Modern Solutions for Piping Systems

Your Premium Partner's

2 November 2017

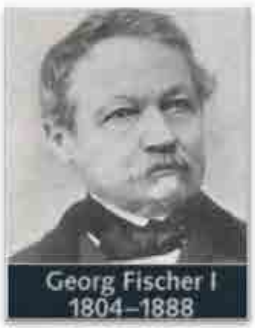

+GF+
We are GF
+GF+

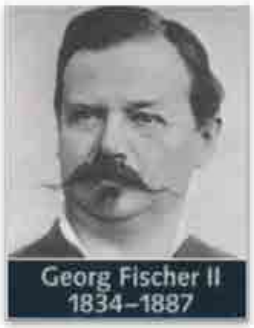
Introduction to

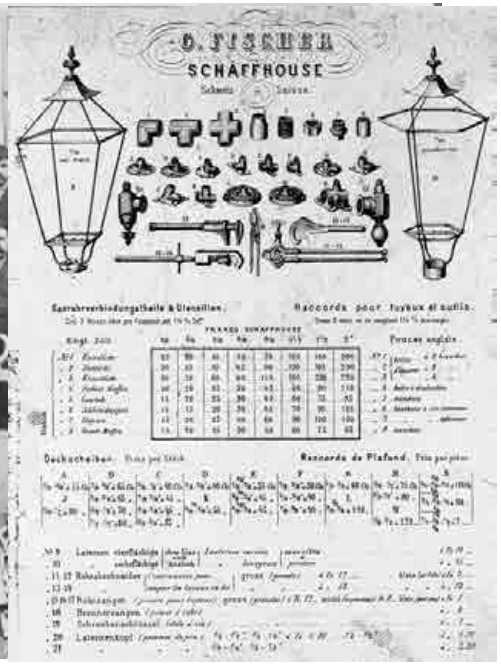
Georg Fischer Piping Systems

We are industrial pioneers

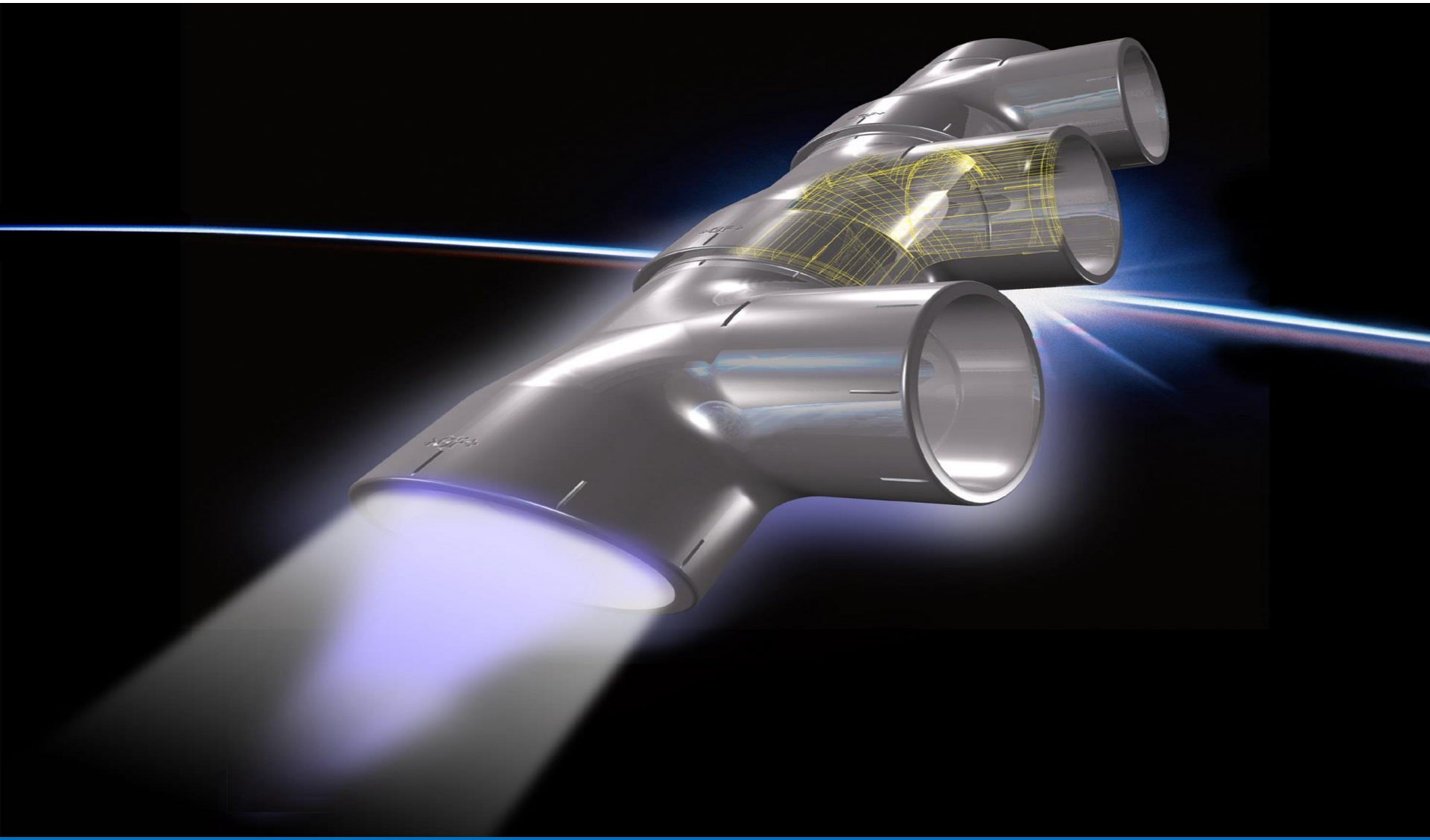
GF was founded more than **200 years** ago and has taken quite a few steps to arrive where it is today. Since 1903 GF is listed on the Swiss Stock Exchange.







PVC Solvent Cement Fittings 1957



We are part of a strong corporation

200 years of successful history

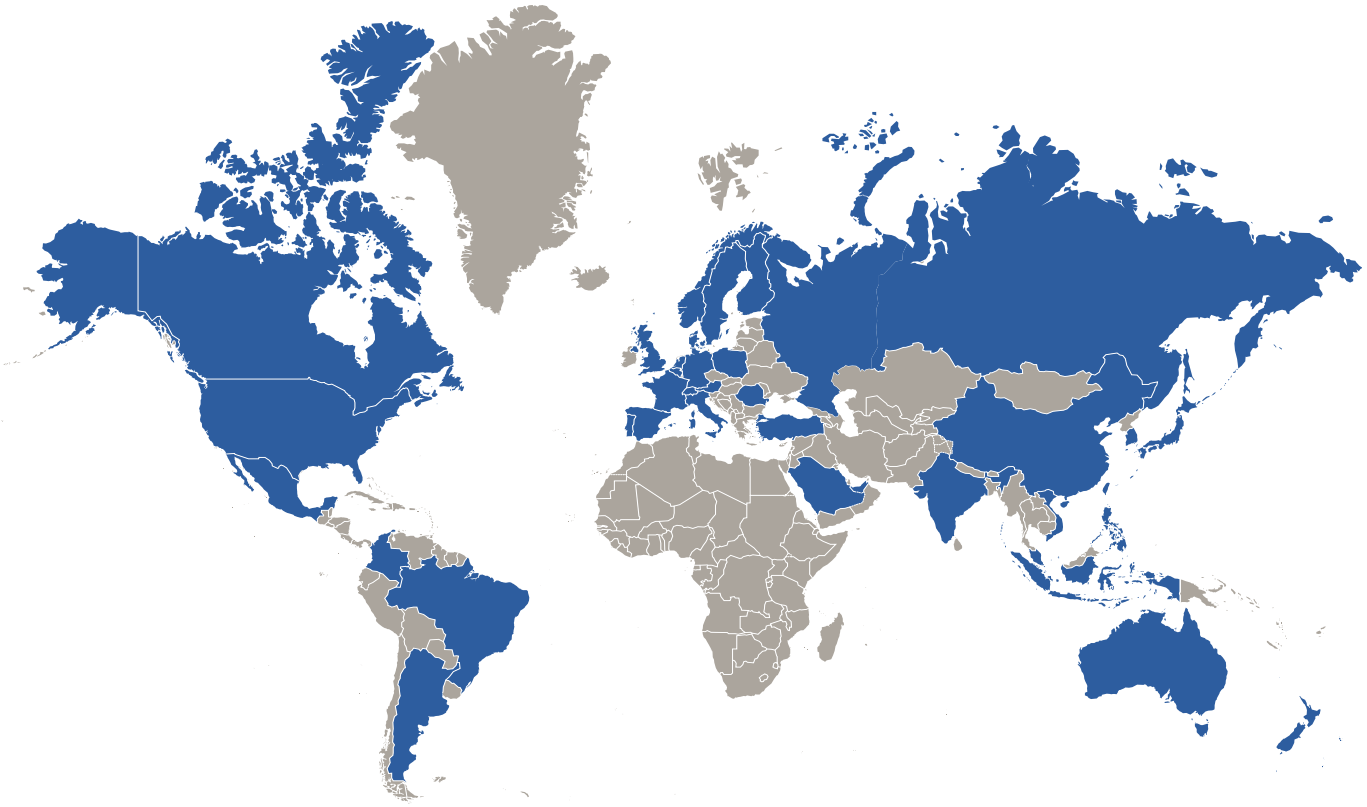
>14,400 employees

124 locations worldwide in over 30 countries

3.744 billion CHF sales in 2016

Worldwide for our customers

Today, GF is present in **more than 30 countries** with a total of over **14 800 employees**. To get **a balanced global footprint** that supports its growth, GF invests in new markets in Asia, the Americas and the rest of the World.



