



## This issue

Brass valves corrode in water installations . . . . .	1
The interest in Legionella is still rather large. . . . .	2
Plumbing and heating installations are still exposed . . . . .	2
Lead and nickel release to drinking water from valves and brass taps . . . . .	3
Courses 2nd half year 2010. . . . .	4
FORCE Technology wins call for proposals . . . . .	4

## Brass valves corrode in water installations

**Coming years will bring serious corrosion problems in brass valves in many water installations with pipes of stainless steel or plastic.**

Many old water installations have been renovated in recent years, and the old hot-dip galvanized steel pipes have been replaced by new pipes of either stainless steel or plastic. The new installations typically have block valves of brass. These brass valves have proven to corrode and cause water damages after only few years in service.

### Local water conditions is an important factor

First and foremost the Copenhagen area and the municipalities directly south of Copenhagen are facing the problem. Besides, similar problems are seen in other coastal areas where the water is hard and has a large content of salt and thus a high conductivity, which increases the risk of corrosion damages.

### Who can be held responsible?

The building contractor has a five year guarantee if the installation was made according to AB92. It exceeds the warranty for two years provided by the supplier. Consequently the plumber may find himself in a terrible predicament if he has not been alert to the issue of water quality when choosing pipes and valves.

### Choose other materials

In areas with corrosive water, small block valves for water installations could be replaced by valves of other materials, for instance gunmetal which has a higher copper content, or stainless steel.

Further information:

**Frank Fontenay**  
+45 43 26 76 44 • fsf@force.dk



*Heavily corroded valve, only a few years old*

### What damages are observed?

The damages typically occur in the form of cracks, fracturing the valve after 1-5 years in service. Often it causes considerable water damages. We have only experienced damages in small valves, for instance block valves under kitchen sinks or in T-pieces on riser pipes.

### What causes the damage?

In old water installations brass valves are cathodically protected by the hot-dip galvanized steel pipes because the hot-dip galvanized steel pipes function as sacrificial anodes. Stainless steel pipes are nobler, and therefore the brass valves corrode faster when they are no longer cathodically protected. Plastic pipes cannot give cathodic protection of the brass parts either, and therefore damages occur here too.



*Heavily corroded brass valve*

## Dear Reader

Welcome to the latest issue of Material News, in which we focus on "water".

Drink water – it is healthy! Very true, albeit with minor modifications. Drinking water may contain metals such as lead, nickel and cadmium. FORCE Technology is leading in the field of metal release in drinking water. Recently we were appointed by the Danish Enterprise and Construction Authority and the Agency for Spatial and Environmental Planning to develop new test methods for use in connection with VA-approvals.

You may also learn about the increasing problems with brass valves in plumbing installations when applied together with plastic and stainless steel piping. Focus is still on problems involving Legionella and FORCE Technology's instructions still apply. The SBI guideline "Corrosion in Plumbing installations" have now been published and are written by a number of FORCE Technology's specialists.

Finally, you will find our course plan for the second half of 2010.

Future issues of Material News will also include features and articles on welding.

Enjoy your reading.

Ernst C. Kristensen  
Vice president

# The interest in Legionella is still rather large

FORCE Technology participated in a project day on water, with focus on Legionella, held on 18 March 2009 at The Royal Library in Copenhagen. Approximately 110 persons partook in this project day. The audience primarily consisted of people from the health sector, the various municipalities, a few consultants and a few suppliers. The project day outcome very clearly showed that the issues involving Legionella are still very relevant.

During the project day news as regards Legionella research, performed in both Denmark and England was presented. Furthermore, the function of the medical officer of



health in connection with reporting cases of Legionella was presented. And finally, the project day included presentations from both Denmark and England describing how outbreaks of Legionella are handled.

