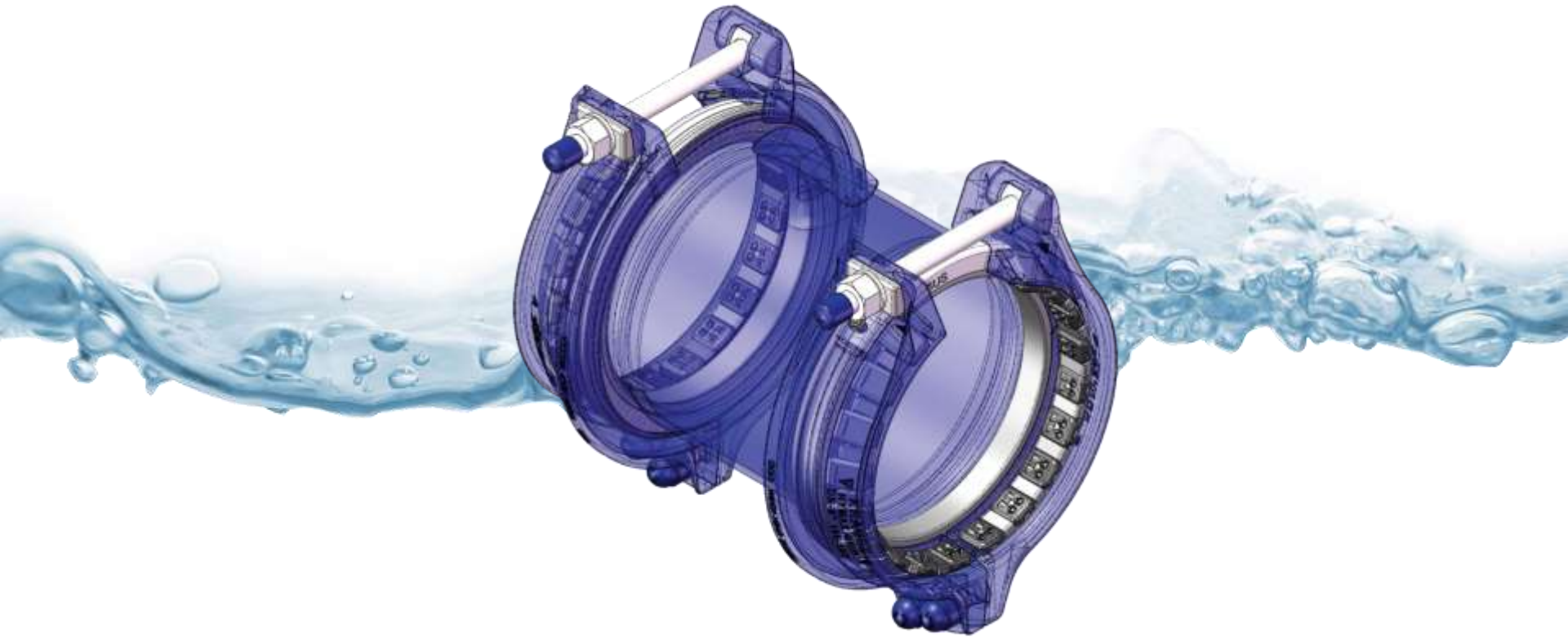
The Evolution of Pipe Couplings

Repair Market



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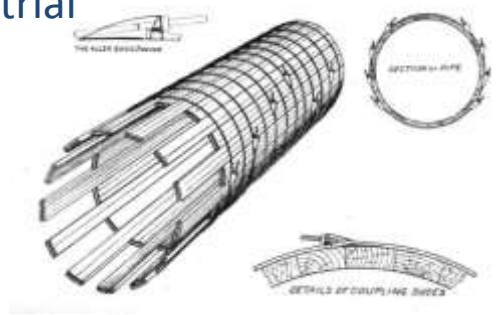
JOIN REPAIR RESTRAIN

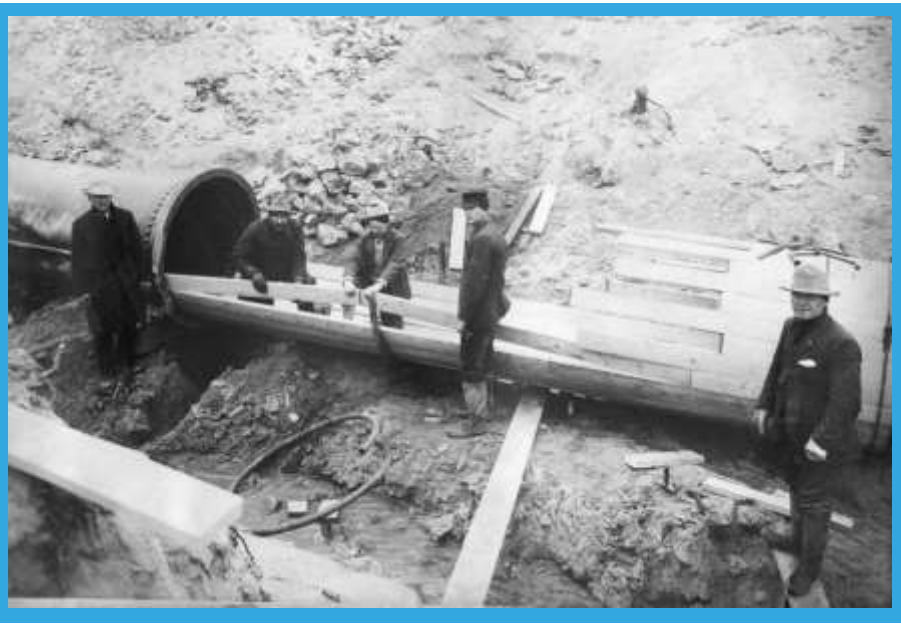
The Need

In the 19th century long pipe lines were installed as part of the industrial revolution, in order to transmit water from reservoirs to cities.

Most pipes were made of wood.

They needed frequent maintenance.





What is a coupling?

Oxford Dictionary: (*technology*) a thing that joins together two parts of something, two vehicles, or two pieces of equipment.

A coupling (*or coupler*) is a very short length of pipe or tube, with a socket at one or both ends, that allows two pipes or tubes to be joined, welded, brazed or soldered together.

Wood, 1812, Philadelphia USA

Cast Iron, France 19th century

Lead, roman empire

Pipe Repair is an SOS Business !