Our diversified profile

We offer three times premium expertise and service to match our customers' needs:

GF Piping Systems

40%

CHF 1´494 million

GF Automotive

36%

CHF 1´335 million

GF Machining Solutions

24%

CHF 916 million

Total sales in 2016: CHF 3´744 million


+GF+
GF Piping Systems
Your solution
+GF+

GF Piping Systems

- Complete systems for the safe transport of liquids and gases
- Pipes, fittings, valves, automation, jointing technologies, measure ment & control
- For industry, utility and building technology

1´494
million (CHF) sales

6´507
employees

> 50
companies worldwide

Figures for 2016


+GF+
GF Automotive
Passion for your lighter future

GF Automotive

- Production of lightweight cast components and systems
- Made out of ductile iron, aluminum and magnesium
- For the global automotive industry and other industrial applications

1´335
million (CHF) sales

5´047
employees

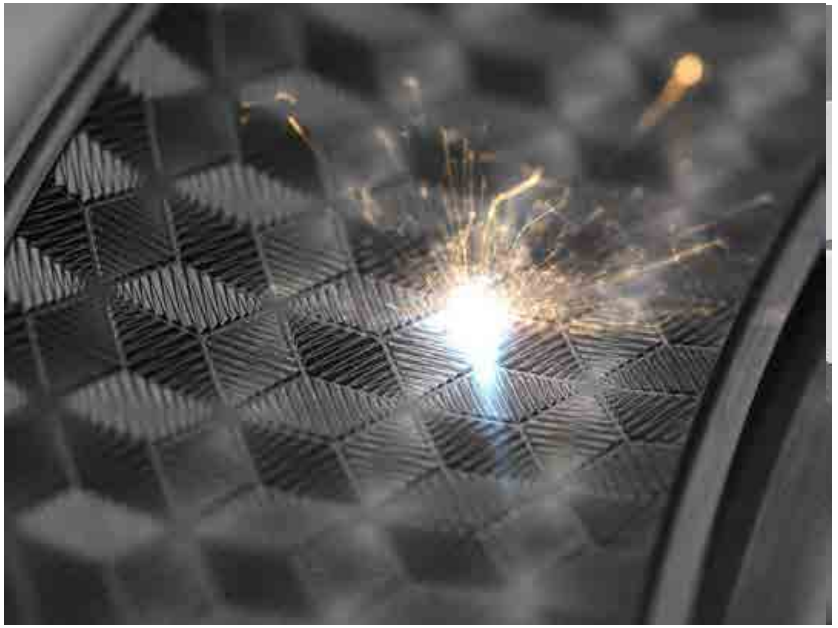
17
companies worldwide

Figures for 2016


+GF+
GF Machining Solutions
Keeping promises

GF Machining Solutions

- Machines and automation solutions for high precision manufacturing technologies
- EDM, milling and laser texturing
- For information and communication technology, aerospace and aeronautics, medical, dental etc.



916
million (CHF) sales

3´102
employees

36
companies worldwide

Figures for 2016

Sustainable for you

Sustainability is a main pillar of the GF business model. GF puts priority on ensuring the safety and health of its employees, conducting business in harmony with the environment and on contributing to finding solutions to sustainability challenges through products and services.

GF's sustainability focus areas are:

- Procurement and Logistics
- Environment and Energy
- People and Safety
- Products and Innovations

See the GF Sustainability Report 2015 for further information.

GF's Clean Water Foundation

- Founded in 2002, **135 projects** in over **50 countries** on four continents have been realized until today.
- Close to **300 000 people** worldwide got access to clean drinking water.
- GF donated more than **CHF 9 million** to the Foundation.
- GF and Caritas Switzerland renewed their partnership in 2015. The Clean Water Foundation donated again **CHF 1 million** for the supply of drinking water.

CLEAN WATER
A commitment of GF

Georg Fischer Piping System

Our Opportunities

Global megatrends inspire our vision

Quality of living

Global megatrends inspire our vision

Substitution

+GF+ Mashail

Water shortage

CO_2 emissions

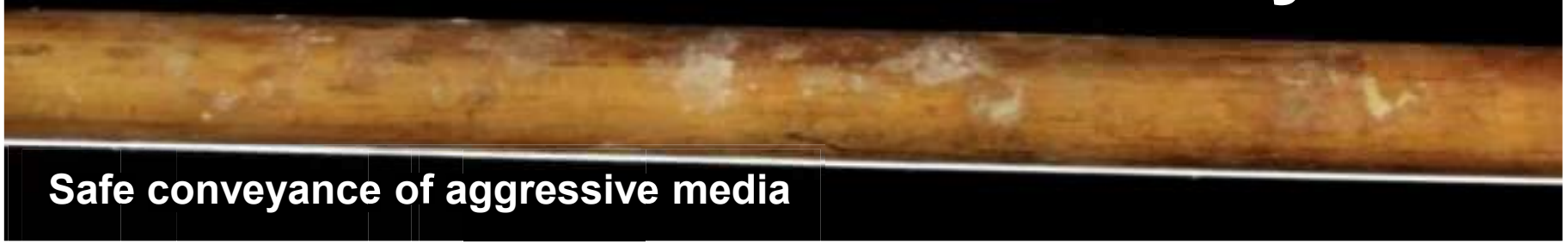
Increasing performance of plastics

Corrosion problems

Plastic growth 3-8%per year

Ban of Freon

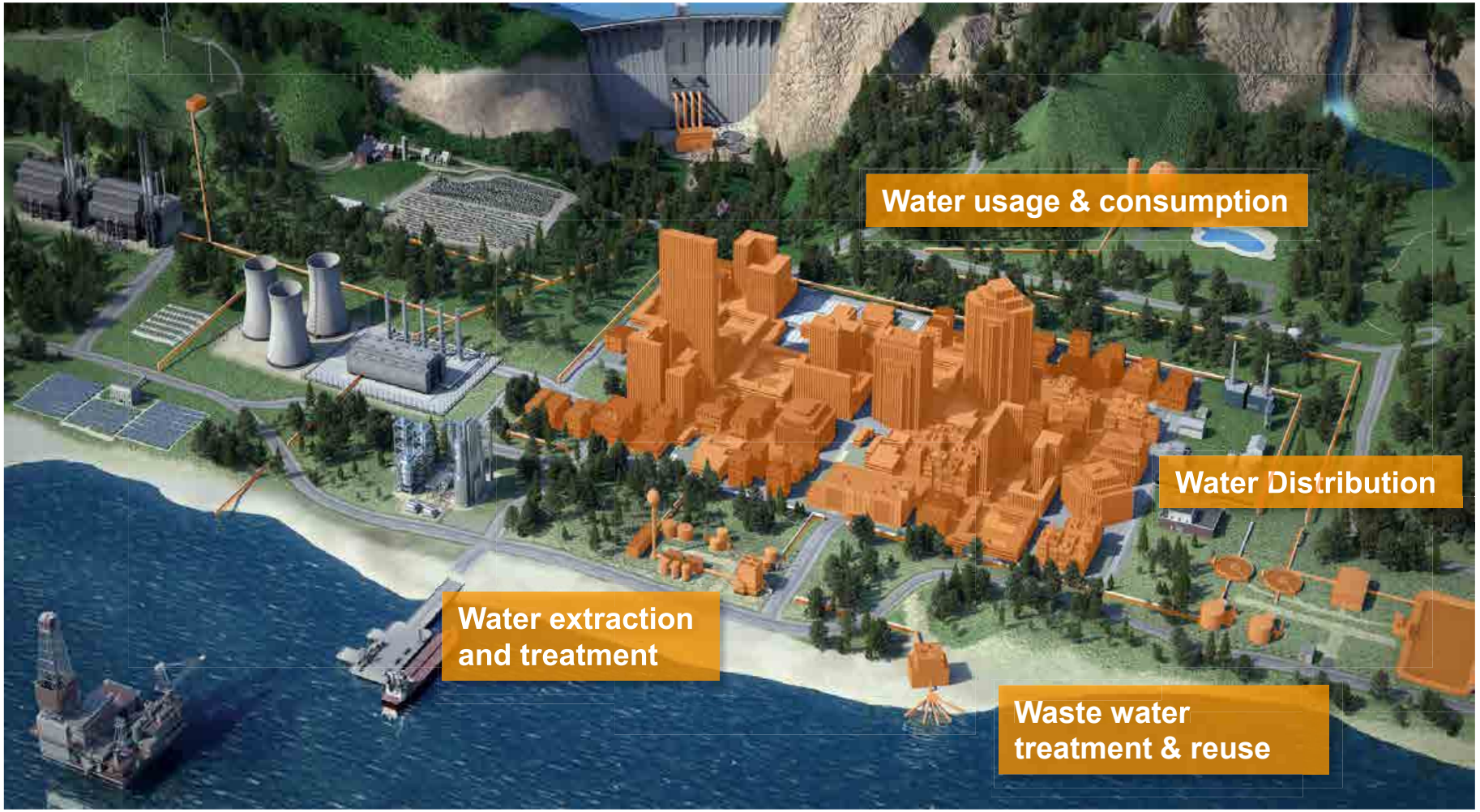
Easy to recycle



Safe conveyance of aggressive media

From the source to the point of use

Wherever you are positioned in the water cycle



…we ensure full compatibility and "peace of mind" to our customers…

+GF+

Mashail

Pipes

Measurement & Control

Training & Support

Tapping Saldles

Machines & Tools

Fittings

…with strong core competence in jointing technology

- Essential for piping systems under pressure (avoid leakage / contamination)
- GF Piping Systems is the reference worldwide in the eyes of the customers
- This technology spans over the 3 businesses of GF Piping Systems (Joint production / shared development)