## Recommendations are still applicable

The conclusion to the project day is that the known precautionary measures (as stated in FORCE Technology's recommendations in maintenance instructions for hot domestic water) still apply:

- The operating temperature in a hot water unit must be set so that the temperature during ordinary operation will not surpass 58 - 60° C and it must not get below 50° C at any location in the installation.
- Dead pipe ends and tap locations, not in use, must be disconnected.
- The stagnation time in the hot water unit and reheating after peak loads must be adjusted so that the period with a water temperature in the range between 20-45° C is minimised.
- Cleansing of hot surfaces and container walls must take place once a year at least, independent of rock formation and bacteria growth.
- De-sludging of hot water taps with electrolysis must occur at least once a week.
- Power adjustment and electrolysis efficiency inspection must be conducted in consultation with the electrolysis supplier

## Facts box

*Legionella pneumophila is a bacteria growing in water. It thrives at temperatures between 20 and 45 °C; and at more than 60 °C the bacteria dies. Legionella may cause Legionellosis, which is a dangerous sort of pneumonia, and which during epidemics may have a mortality rate of 10-20 %. Also the liver, the kidneys and the central nervous system may be infected, if you catch Legionella. Approximately 100 incidents of Legionellosis are recorded in Denmark every year.*

## Sparring partner

Use FORCE Technology as your sparring partner in connection with projecting, operation and maintenance of your domestic water unit. This way you ensure that Legionella issues are considered in both the projecting and operating phases.

Furthermore, materials choices and the system structure are planned so that the system will be given the longest possible service time and the operating costs will be the lowest possible.

Further information:

**Søren Klinggaard**

+45 43 26 71 99 • [srk@force.dk](mailto:srk@force.dk)

# Plumbing and heating installations are still exposed

Still there is a risk of serious and costly corrosion damages in plumbing and heating installations even though the pipes are often made of plastic or stainless steel nowadays. You may read about it in the new SBI guideline Corrosion in plumbing and heating installations written by corrosion specialists from FORCE Technology.

Previously hot-dip galvanized steel pipes were used in domestic water installations, but now they are often replaced by plastic and stainless steel which is more corrosion resistant. One of the key changes in the guideline is instruction on how to make plumbing and heating installations based on the new pipe types in order to avoid or reduce corrosion best possibly.

## Brass valves are especially exposed

The new corrosion resistant pipe materials

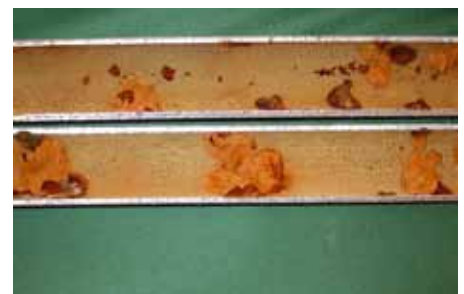
have resulted in far fewer damages on the pipes.

Unfortunately far more damages have been experienced on the valves however.

"Pipes in hot-dip galvanized steel ensure cathodic corrosion protection of brass parts for valves and fittings, whereas plastic and stainless steel pipes do not. In recent years we have seen a rapidly increasing number of serious damages on brass valves that have corroded after few years in service in areas with hard water with high conductivity", says FORCE Technology's corrosion specialist Frank Fontenay.

## Guideline now includes Legionella

The SBI guideline also describes quality assurance of water and precautions against heavy metal release and growth of Legionella bacteria and other microorganisms. In addition to the section on corrosion in water installations, you can read about corro-



sion in for instance drain and district heating installations and cooling systems.

## Courses

We also offer courses in: "Water installations, materials and corrosion prevention", "Legionella and water quality in water systems" and "Cooling with fresh water".

Further information:

**Frank Fontenay**

+45 43 26 76 44 • [fsf@force.dk](mailto:fsf@force.dk)

# Lead and nickel release to drinking water from valves and brass taps

In Denmark we have rather satisfactory ground water resources ensuring that everybody has access to clean drinking water. That is most often the case when the drinking water leaves the waterworks. But what happens to the water during its long journey from the water works to the consumers' taps?

## Chemical reactions

When drinking water is transported chemical reactions occur between water and the materials in pipes in various domestic installations. The processes entail that metal may be released in the drinking water. Especially domestic installations are of great significance to the content of metals in the tap water. This water usually contains many different materials and the water is often stagnant in the installations many hours every day.

Earlier, focus was put on the pipe materials as they constitute the main part of our water installations. Large investigations in Germany, the Netherlands, and Denmark entail that today we are quite up front as concerns the connection between water quality and metal release from pipe materials. In table 1 is stated which requirements must be met as regards water quality, for a given pipe material, if one is to avoid specific problems with corrosion and metal release.