It requires special skills

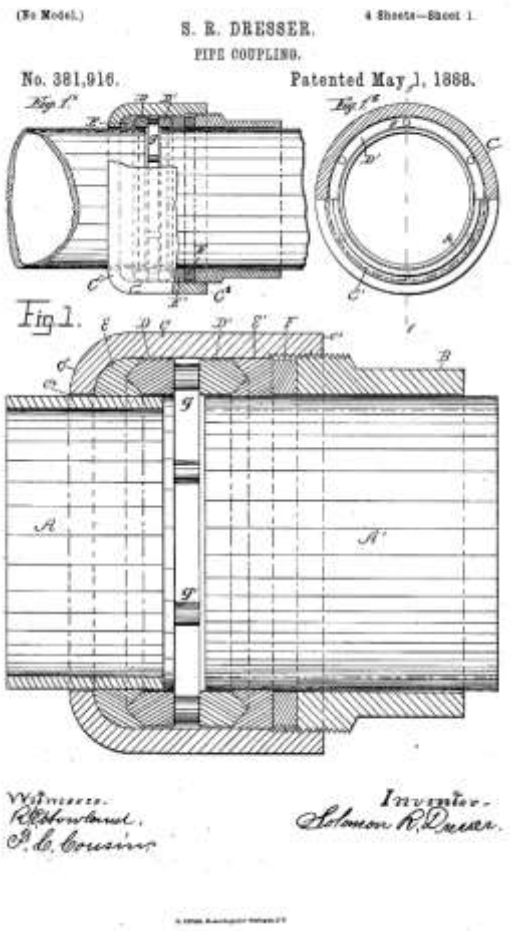
And professional knowledge

It is done under harsh conditions

And must be completed fast to minimize suffering

History: First pipe coupling patent – 1888*

The first coupling US patent was introduced in 1885 filed in 1888 by *Dresser*



*Source: US patent Office

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Evolution of couplings

Multi-component Dedicated Coupling

- Designed for ONE type of pipe size & material
- Steel

Multi-bolt Dedicated Coupling

- Designed for One pipe size & material
- Ductile Iron

Wide Range Coupling Rigid joint

- Designed for different pipe sizes & materials
- Rigid joint
- Multi-bolt

Wide Range Flexible joint

- Wide-range
- 2-bolt
- Dual sealing
- Flexible Joint – dynamic deflection

Restrained Coupling

- Wide-range
- Prevents axial movement & pipe pullout
- Internal restraint

Multi-purpose Wide range Coupling

- Advanced openable coupling
- Stainless Steel
- Dynamic deflection

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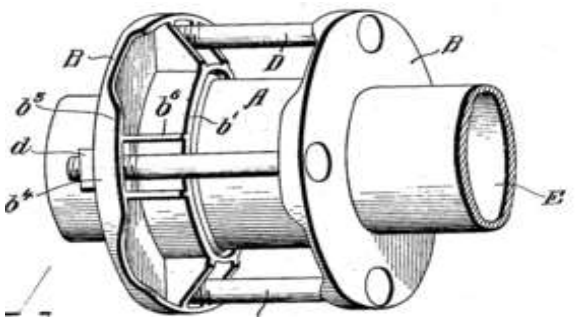
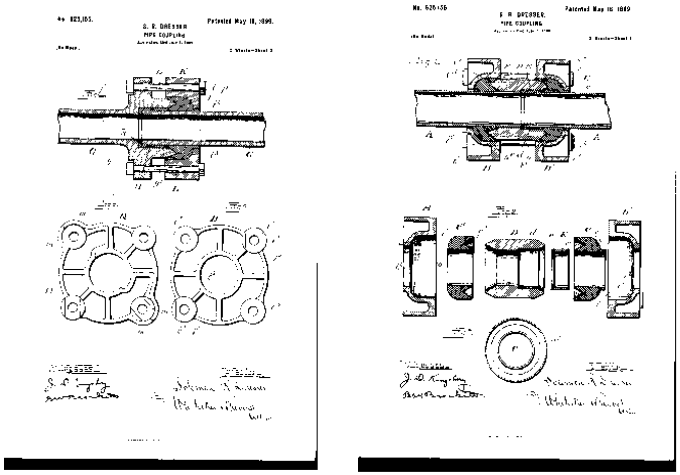
Dresser's first pipe coupling

- **Introduced in 1888 by Solomon Dresser**
- **Features:**
  - Made of Steel
  - Used for Gas in oil fields
  - Rubber sealing
  - Provided the basis for the pipe repair industry



1908 version



Common water and wastewater pipe materials

CAST IRON

COPPER

GRP

DUCTILE IRON

HDPE

ASBESTOS CEMENT

STEEL

PVC

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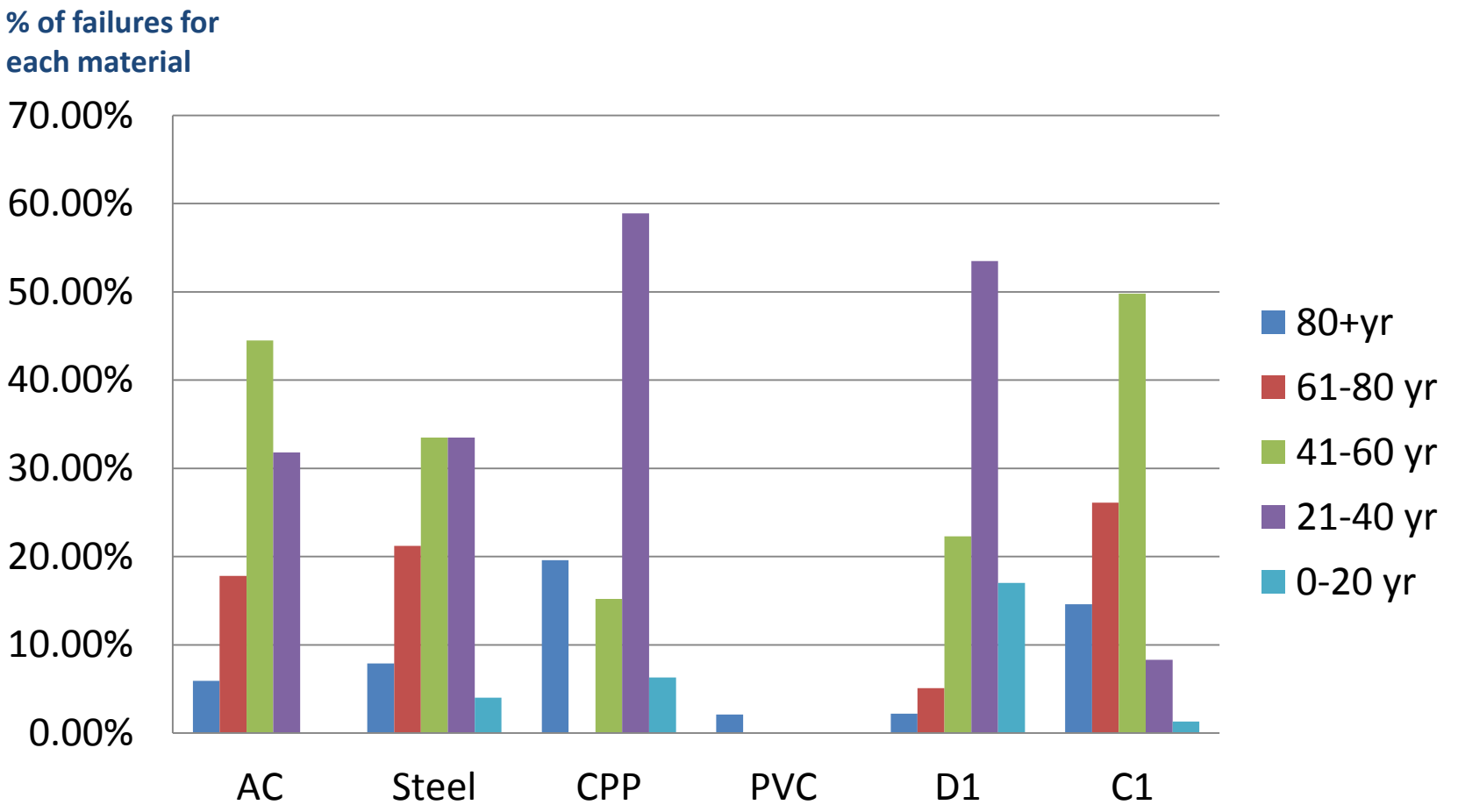
COMMON PIPE FAILURE BY PIPE TYPES