Focus on highly active market segments

Building Technology

Water Treatment

Water & Gas

Chemical Process Industry

Marine

Microelectronics

Cooling

Energy

Market Segment

Energy

Pioneering Green Solutions

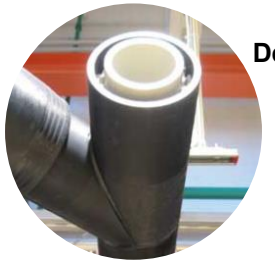
Renewable Energies

Conventional Power Plants

Market Segment Energy

Applications

Cooling Water



Chemical Conveyance

Flue Gas Desulfurization

Water Intake Lines

Compressed Air

Measurement, Control & Actuation

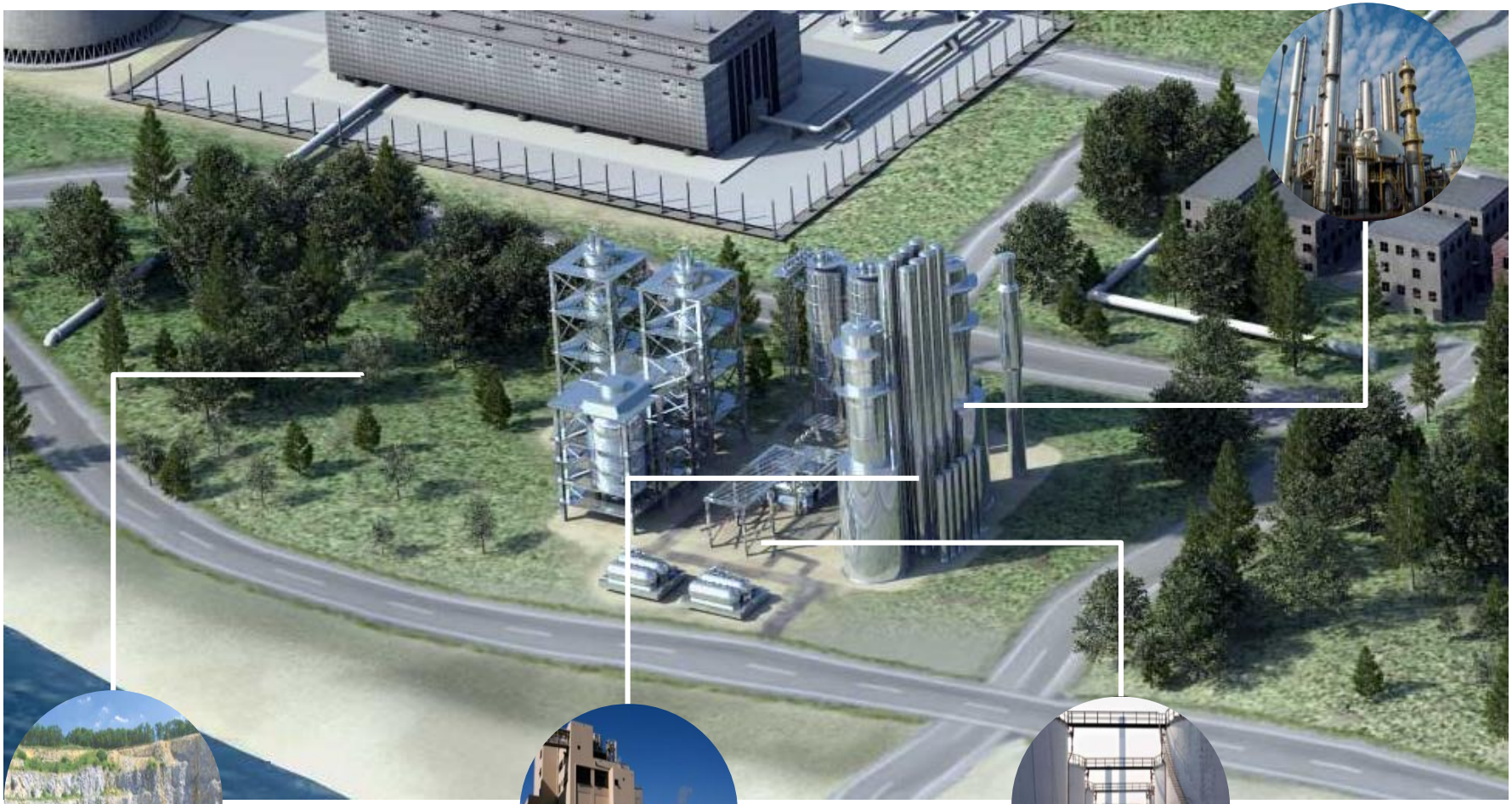
Value Added Services

Maintenance & Repair

Market Segment

Chemical Process Industry

Chemical Production



Mining

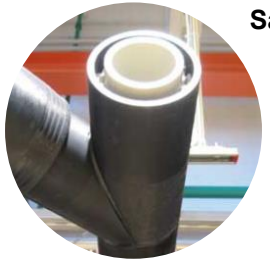
Surface Treatment

Chemical Distribution

Market Segment Chemical Process Industry

Applications

Cooling Water



Chemical Conveyance

Safety Showers

Mixing

Draw Off Station

Tank Filling

Dosing/Dilution

Neutralization

Market Segment

Cooling

Cold Stores

Food
Production

Beverages

Commercial
Refrigeration

Market Segment Cooling

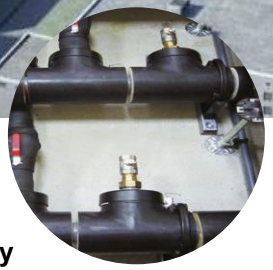
Applications

Data Centers

Rooftop

Cooling Towers

Heat Recovery



Residential

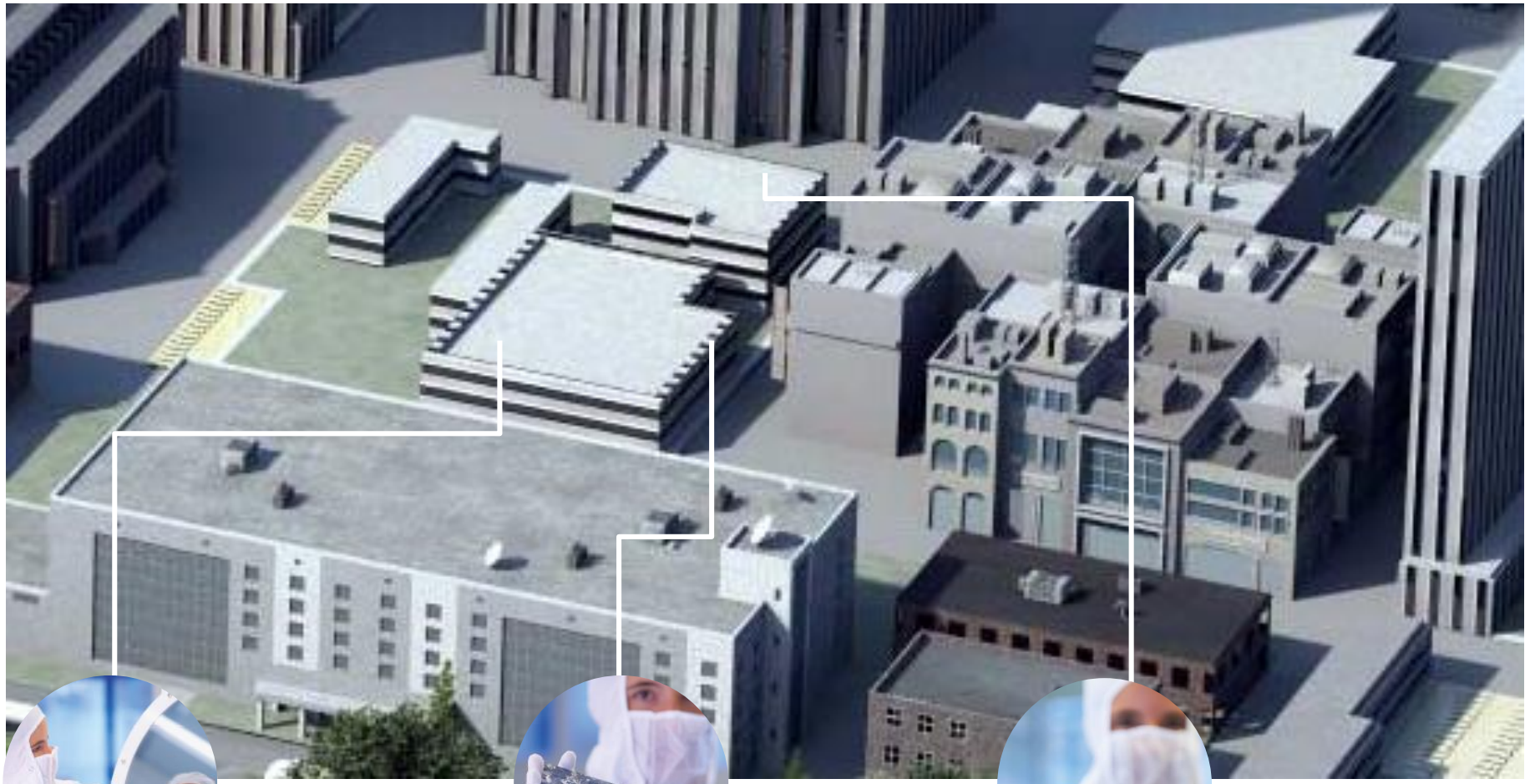
Industrial

Value Added Services

On-Site Training

Market Segment

Microelectronics



Semiconductor

Photovoltaic

TFT/HB-LED and Storage Media

Market Segment Microelectronics

Applications

Process Cooling Water

Chemical Distribution / Conveyance

DI Water / Specified Water

Speciality Waste

Ultrapure Water / Hot Ultrapure Water

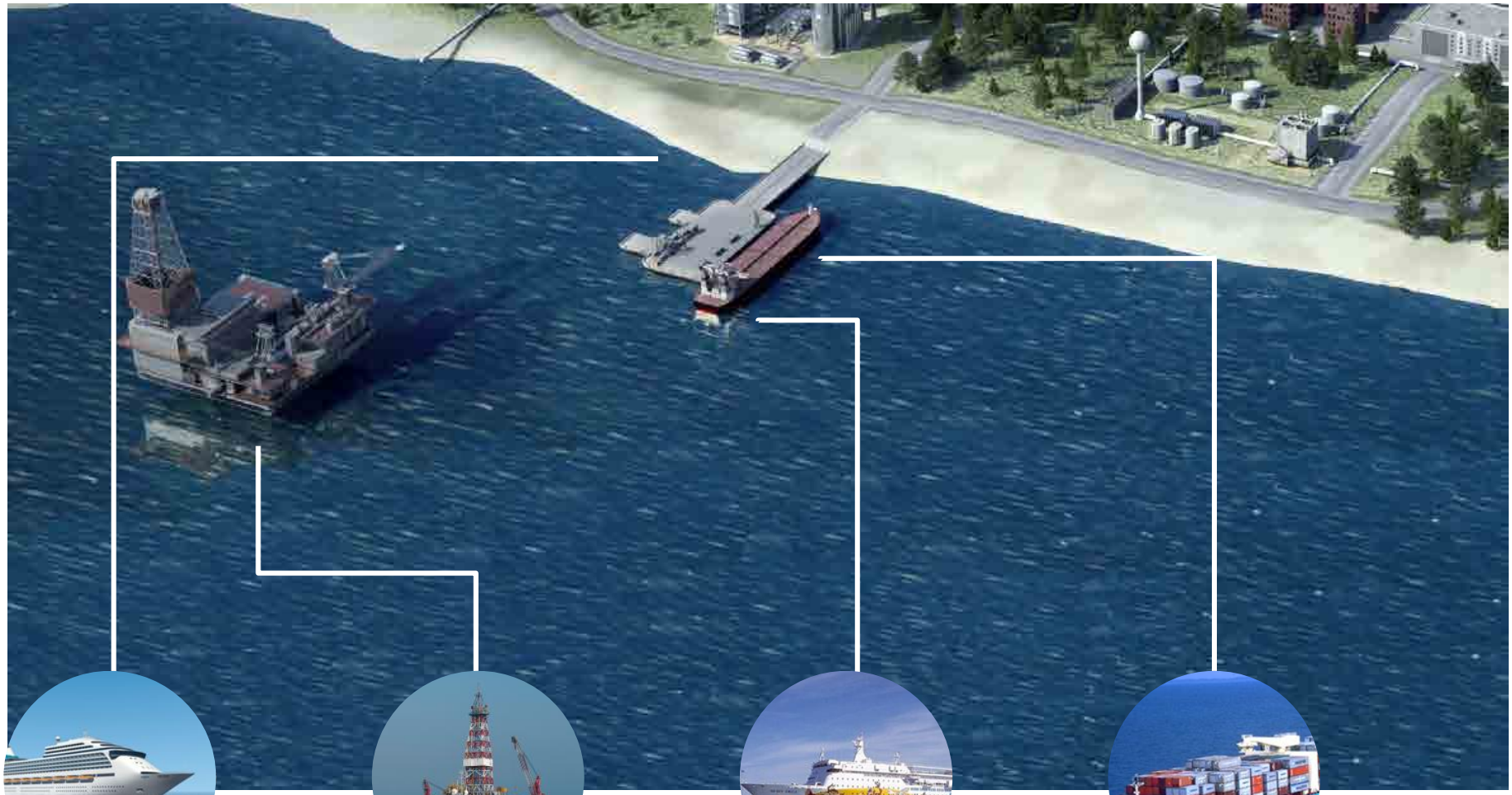
Membrane Technology

Process / House Vacuum

Neutralisation

Market Segment

Marine



Cruisers

Offshore

Ferries

Merchant Fleet

Market Segment Marine

Applications

Hot & Cold Water

HVAC

Ballast Water

Compressed Air

Grey and Black Water in Ships

Bunker Lines

Ballast Water Treatment on Ships

Water Treatment

Market Segment

Water & Gas

Water

Gas

Market Segment Water & Gas

Applications

Water Distribution

Gas House Connections / Service Lines

Transport Lines

Small Dimensions

Water Intake Lines

Water and Gas / Maintenance and Repair

Big Dimensions

Fire Fighting

Market Segment

Water Treatment

Industrial Process Water

Drinking Water Process

Waste Water Treatment

Market Segment Water Treatment

Applications

Membrane Technology (Ultrafiltration, RO)

Neutralisation

Dosing / Dilution

Mixing

Media Filtration

Chemical Distribution / Conveyance

Ion Exchanger

Industrial Grade Water

Market Segment

Building Technology

Industrial Building

Hotel

Hospital

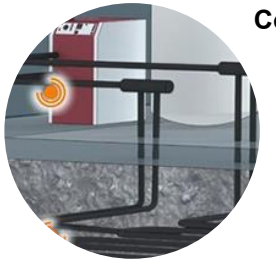
Residential Building

Applications

Hot & Cold Water

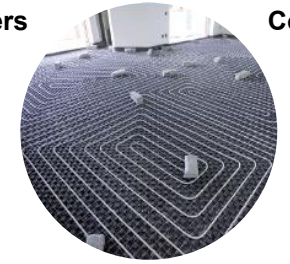
Process / House Vacuum

AC Cooling



Geothermal

Cooling Towers



Heating

Compressed Air

Fire Protection / Sprinkler System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All about you

With more than 60 000 products we meet your every need

Product Materials

Jointing Systems

Threaded

Butt Fusion

Electrofusion

Socket Fusion

BCF Welding

Solvent Cement

Flanged

Mechanical

IR Welding

Push-Fit

Compression

Application Specialists

Which Material is Suitable for my application?

- Determined by the following parameters:

  - ✓ **1. Working Pressure**
  - ✓ **2. Working Temperature . (Average – Not maximum)**