## Focus on fittings and fixtures

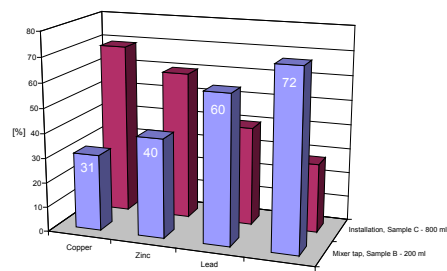
Over the past few years focus has moved from pipe materials to fittings and mixer

taps. Release of metals from fittings and mixer taps is often much more complicated, as spare parts are made of metal alloys, i.e. mixtures/combinations of various metals that not necessarily dissolve at the same rate. It turns out that the materials applied actually release surprisingly high amounts of metal, and not least metals that are quite undesired in our drinking water, in spite that these parts constitute a very small part of the total installation. And it has turned out that release of lead and nickel is higher in some cases than expected.

The major part of the valves, fittings and taps we use in domestic water installations are made of the copper alloys brass and gunmetal. Today the most commonly used alloy is dezincification resistant brass, which typically consists of approximately 62 % copper and approximately 36 % zinc, added approximately 2 % lead and 0.1 % arsenic. Lead is added to brass to make it more suitable for machining (lead becomes chip breaking).

## How may consumers avoid metals in their drinking water?

The Danish building regulations specify that factory-made products applied in drinking water installations must be approved by the Danish Enterprise and Construction Authority. The most common kind of approval is the so called VA-approval, which is compulsory for products that are specified as having influence on the quality of drinking water.



Measuring metal release in fractionated water samples, extracted from randomly selected domestic water installations with new taps, in Zealand, <2 years, shows that 72 % of the nickel released in the first litre of water, taken after 4 hours stagnation, turns up in the first drained 200 ml. For lead the figure is 60 %. Nickel is released from nickel and chromium plated parts and lead is released from machined and forged parts of brass or gunmetal (e.g. taps, tap piping, closing valves and various fittings).

In connection with VA-approval of e.g. taps, lead and cadmium releases are measured. These measurements ensure that products releasing high amounts of lead or cadmium in the water, i.e. as lead or cadmium bearing solders have been applied are not launched at the market. Nickel is not part of this approval regulation, but the authorities have launched an investigation and FORCE Technology is working on finding an applicable method for testing products for nickel release.

## Let your tap water run for a while

As a consumer, you can do something yourself to avoid high concentrations of metals in your drinking water. The National Agency of Environmental Protection recommends that you let your tap water run for a little while, two-three seconds, before drinking the water from the tap. This corresponds to approximately one glass of water. This recommendation especially applies, if the water has been stagnant, e.g. over night.

If you are about to replace your tap, it is possible to reduce the lead and nickel release in the water by choosing a stainless steel tap or a paint coated tap instead of a chromium plated one. Even though stainless steel contains nickel, neither stainless steel taps nor valves release lead or nickel in the water. Nor do paint coated taps release nickel.

Material	Requirements for water chemistry	Other requirements
Hot-dip galvanized steel	100mg/l<[HCO <sub>3</sub> -]<300mg/l ([Cl-]+2[SO <sub>4</sub> -])/[HCO <sub>3</sub> -]<11) [Ca <sup>2+</sup> ]>20mg/l pH>7	Electrolysis in systems with domestic hot water. The material is unsuitable when water consumption is low.
Copper	100mg/l<[HCO <sub>3</sub> -]<240mg/l 7,5½<pH<9	Requirements for water flow velocity, cf. DS 439.
Stainless steel with stainless steel fittings	[Cl-]<150mg/l (250 mg/l)2	Non-replaceable pipes for domestic hot water must be protected against outside humidity
Stainless steel with gunmetal fittings	[Cl-]<250mg/l	Non-replaceable pipes for domestic hot water should be protected against outside humidity. Should not be combined with hot-dip galvanized steel.
PEX, PEX-aluminium, PVC-C	No requirements	

Table 1: Pipe materials for domestic water installations, requirements for water quality.