Pipe Materials and Typical Problems*

	Corrosion	Circular Breaks	Leaking Joint	Longitudinal Cracks	Surface Softening	Perforation (Holes)	Pipe Wall Rupture	Delamination
CAST IRON	★	★	★	★	★		★	
DUCTILE IRON	★		★			★	★	
STEEL			★			★	★	★
COPPER	★	★	★				★	
HDPE			★				★	
PVC			★	★	★		★	
ASBESTOS CEMENT		★	★	★	★	★		
GRP								★

*Source: water association of Australia

Percent of failures as a function of age and pipe material



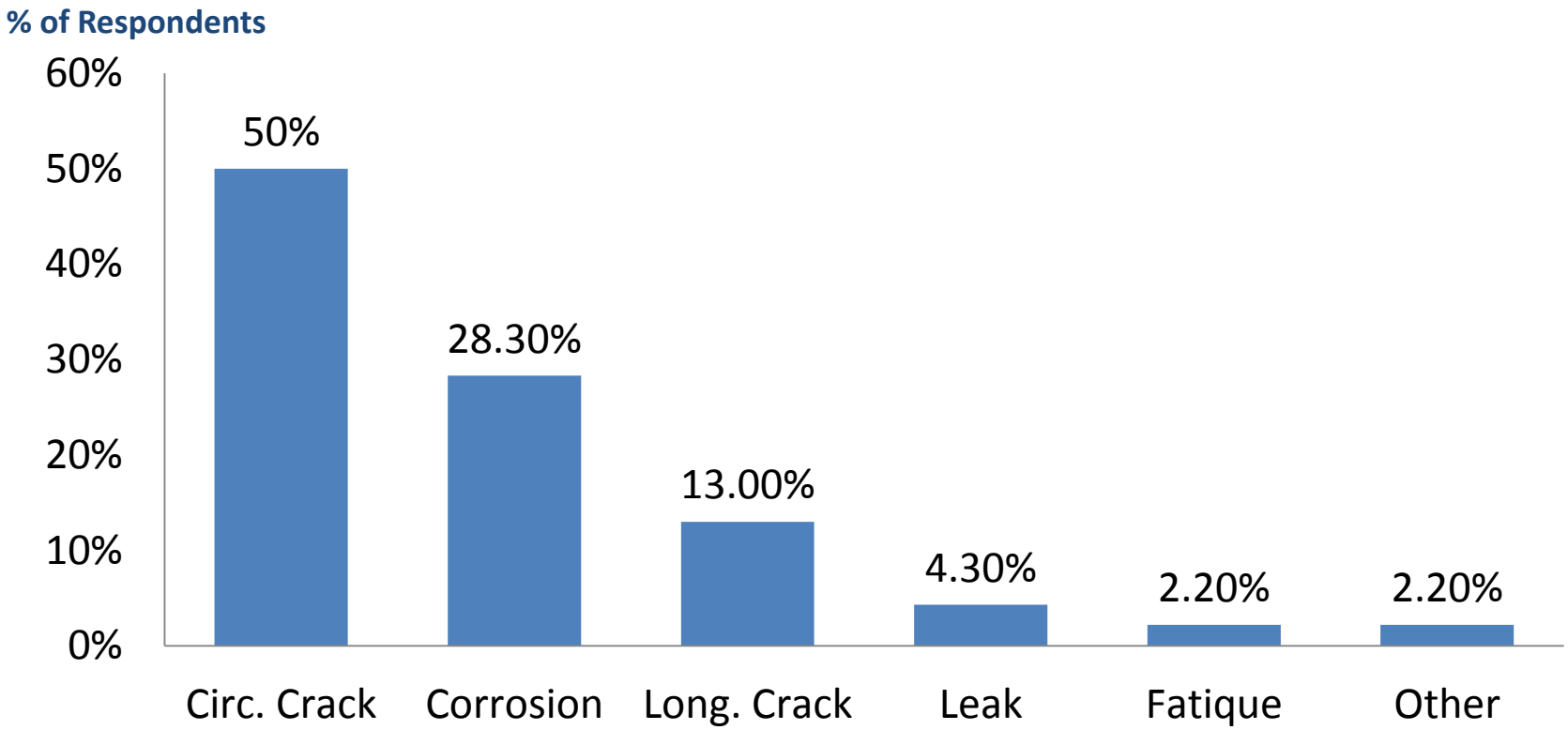
SOURCE: April 2012 Utah State University Buried Structures Laboratory

Failure data over a 12-month period

PIPE MATERIAL	LENGTH MILES	NUMBER OF FAILURES	FAILURE RATE #/(100mi)/(year)
CI	33,611	8,204	24
DI	33,238	1,620	5
PVC	26,840	689	2
CPP	2,355	128	5
Steel	4,300	581	13
AC	13,502	954	7
Other	3,755	787	21
TOTAL	**117,603**	**12,963**	**77**

SOURCE: April 2012 Utah State University Buried Structures Laboratory

Most common failures - breakdown



SOURCE: April 2012 Utah State University Buried Structures Laboratory

Pipe failure types in water systems

Common failures:

- Corrosion
- Longitudinal cracks
- Circular Break
- Leaking joint

Holes

Pipe failure types in water systems

Common failures:

- Corrosion
- Pipe wall rupture
- Leaking joint
- Holes

DUCTILE IRON

Hole

Pipe Wall Rupture

Pipe failure types in water systems

Common failures:

- Surface softening
- Pipe wall rupture
- Leaking joint

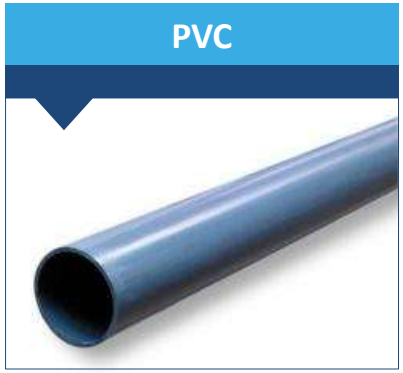
Longitudinal Crack

Circular Break

Pipe failure types in water systems

Common failures:

- Pipe pullout due to Smooth surface
- Cracks
- Pipe wall rupture



Pipe failure types in water systems

Common failure:

- Holes
- Leaking joint
- Delamination

Pipe failure types in water systems

Common failure:

- Pipe wall rupture
- Leaking joint
- Rapid Crack Propagation

Polyethylene (HDPE)

Pipe failure types in water systems

Common failures:
- Joint leaks
- Fiberglass delamination

PIPE REPAIR METHODS IN WATER SYSTEMS

Pipe Repair in water systems

Asbestos Cement

OLD

Original asbestos coupling

NEW

Hydraulic wide-range openable
Coupling in a repair function

Hydraulic wide-range openable
Coupling in a joining function

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Pipe Repair in water systems

GRP pipe

OLD

Glued GRP Coupling

NEW

Wide-range openable Coupling

Pipe Repair in water systems

PVC pipe

OLD

Dedicated coupling on PVC replacement pipe

NEW

Wide range couplings on PVC replacement pipe

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Common pipe repair solutions






OLD COUPLINGS VS. NEW COUPLINGS

- Installer Interface: Multiple Bolts
- 2-bolt couplings
- Installation-ready
- Installation stages

Installer Interface - Cumbersome

OLD - Multiple Bolts

- Wide-range coupling
- Involves under-pipe work

Installer Interface - Ease of Use

NEW - 2/4 Bolts

- Wide-range coupling
- Top-facing bolts
- No under-pipe work

Installer Interface - Ease of Use

NEW - Installation-Ready Technology

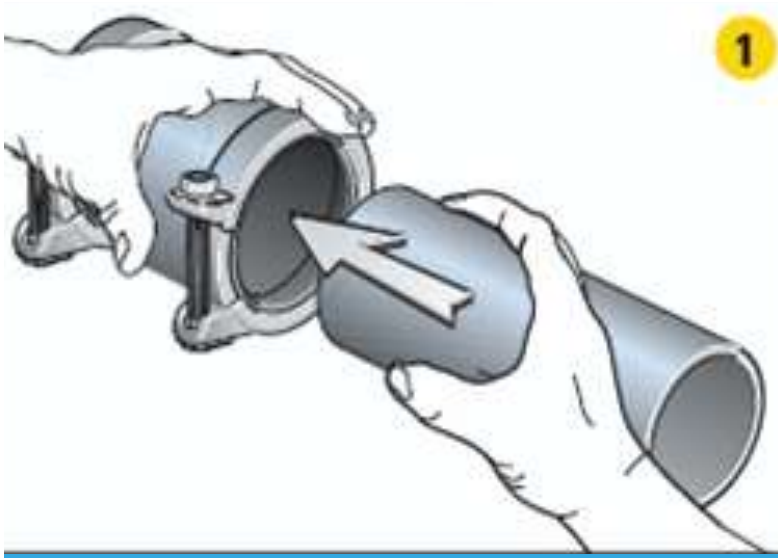
- Stab-fit design
- Lighter and simpler
- 1 or 2 Top-facing Bolts
- No need for disassembly
- No need for under-pipe work
- Coupling slides easily on pipe

New

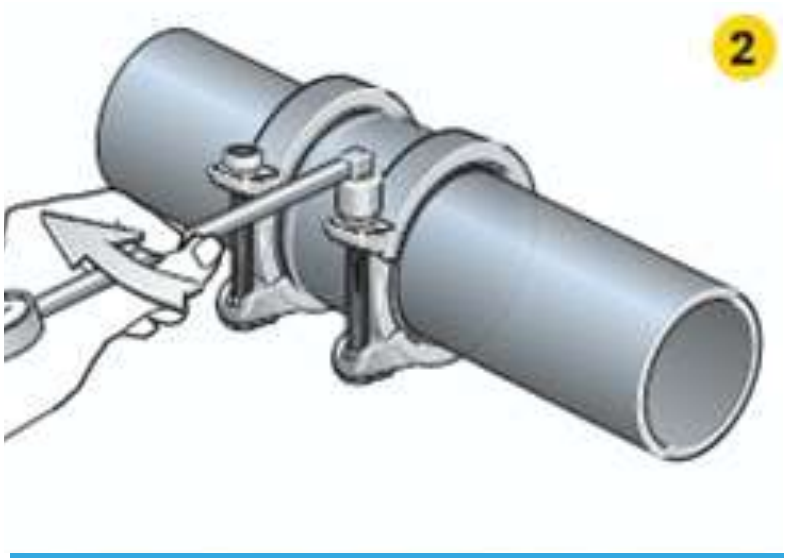
Old

Installer Interface - Ease of Use

Wide-range coupling Installation



Installing without dismantling



Tightening the bolts.