  - ✓ **3. Type of Fluid or Gas, Chemical concentration and mixture.**
  - ✓ **4. Required Design Life of the System**

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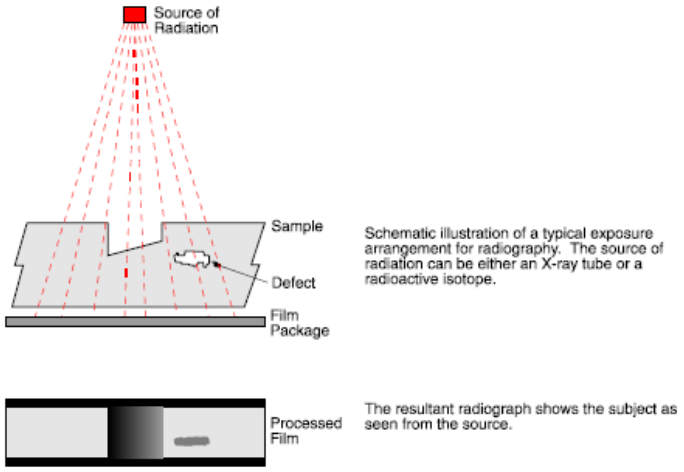
GF Strategy 2020

NDT for Polyethylene Pipe Systems

Non Destructive Testing

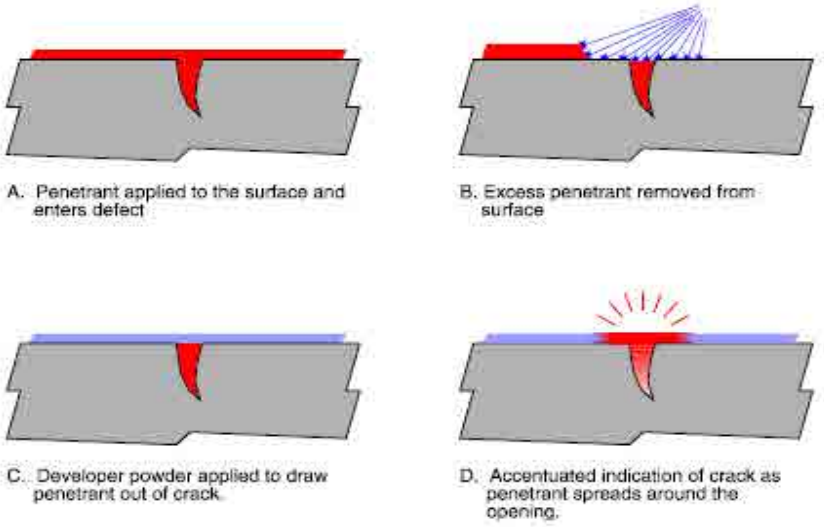
Of the many different Non Destructive Testing (NDT) and inspection techniques for detecting flaws, liquid penetrant and magnetic particle testing account for about half of all nondestructive tests.

Ultrasonic and X-ray methods account for about another third, eddy current testing about 15%, and all other methods for only about 5%.



Schematic illustration of a typical exposure arrangement for radiography. The source of radiation can be either an X-ray tube or a radioactive isotope.

The resultant radiograph shows the subject as seen from the source.



A. Penetrant applied to the surface and enters defect

B. Excess penetrant removed from surface

C. Developer powder applied to draw penetrant out of crack

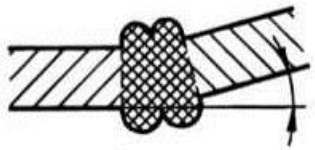
D. Accentuated indication of crack as penetrant spreads around the opening.

NDT Overview

Method of Testing	Limitations
Ultrasonic	Normally requires coupling to material either by contact a fluid such as water. Surface needs to be smooth. No cold welds.
Radiography	Radiation safety requires precautions; expensive; detection of cracks can be difficult unless perpendicular to x-ray film.
Visual Optical	Can be applied only to surfaces, through surface openings, or to transparent material
Eddy Current	Limited to electrically Heat conducting materials; limited penetration depth
Liquid Penetrant	Flaw must be open to surface. Not useful on porous materials or rough surfaces
Magnetic particles	Limited to ferromagnetic material; surface preparation and post-inspection demagnetization may be required

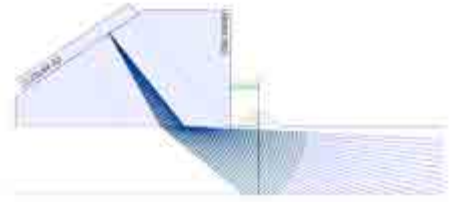
Quality control on construction site
NDT Methods for butt-fusion joints

- Visual DVS 2202-1

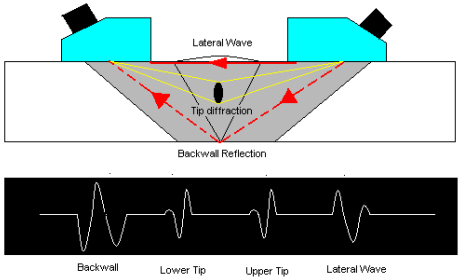


- Bead bend back test

- Phased array ultrasonic (PAUT)



- Ultrasonic time of flight diffraction (TOFD)



Why is Non Destructive Testing (NDT) important.

- NDT is a quality assurance management tool

- Assures the owner that the material & product is safe, reliable and will be “fit for service”

- Materials & products which fail to achieve their projected life due to undetected defects may require expensive repair or early replacement, resulting in early shutdown and revenue loss.

Why is Non Destructive Testing (NDT) important.

- Existing NDT methods focus on metal piping with costly NDT techniques, such as X-Ray

- For thermoplastic systems to be accepted, we need to meet these quality control procedures set out by the various stakeholders (owners, engineering, consultants) in the metal market.

- GF NDT uses ultrasonic technology for butt fusion welds for PE and PP pipe systems
  - Proven ultrasonic technology
  - NO site problems of health and safety
  - NO radiation on site
  - NO bulky test equipment
  - NO complicated documentation

Why test PE and PP Butt Fusion Joints with ultrasonic methods?

- **Hidden** defects are very difficult to detect with “Bead bend back test” or visual inspection methods

- No surprises !