1)The concentration is stated in mmol/l.

2)Several brands are approved up to 250 mg/l, which is the threshold values for chloride in drinking water.

Further information:

**Frank Fontenay**  
+45 43 26 76 44 • fsf@force.dk

**Asbjørn Andersen**  
+45 43 26 71 90 • asa@force.dk

# Courses in "Corrosion and Materials Technology" and "Maintenance" 2010

Area	Ref	Title	Duration	Date (2nd half year 2010)	Price DKK
Aluminium	A.2	Aluminium – Deterioration, corrosion, cracks, wear	2 days	21 - 22 September	8.600
	A.5	Aluminium – Joints	2 days	14 - 15 September	8.600
Building	B.3	Domestic water installations, materials and corrosion prevention	2 days	5 - 6 October	8.600
	B.5	Legionella and water quality in the domestic water system	1 day	23 November	5.100
Energy Systems	E.1	Maintenance of boiler systems	3 days	9 - 11 November	11.600
	E.80a	Cooling with sea water	1 day	7 September	5.100
	E.80b	Cooling with fresh water	2 days	12 - 13 October	8.600
Stainless Steel	R.5	Welding of stainless steel	3 days	30 November – 1 December	11.600
	R.8	Food safety – stainless production equipment	2 days	28 - 29 September	8.600
Steel	St.3a	Steel – Surface treatment, corrosion protection	2 days	2 - 3 November	8.600
Systematic Maintenance	V.06	Inspection and Maintenance, module 1 (Materials and deterioration)	3 days	25 - 27 October	11.600
	V.07	Inspection and Maintenance, module 2 (NDE and NDT methods)	4 days	15 - 18 November	14.600
	V.08	Inspection and Maintenance, module 3 (Planning the inspection and maintenance)	3 days	6 - 8 December	11.600

## Sign up

Please sign up with Jette Jacobsen at +45 43 26 74 26, via mail [jtj@force.dk](mailto:jtj@force.dk) or on our web site [www.forcetechnology.com](http://www.forcetechnology.com)

## FORCE Technology wins call for proposals

Danish Enterprise and Construction Authority and Agency for Spatial and Environmental Planning have selected FORCE Technology to conduct a project that compares several methods for assessment of nickel release from taps. The project is scheduled to run over a year, terminating in November 2010.

### What is the project about?

The project entails development of test methods for use in VA approvals (approvals of water and drain installations). Results from a 26-week rig test in a waterworks will be compared to various faster and simpler tests to assess the possibility of using these methods for increased consumer protection.

### VA approval

Products that are used for drinking water must have a statutory VA approval regarding health related properties. The VA approval



*FORCE Technology is going to investigate nickel release from taps*

means that the product is tested for release of lead and cadmium. Today the approval procedure does not include an assessment of nickel release although it has been known for many years that nickel-plated products

may release considerable amounts of nickel to the drinking water. This may cause discomfort in persons who are hypersensitive to nickel.

### Avoid nickel in drinking water

Consumers wanting to avoid high nickel content in their drinking water are presently referred to letting the water run for some seconds when the tap has not been used for some time. Alternatively consumers may choose to buy a tap that has not been nickel- or chromium-plated, but this requires consumer knowledge about nickel release.

### Further information

Further information about the project can be found here: [www.ebst.dk](http://www.ebst.dk) under "Udbud" (call for proposals).

### Further information:

**Asbjørn Andersen**

+45 43 26 71 90 • [asa@force.dk](mailto:asa@force.dk)

Material News is a newsletter on corrosion, metallurgy and welding. The newsletter is published twice a year.

Material from the newsletter may be used with clear indication of source.

For more information please use our website: [www.forcetechnology.com](http://www.forcetechnology.com)

Editors:  
Marianne Krogsgaard Berg  
(editor in chief)  
Jette Jacobsen

Material News is published by  
FORCE Technology  
Park Allé 345  
2605 Brøndby  
Tel.: +45 43 26 70 00  
Fax: +45 43 26 70 11  
[info@forcetechnology.com](mailto:info@forcetechnology.com)  
[www.forcetechnology.com](http://www.forcetechnology.com)