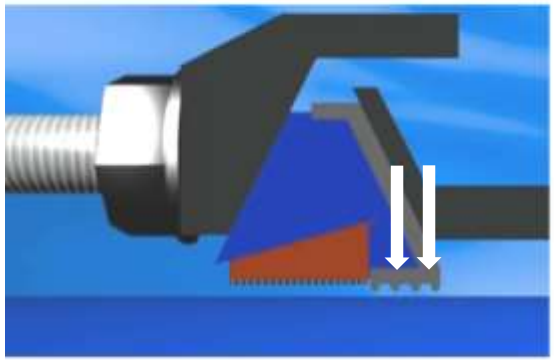
TECHNOLOGICAL ADVANCEMENTS

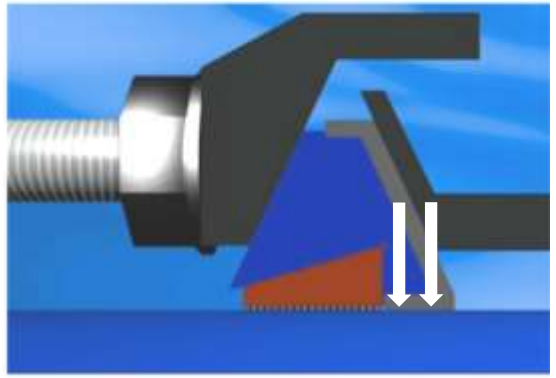
- Gaskets
- Restraint Couplings
- New Multi-purpose Couplings

GASKETS – OLD VS. NEW

- The Cone-shaped Gasket
- The Hydraulic Pressure-Assisted Gasket
- Hydraulic Gasket Allows Continuous Dynamic Deflection
- 2-Layer Removable Gasket accommodates wide range

OLD – the Cone-shaped Gasket
(no flexibility/deflection of the pipes)



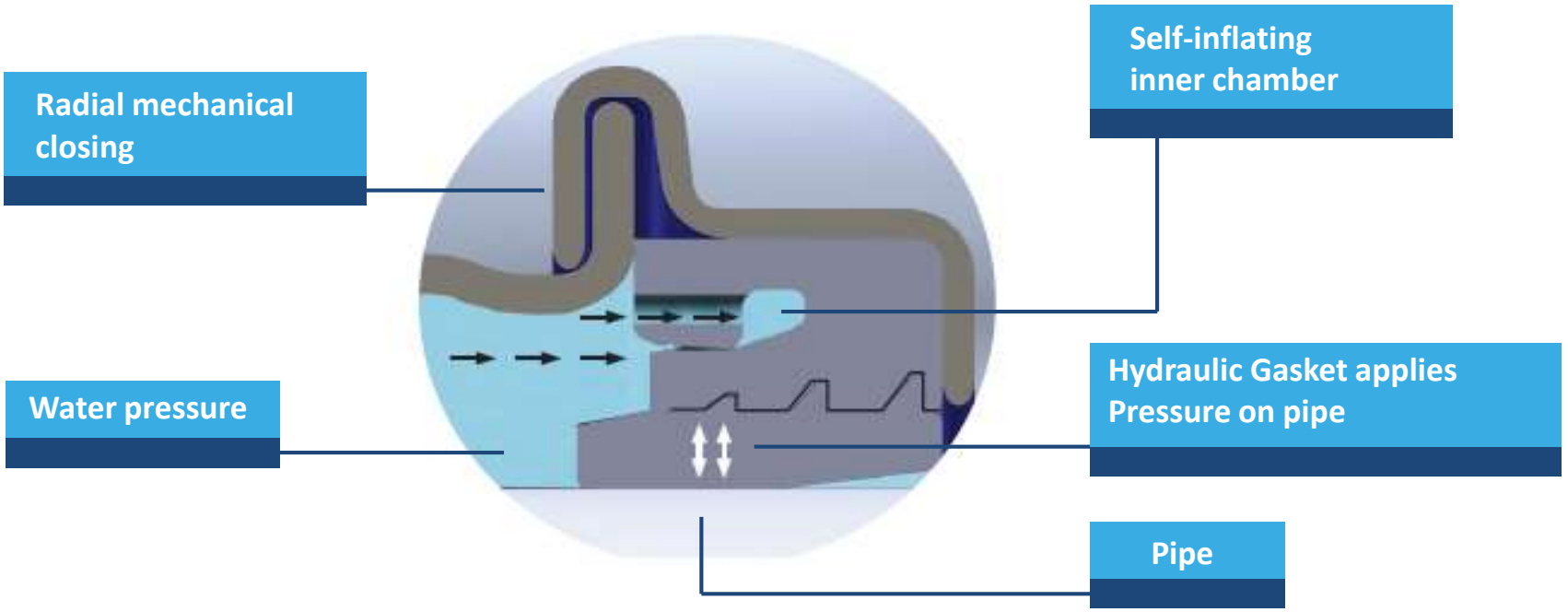


No ground shift absorption

May Lead to more breaks near the installation

NEW – The Hydraulic Pressure-Assisted Gasket

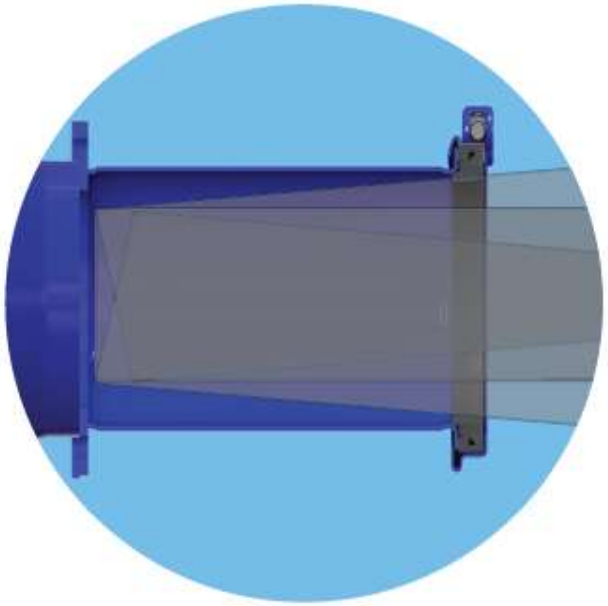
Allowing Continuous Dynamic Deflection



NEW – Hydraulic Pressure-assisted Gasket
Allows Continuous Dynamic Deflection

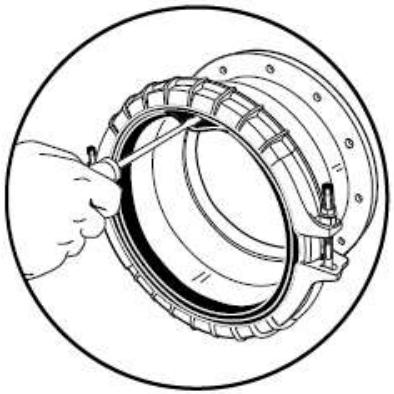
- **Allows several degrees of pipe shift during installation**
- **Absorbs ground shifts due to extreme conditions after installation**
- **Prevents pipe damage in the long run**