Examples:

- Improper welds with no or only partial fusion caused by inadequate jointing preparation or wrong parameters
- Inclusions like soil, dirt or other contamination in the fusion zone prevents good joining

NDT – Current Status (Metal Pipes)

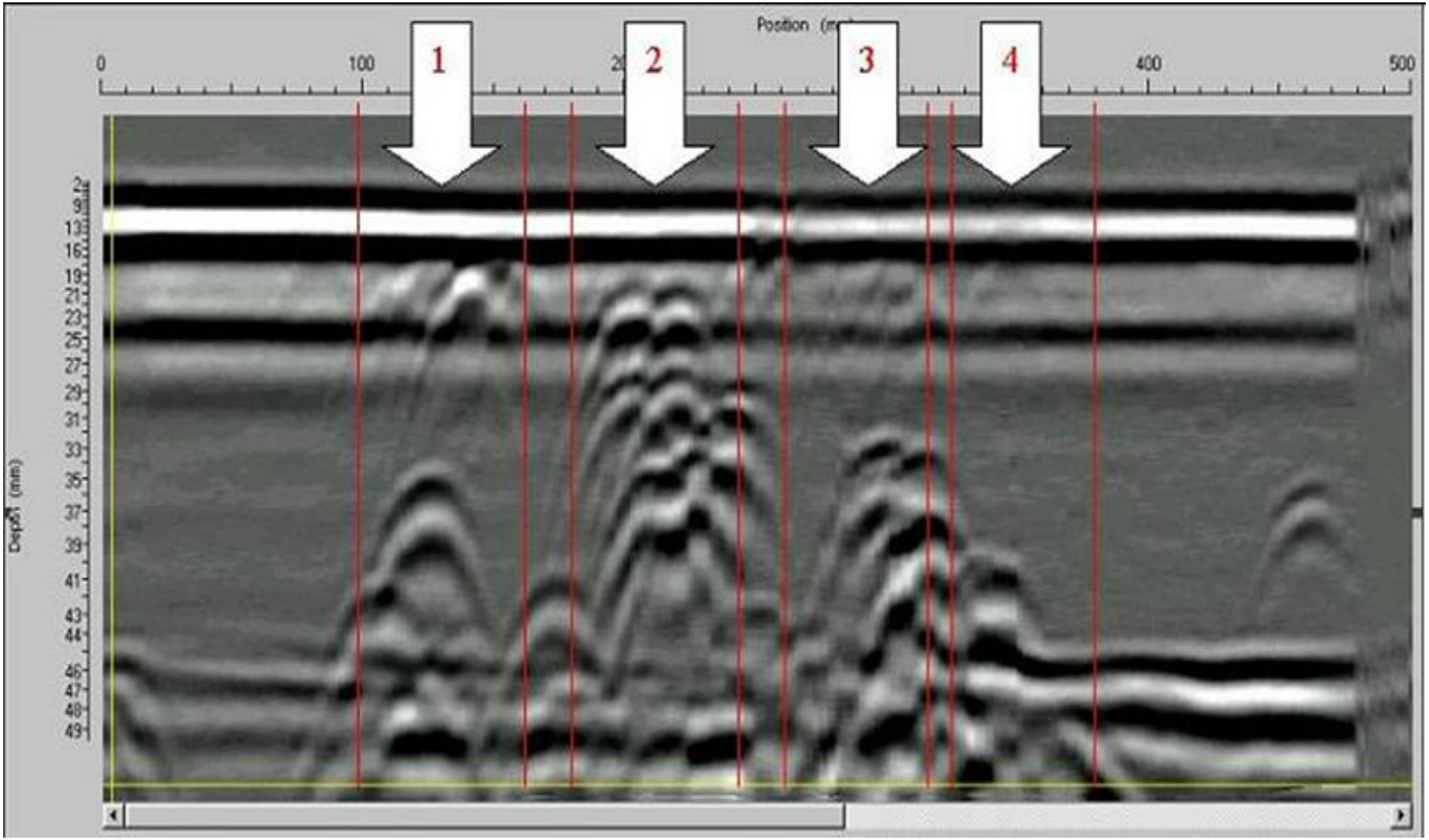
- NDT of metallic pipes often takes 3 days for client to receive the data.
- Client then sends data to a consultant or inspection body to verify the data.
- It is up to the owner of the system to decide whether a questionable joint has to be replaced or not. Up to now no Fail/Pass criteria exists worldwide to support this decision.
- No warranty given.

The First NDT for butt fusion of PE and PP pipes with a pass/fail statement and 10 year warranty

NDT with “Fit for Service” encompasses the GF quality process. By using butt fusion welding, our machines, our training methods, checked with NDT will prove to the owner complete integrity of our system.

- **Increase quality**
  Pass /fail “Fit for Service” weld report
- **Increase safety**
  Detect potential defects at fusion weld
- **Increase savings**
  Between 20-30 tests per day, reducing costs
- **Increase time**
  Fusion weld integrity with long term life expectancy

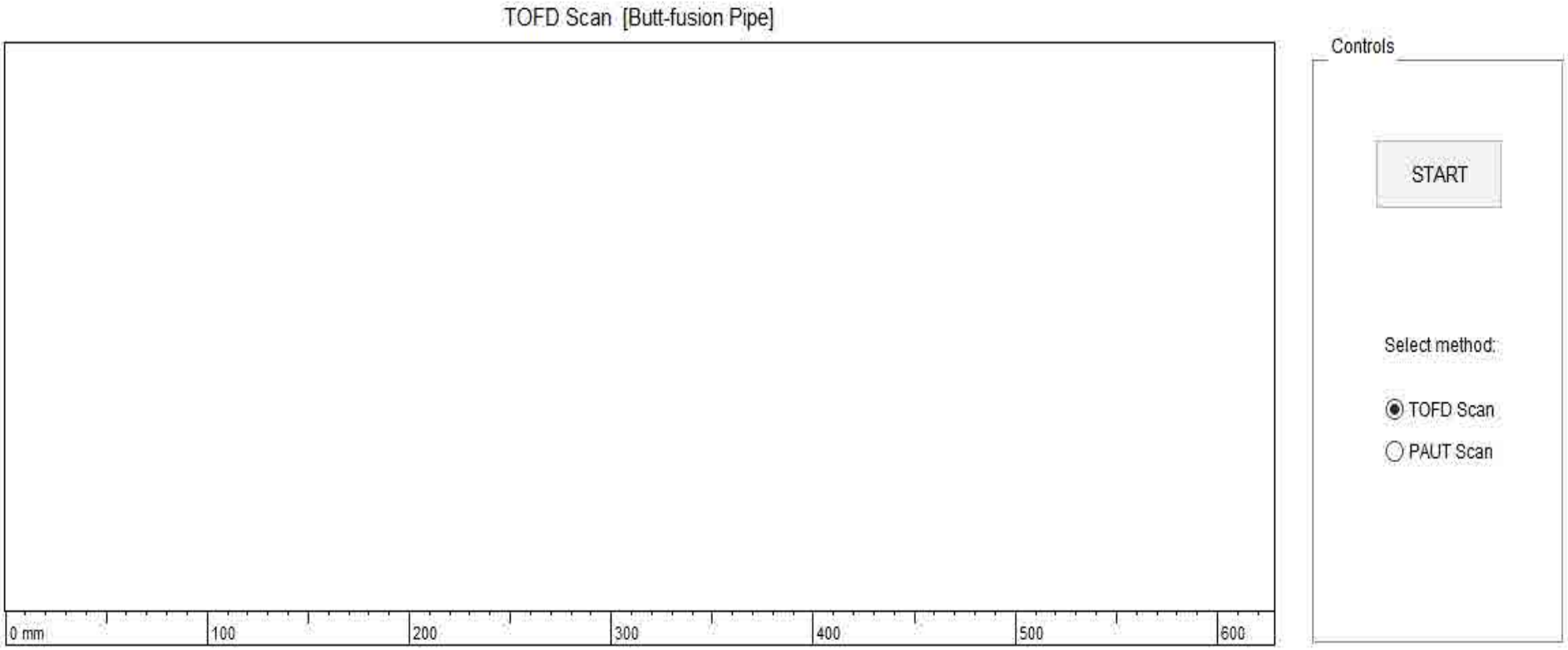
Verification of Pass / Fail criteria



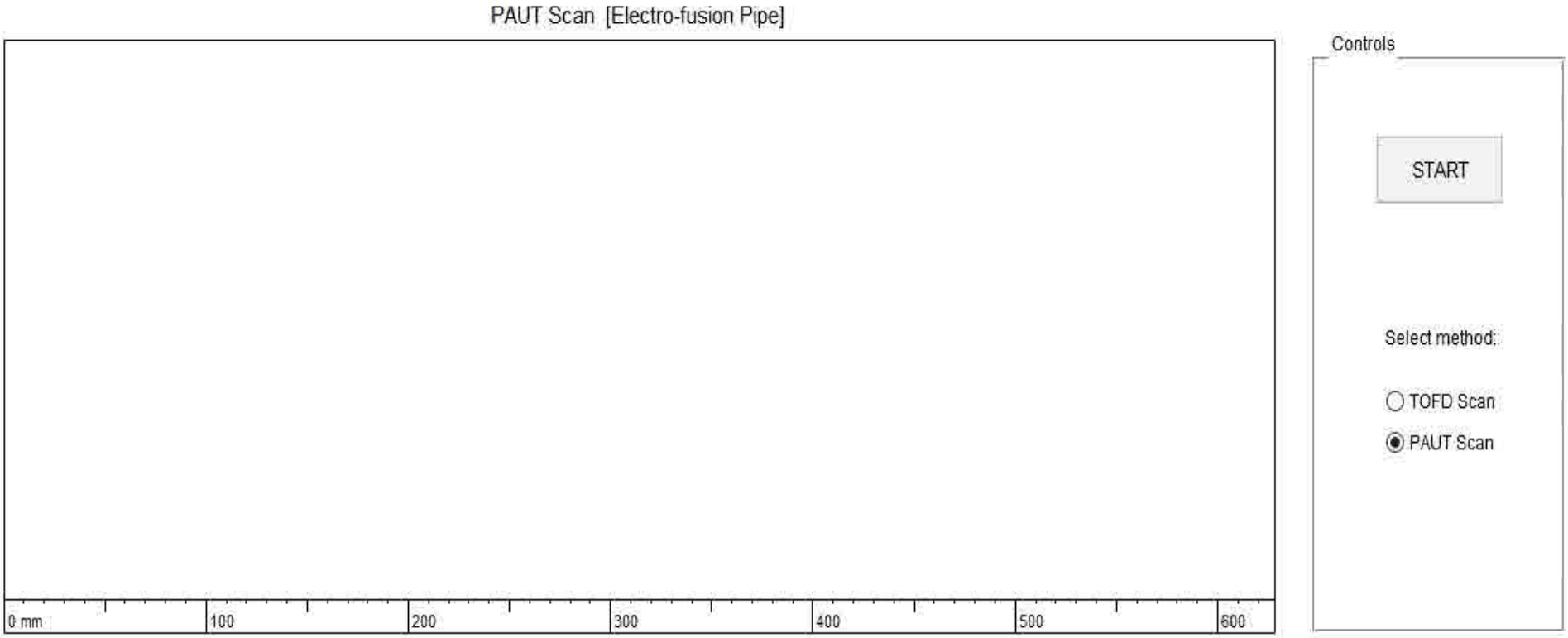
GF NDT – How Does it Work

Essentially a photograph or scan is analysed, and algorithms are used to detect unique patterns on the surface, such as ridges or unique marks, by analysing the lightest and darkest areas of the image.

