projects. We do that using our knowledge of legislation and regulations and we create practical solutions. We see signage as part of a safety culture, a visual translation and an information facility aimed at keeping a location running safely and properly maintained on a daily basis.

It must be possible to rely on safety signage at all times: the signage must be made and installed properly. That applies not only to the materials used, but even more to the way the signage is applied and where. Our trained and certified teams understand that they are one aspect of safety on site, and know the role that they have in that regard. We understand your situation, so we can provide the best possible solutions.

3M™ Platinum Graphic Select Provider™

Blomsma is a 3M™ Platinum Graphic Select Provider™. That is the highest achievable level for suppliers in the signage market. This means that Blomsma Signs & Safety is allowed to provide guarantees independently on behalf of 3M™. These guarantees are given for the materials, the production and the assembly/mounting. What this means for you is the optimum project guarantee and complete certainty.

3M Select Graphic Provider Platinum

3M™ MCS™ Warranty

PolyesPro®

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MANAGEMENT SYSTEM CERTIFICATION DNV·GL ISO 9001 = SCC*

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3M™ MCS™ Warranty

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