PLAY video

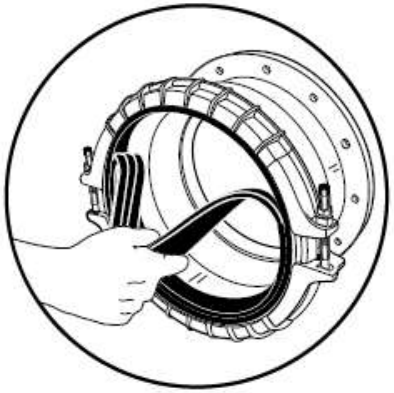


NEW – 2-Layer Removable Gasket Accommodates Variable Pipe Sizes

Insert Screwdriver



Peel Inner Layer



Remove Inner Layer

→ **True Wide-Range Coupling replaces several dedicated-range products**

Before detaching
The inner layer

After detaching
The inner layer

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RESTRAINED COUPLINGS – OLD VS. NEW

- External restraint vs. in-product restraint
- Restraint Couplings – Ready-to-use
- Restraint Closure Mechanism – Old Vs. New
- 2 Closing Methods
- Restraint Action Shows on Pipe
- How Restraint prevents axial movement

External restraint vs. in-product restraint

Eliminating the need for external anchoring

OLD – Dedicated Coupling
With External Restraints

NEW – Wide-range
Restraint Coupling
No External Restraints

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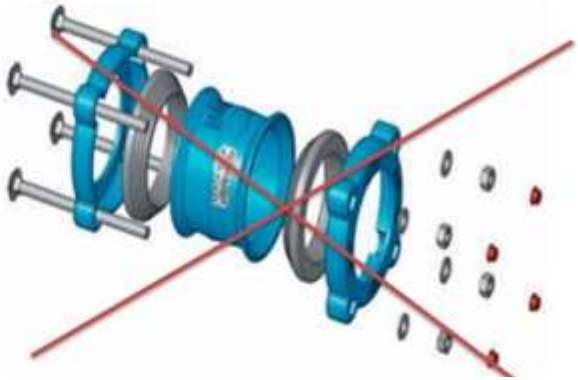
Restraint Couplings – Ready-to-use

OLD



NEW

No need to disassemble before installation

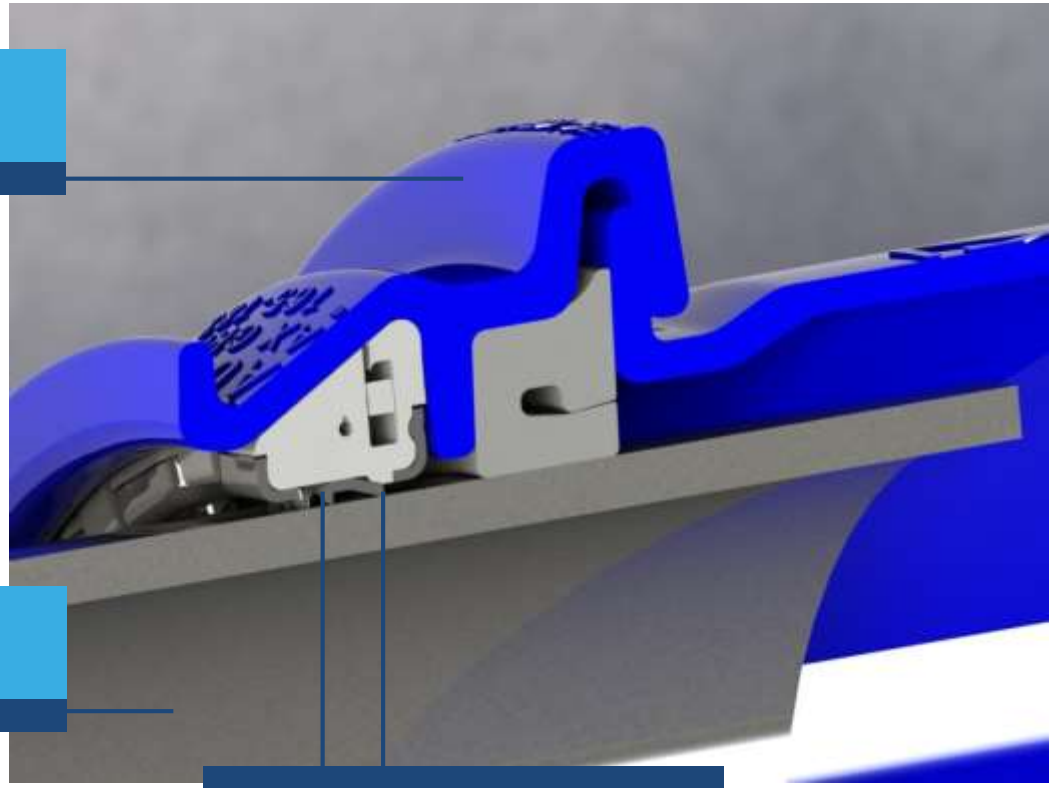
Restraint Couplings - 2 Closing Methods
Multiple Bolts Vs. 2-Bolts

OLD – Axial closing method

NEW - Radial closing method

Restraint Action Shows on the Pipe

Restraint prevents axial movement



Grip slides on slope
Preventing pipe motion

Pipe exerts pressure

Teeth go deeper into the pipe

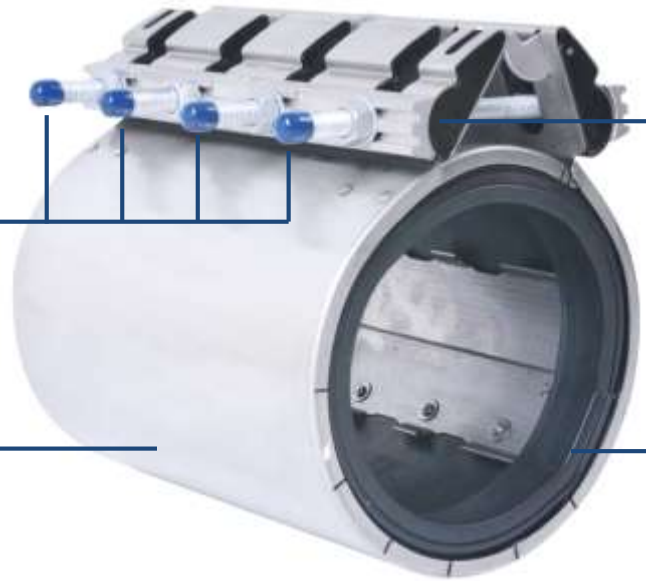
RECENT DEVELOPMENT:

Openable Multi-purpose Couplings

- Openable Coupling Structure
- Multi-purpose applications
- Wide-range gasket
- Hydraulic Gasket – side View

Openable Coupling Structure

PLAY VIDEO



Openable Multi-purpose Couplings

APPLICATIONS:

Joining pipes as a **coupling**

Sealing breaks and cracks in pipes as a **clamp**

Repairing holes as a clamp

Allowing Dynamic Deflection (up to 3° / each end)
Absorbing ground vibrations and temperature changes