GF NDT – How Does it Work
Butt Fusion Welds

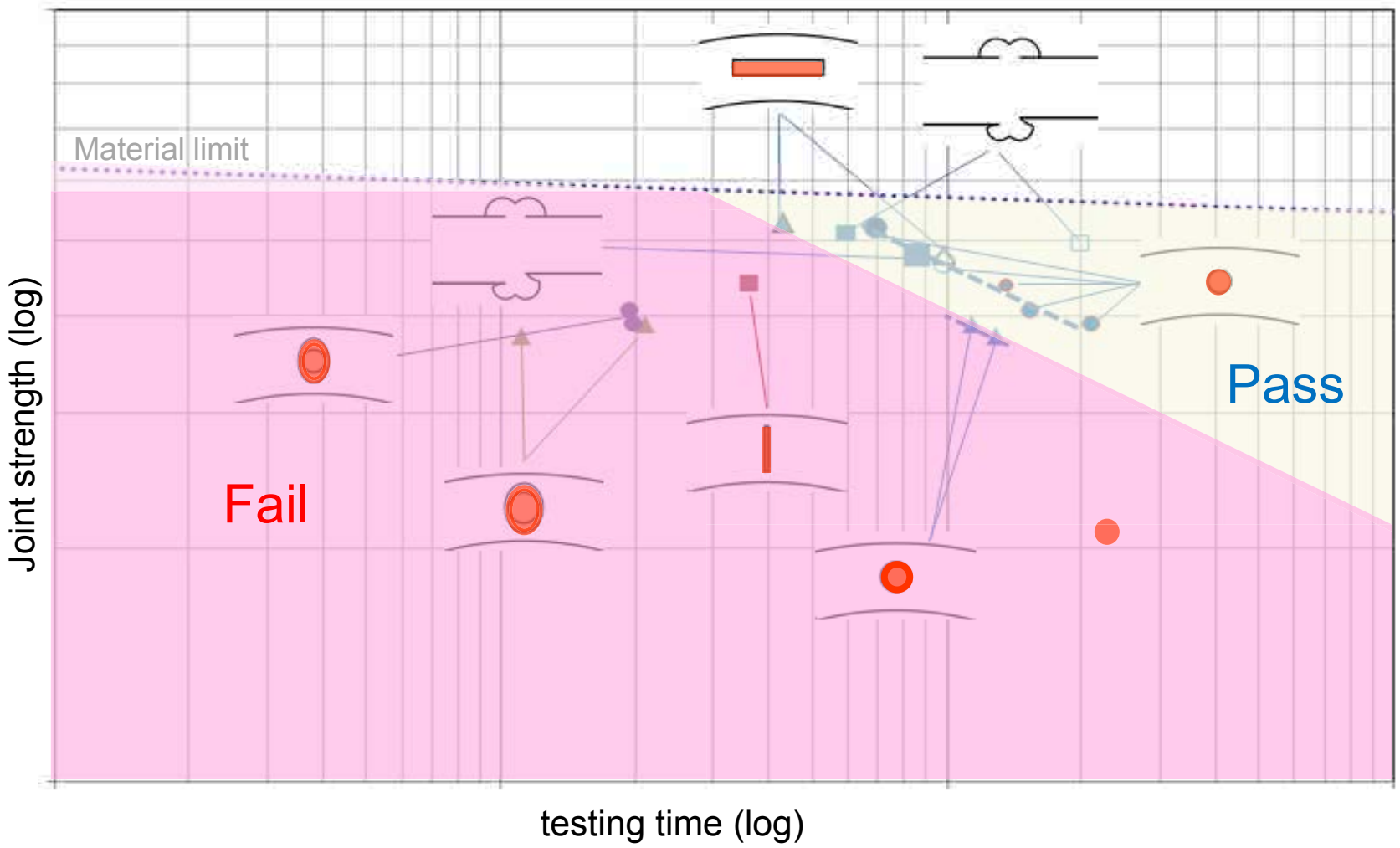


GF NDT – How Does it Work Electrofusion Welds



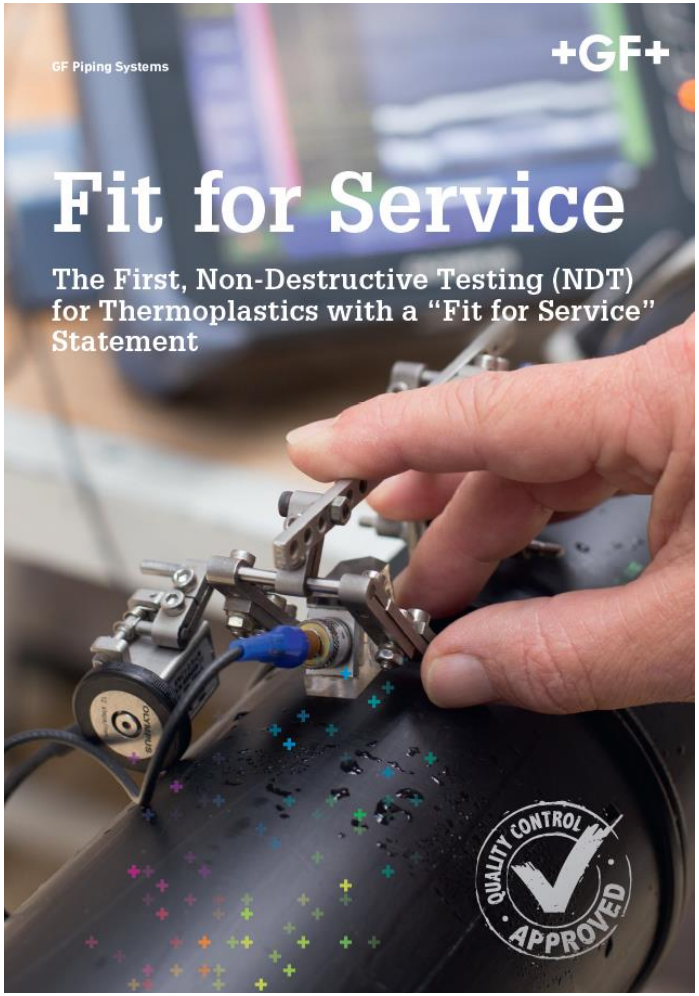
Verification of Pass / Fail criteria

Long term test on BF with different flaws / defects



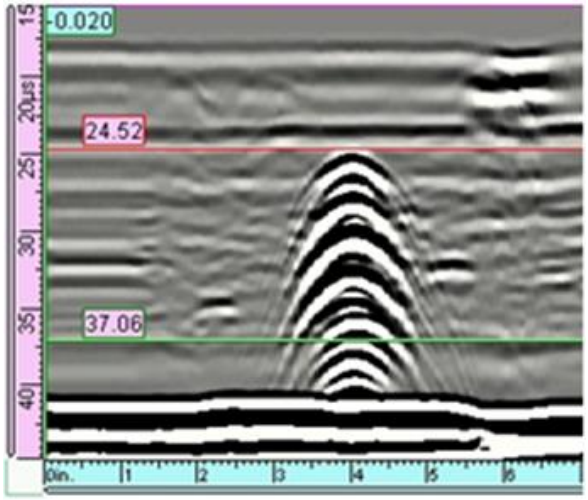
Integrating NDT Services

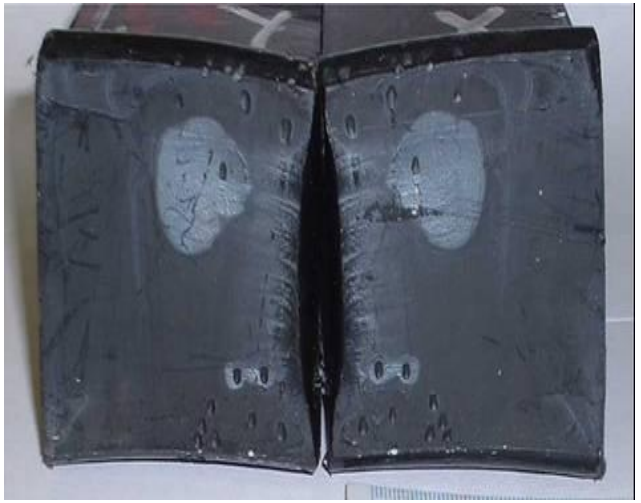
- The actual test is carried out with specially modified sensors and readout display
- Our partner NDT Innovations has over 10 years international testing experience
- GF has now over 14 years internal long term testing know how for NDT “pass-fail” statement
- The primary target of services is to gain entry into metal dominated market segments



NDT of Butt-Fusion Joints with Ultrasonics

Why testing HDPE BF-joints with ultrasonic methods?





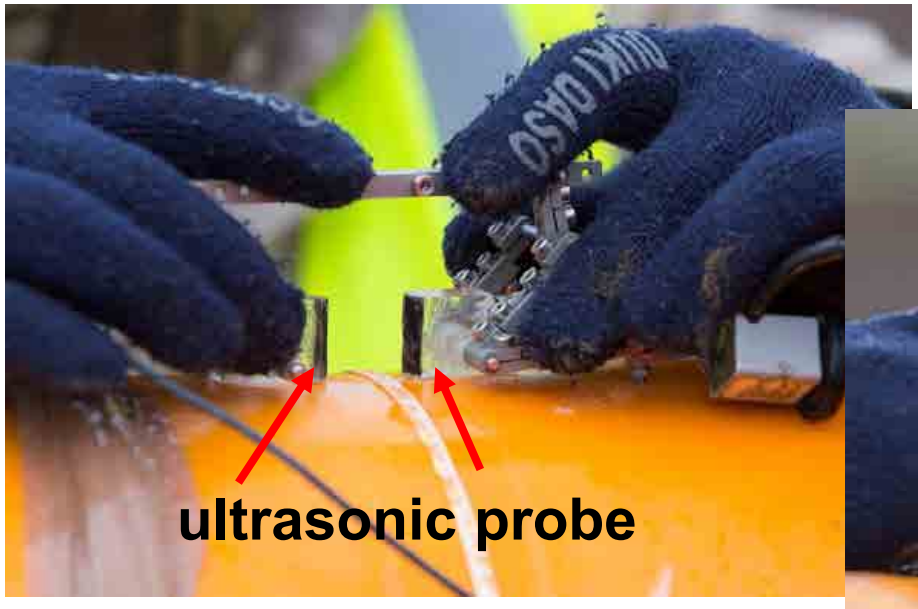
… because it is better to know what is inside the box!