JOIN

REPAIR

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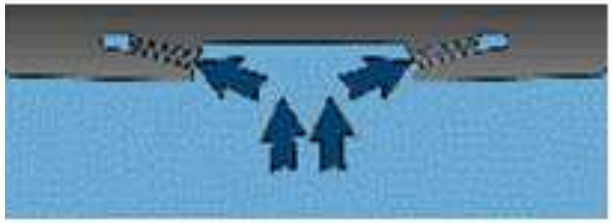
New Wide-range gasket

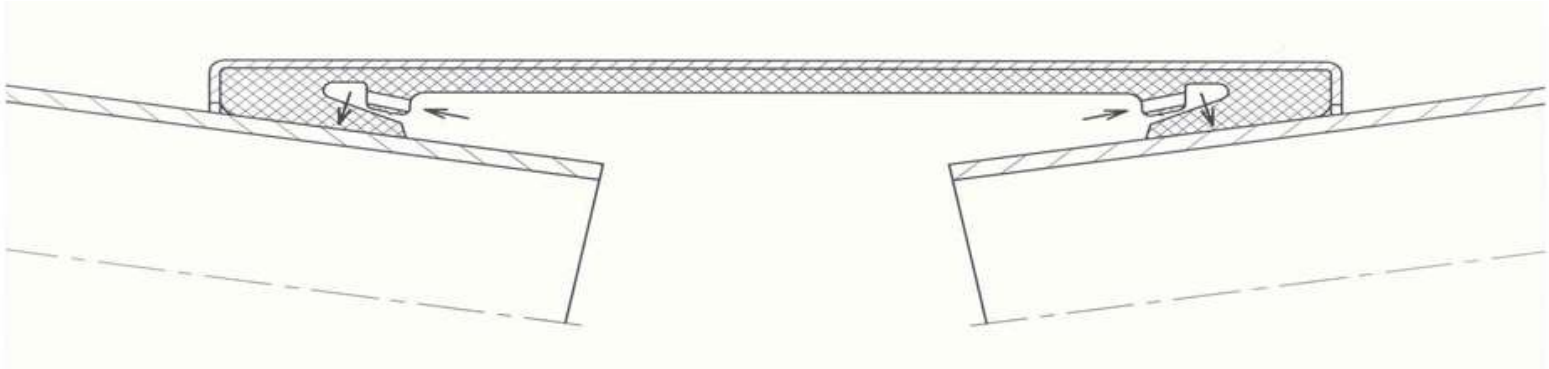
Low water pressure



High water pressure

Openable Coupling - Hydraulic Gasket's Mode of Operation

Hydraulic Gasket – side View



Openable Coupling - Installations








SUMMARY – EVOLUTION OF COUPLINGS

Multi-component
Dedicated Coupling

Multi-bolt
Dedicated Coupling

Wide-range
Rigid joint

Wide-range
Flexible joint

Restrained
Coupling

Multi-purpose
Wide-range Coupling

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Relevant Standards

See appendix

- AWWA C-219
- NSF 61
- NSF 372
- EN-681

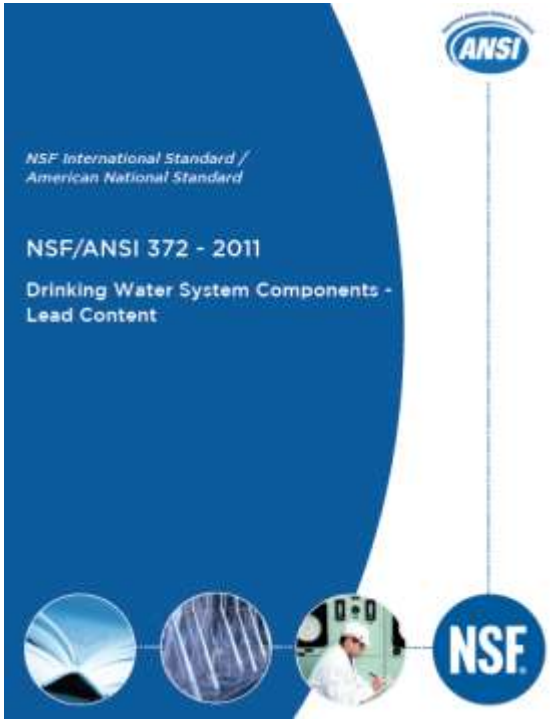
THANK YOU!

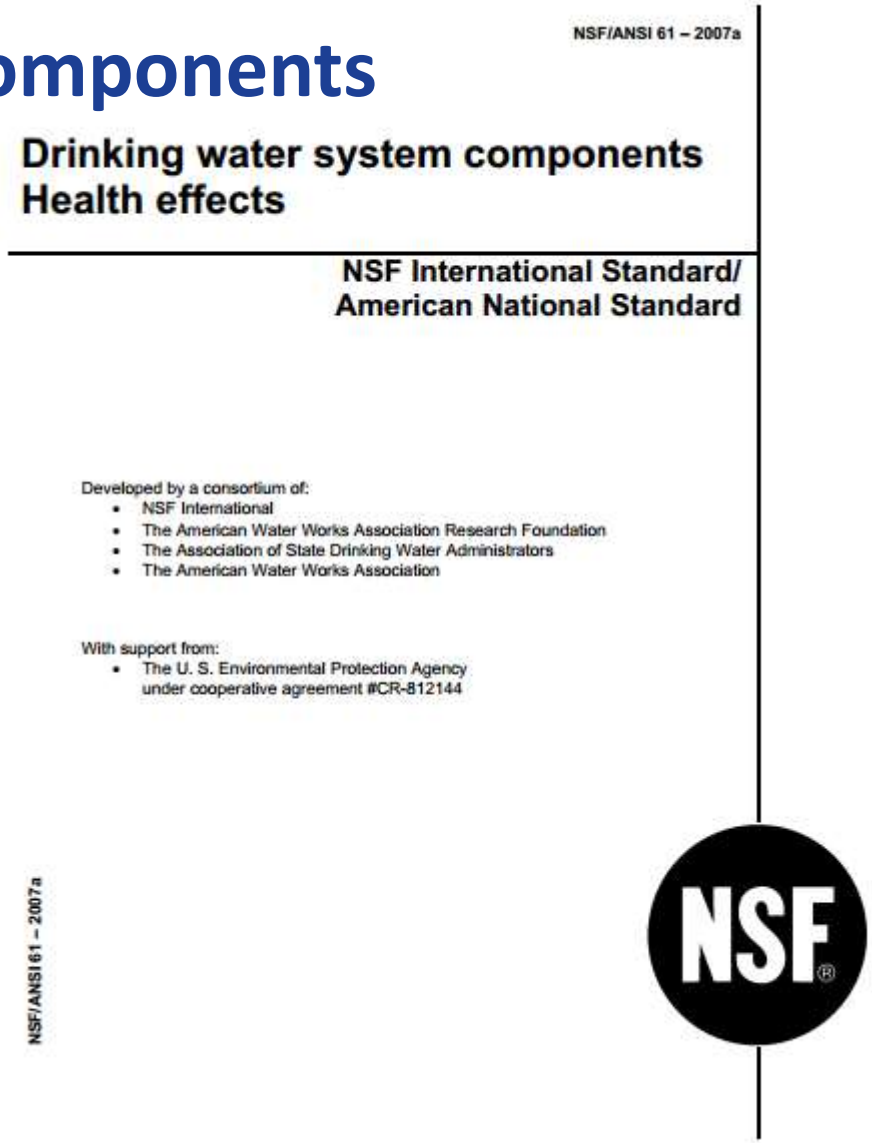
APPENDIX:

Relevant Standards

Drinking Water System Components

- NSF/ANSI 61
- NSF/ANSI 372





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NSF/ANSI 61

Drinking water system components – Health effects

Purpose :

This Standard establishes minimum health effects requirements for the chemical contaminants and impurities that are indirectly imparted to drinking water from products, components, and materials used in drinking water systems. This Standard does not establish performance, taste and odor, or microbial growth support requirements for drinking water system products, components, or materials.

Scope :

This Standard is intended to cover specific materials or products that come into contact with: drinking water, drinking water treatment chemicals, or both. The focus of the Standard is evaluation of contaminants or impurities imparted indirectly to drinking water. The products and materials covered include, but are not limited to, process media (e. g., carbon, sand), protective materials (e. g., coatings, linings, liners), joining and sealing materials (e. g., solvent cements, welding materials, gaskets), pipes and related products (e. g., pipes, tanks, fittings), mechanical devices used in treatment/transmission/distribution systems (e. g., valves, chlorinators, separation membranes, point-of entry drinking water treatment systems), and mechanical plumbing devices (e. g., faucets, endpoint control valves).

NSF/ANSI 372

Drinking Water System Components Lead Content

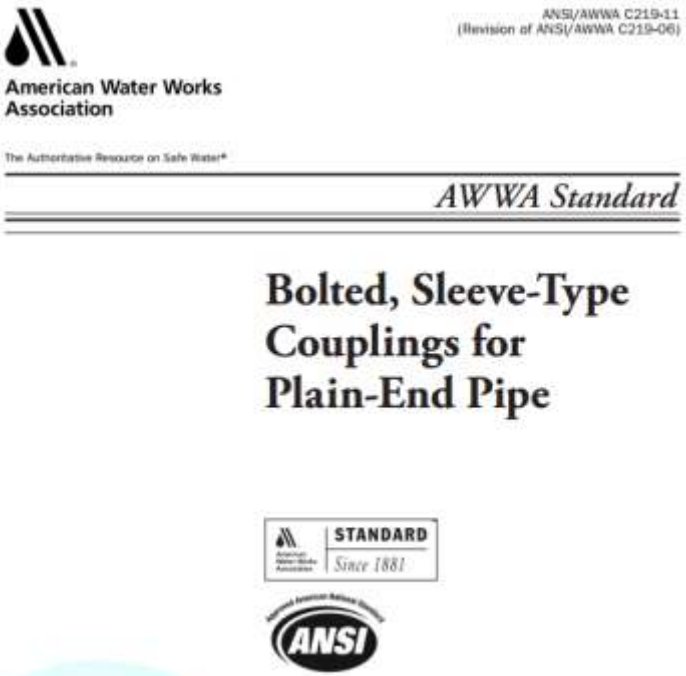
Purpose : This standard establishes procedures for the determination of lead content based on the wetted surface areas of products.

Scope :

This standard applies to any drinking water system component that conveys or dispenses water for human consumption through drinking or cooking.

AWWA Coupling Standards

- AWWA C219
- AWWA C227



ANSI/AWWA C219-11
(Revision of ANSI/AWWA C219-06)

American Water Works Association

The Authoritative Resource on Safe Water™

AWWA Standard

Bolted, Sleeve-Type Couplings for Plain-End Pipe

STANDARD Since 1881

ANSI

ANSI/AWWA C227-11
(Revision of ANSI/AWWA C227-07)

American Water Works Association

The Authoritative Resource on Safe Water™

AWWA Standard

Bolted, Split-Sleeve Restrained and Nonrestrained Couplings for Plain-End Pipe

STANDARD Since 1881

ANSI

Effective date: April 1, 2011.
First edition approved by AWWA Board of Directors Jan. 21, 2007.
This edition approved Jan. 23, 2011.
Approved by American National Standards Institute Jan. 26, 2011.

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AWWA C219-11
Bolted ,Sleeve-Type Couplings for Plain-End Pipe

- **Scope**: This standard describes bolted, sleeve-type couplings, reducing or transition couplings, and flanged coupling adapters used to join plain-end pipe. Couplings may be manufactured from carbon steel, stainless steel, ductile iron, or malleable iron, and are intended for use in systems conveying water. This standard covers nominal pipe sizes from 1/2 in. (12.5 mm) through 144 in. (3,600 mm).
- **Purpose**: The purpose of this standard is to provide the minimum requirements for couplings of plain-end pipe, including requirements for materials, design, testing and inspection, installation, and shipping.

AWWA C227-11

Bolted, Split-Sleeve Restrained and Non-restrained Couplings for Plain-End Pipe

- **Scope** : This standard describes bolted, split-sleeve couplings (couplings) used to join plain-end pipe of similar outside diameter. Couplings may be manufactured from carbon steel or stainless steel and are intended for use in systems conveying water, wastewater, or air used in water treatment. The standard covers nominal coupling sizes from 3/4 in. (20 mm) through 144 in. (3,600 mm).
- **Purpose** :The purpose of this standard is to provide the minimum requirements for bolted, split-sleeve couplings for plain-end pipe, including requirements for materials, design, testing and inspection, installation, marking, and shipping

AWWA - Repair clamp Standard

- AWWA C230

This standard provides minimum requirements for fabricated full-encirclement stainless-steel band clamps for use in the repair or service connection of potable water, wastewater, and reclaimed water piping systems.

They are intended for pipe sizes 2 in. (50 mm) through 12 in. (300 mm). This standard does not cover stainless-steel tapping saddles whose seal is not fully circumferential.

Covered requirements include materials of construction, design, manufacturing, and installation instructions. The standard also covers inspection, quality assurance, test procedures, marking, packing, shipping, and affidavit of compliance.