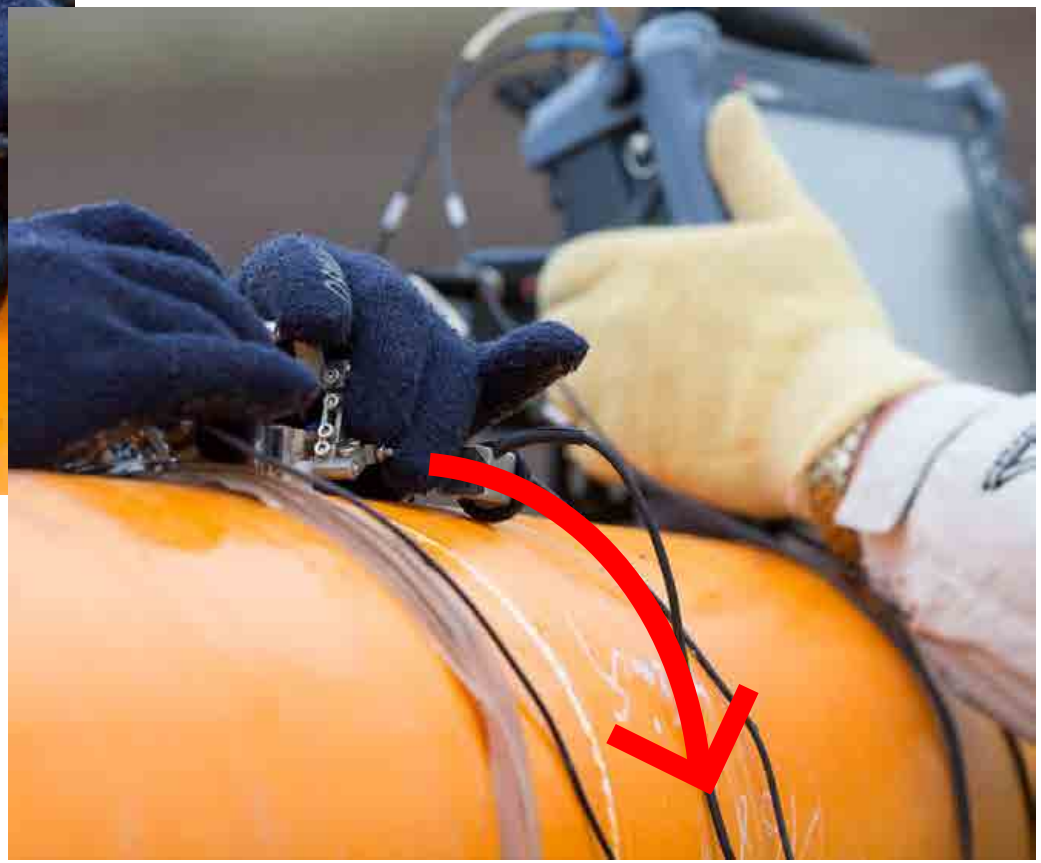
Convert metal heads to plastics

- Metal piping systems currently use a NDE (non destructive examination) to test weld integrity, related to the metal welding procedure used.
- For thermoplastic systems to be more accepted in specific market segments, we need to meet these quality control procedures set out by the various stakeholders (owners, engineering, consultants) in the metal market.
- Using PE100 hidden defects at the weld are currently very difficult to detect with old “bead bend back tests” or visual inspection.
- Using proven technology of Ultrasonic Weld Inspection provides a quick, safe, quality controlled and in-situ testing system.

✓ GF Piping is the 1st company to support the customer, by providing a weld quality judgement derived by its unique pass or fail “Fit for Service” statement and 10 year warranty on the tested weld.

Which method is applied?
Ultrasonic Time Off Flight Diffraction (TOFD)

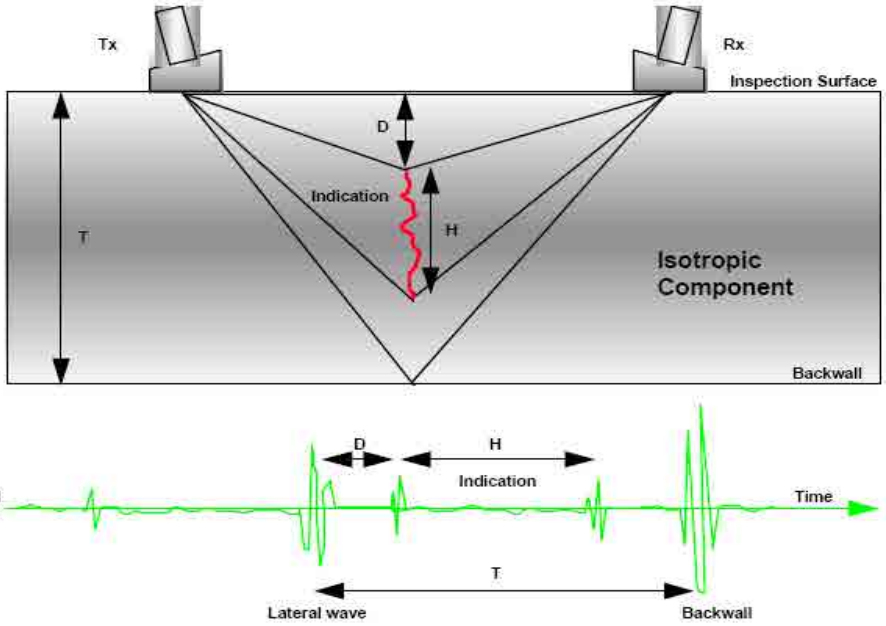




- On both sides of the weld an ultrasonic probe is positioned and moved along the entire bead

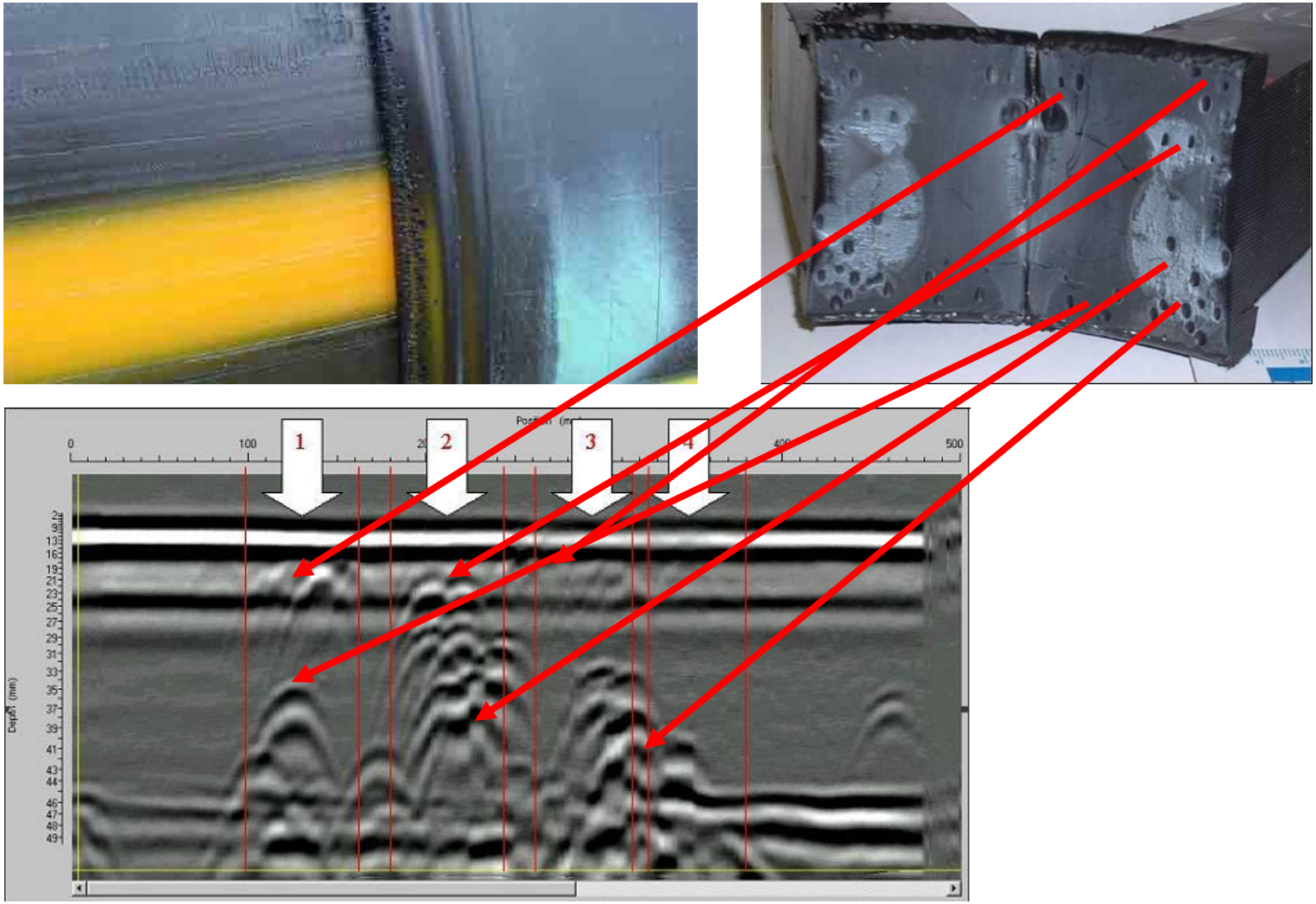
Ultrasonic Time Off Flight Diffraction Brief description (TOFD)

- One ultrasonic probe acts as an emitter and sends the ultrasonic waves through the wall thickness (T), the other probe acts as a receiver.
- When an ultrasonic wave interacts with a flaw it results in diffracted waves from the crack tips.
- Dimensions of flaws are measured by calculating the time of flight of the diffracted waves from the sender to the receiver.

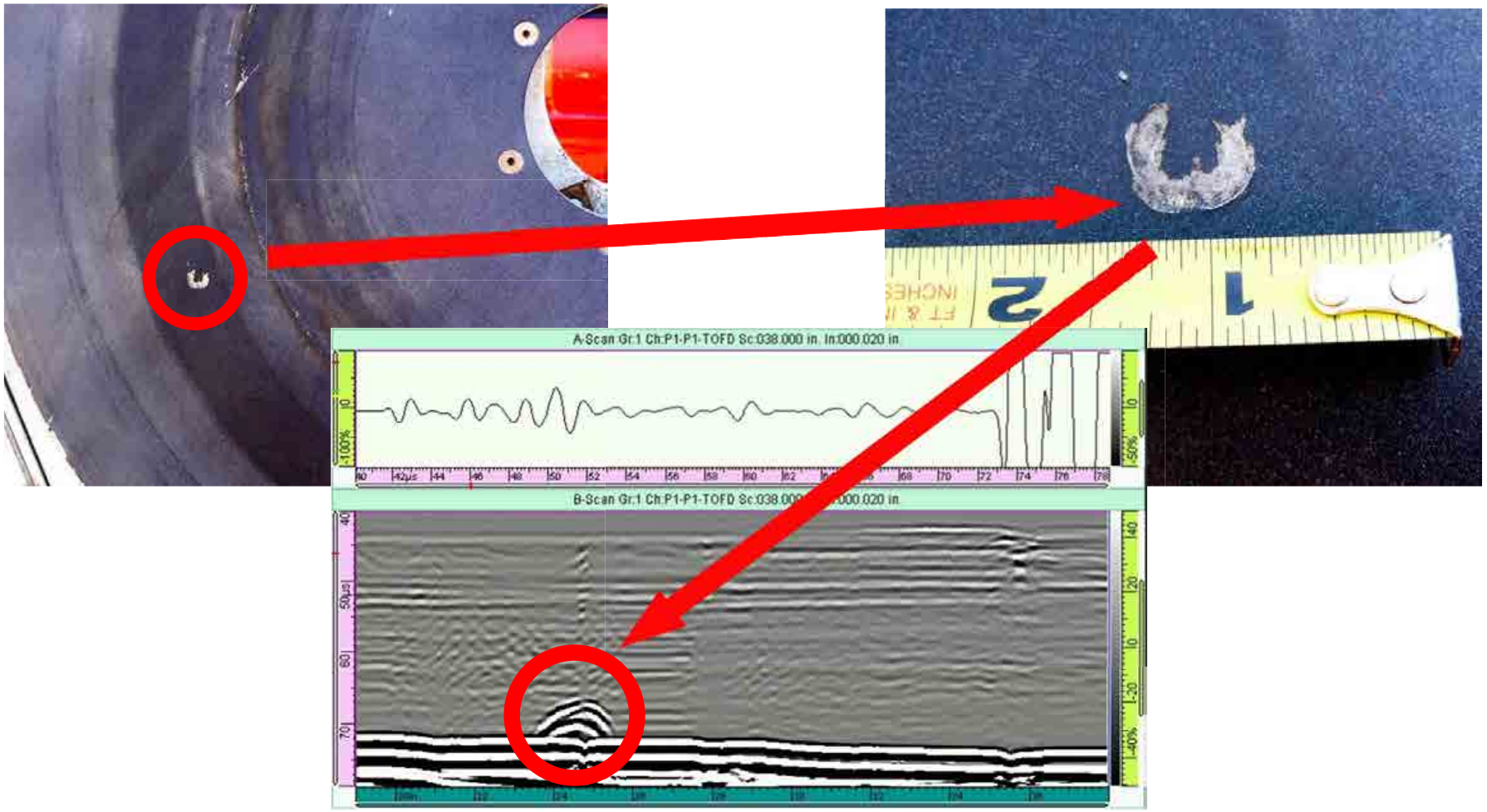


T = wall thickness

Example of defects
Porosity in fusion boundary



Example of defects
Contamination from heating plate



What can GF Services offer?

- On-site testing of PE and PP butt-fusion joints by a certified crew for pipe sizes 63mm – 1600mm (butt fusion joints).
  (inspectors qualified in accordance with SNT-TC-1A or PCN/EN473 or CSWIP or equivalent approved)

- Report of each tested joint with or without indication of detected defects. Defects as small as 1.0mm in size.

- Clear and documented Fit For Service statements (pass / fail) regarding the long term behavior of the joints.

NDT Testing - Size Ranges

	2016	2017
Butt Fusion metric range	63mm - 1600	-
Butt Fusion ASTM range	4” – 42”	-
Electrofusion range metric	63-315	>315
Electrofusion range astm	-	4”-24”

NDT Testing – For Butt & Electrofusion

Reference Codes and Standards

Reference	Title
E317	Standard Practice for Evaluating the Performance Characteristics of Ultrasonic Pulse-Echo Testing Systems without the Use of Electronic Measurement Instruments
B31.3	Process Piping
SNT-TC-1A	Recommended Practice for Qualification of Non- destructive Examination (NDE) Personnel
BS7706	Guide to Calibration and Setting-up of Ultrasonic Time of Flight Diffraction (TOFD) Technique for the detection Location, and Sizing of Flaws
EN 583-6	Non-destructive Testing - Ultrasonic Examination - Part 6: Time-of-flight Diffraction Technique as a Method for Detection and Sizing of Discontinuities

Tasks associated to metal welding*

Task	Description - metal	Description - plastics	Benefits of non metal piping technology
Material Preparation	Blasting, removal of oils, etc.	Surface cleaning with normal cloths	Reduced costs for initial pipe cleaning Reduced time for cleaning
Joint Preparation	For butt welding – bevelling of pipe using bevelling equipment	Peeling oxide layer and straight edge in one step, cleaning with Tangit cleaner	Minimal specialised equipment needed, no additional process preparation steps, time saving
Preheat/tack-up	Raising the temperature of the parent steel before welding slows the cooling rate of the weld and base material providing greater resistance to fabrication hydrogen cracking	Clamping of pipe in machine	No additional time consuming jobs, reducing costs, increasing speed of installation
Actual welding & onsite costs	Welder labour, hot work permits, consumable materials (electrodes, shielding, gas) 10 off 2” welds per 8 hr day	Automated or manual fusion process 32 off 2” welds per 8 hr day	Minimal training required to operate HDPE butt fusion machine No costs for welding electrodes, shielding and other consumables No hot permits, reducing fire risks, reduce documentation, reduce health and safety risks, no flames on site Butt Fusion Machine rental pool or as investment Increased number of welds per day
Post-weld treatments	Brushing, grinding, passivation and pickling to remove all imperfections including slag/spatter	Not needed	No additional cleaning costs, minimize safety risk, reduced environmental pollution risks Reduced weld induced stresses, increase lifetime, reduce maintenance costs associated with weld fatigue and corrosion
Pickling/passivation	Hydrofluoric / nitric acid / citric treatment	Not needed	No acid cleaning costs, minimize safety risk, reduced environmental pollution risks No chemical waste disposal system, reducing costs No specialised personal protective equipment require Reduced air monitoring equipment costs
Non destructive examination (NDE)	Radiography, magnetic particle, liquid dye penetrant, ultrasonic	Visual bead inspection, and ultrasonic with pass/fail criteria and warranty	No costly Radiography tests with increased health and safety risks Easy Ultrasonic NDT for HDPE butt fusion with Pass/Fail

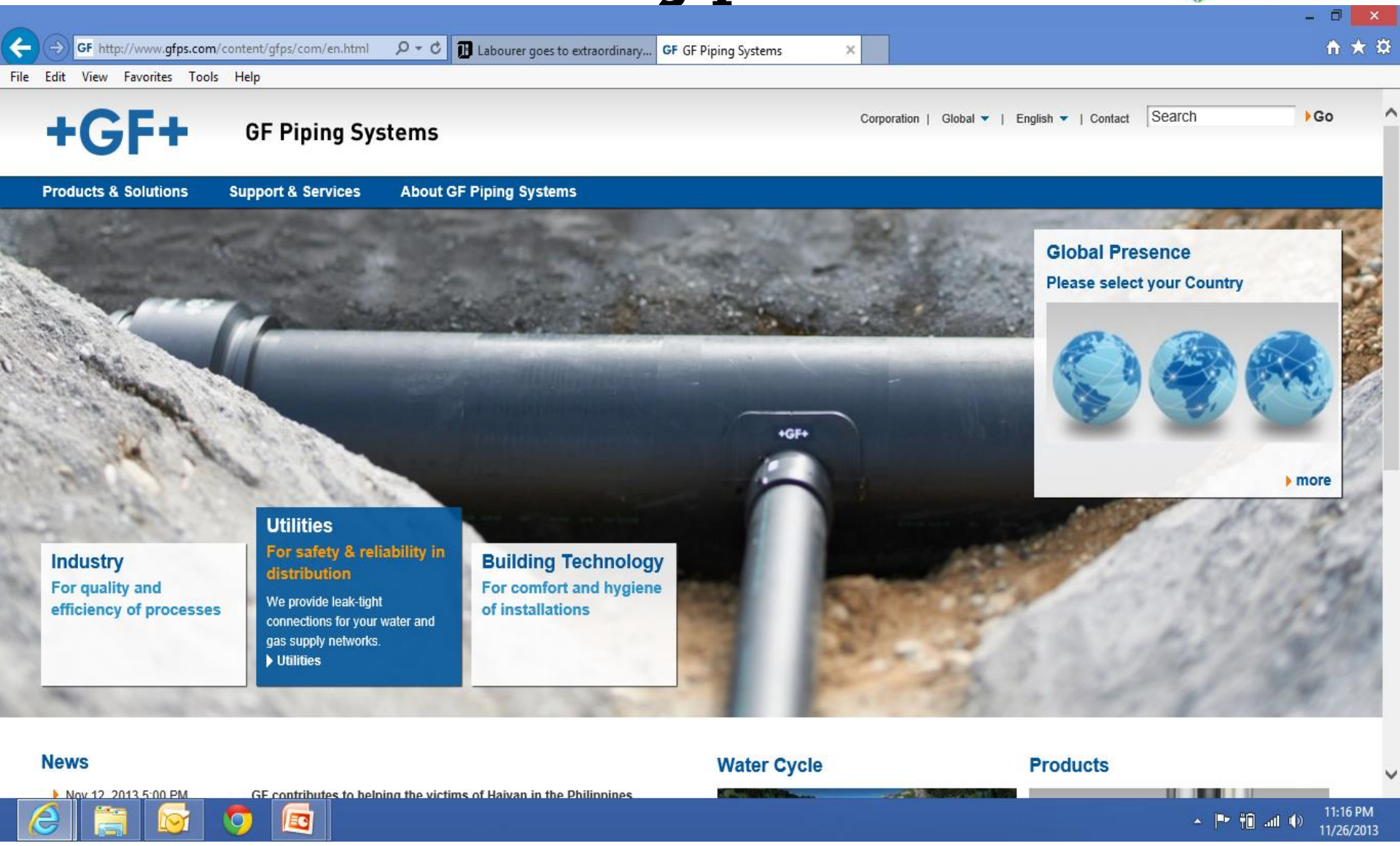
*Compared to HDPE butt fusion

NDT Testing - Conclusions

- NDT is the last element in the installation chain of a safe PE100 piping system.
- A safe PE piping systemstarts with high quality products made from PE100 material listed by thePE100+ association.
- The welding has to be carried out by a certified operators using properly working welding equipment where the complete fusion process is monitoredand documented.
- The very last puzzle piece for successful NDT a correctly working QA/QC organization has to be established on the job site.

More Information

New Web-Site – www.gfps.com



New CAD Library

GF Piping Systems

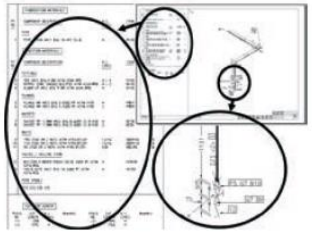
+GF+

CAD Library

- 3D/2D Drawings
- >30 different formats
- Complete GF Product Range
- cad.georgfischer.com

The comprehensive CAD library is GF Piping Systems' most frequently used planning tool. The database comprises over 25,000 drawings and technical data on pipes, fittings, measurement and control technology, and manual and actuated valves

GFDO_6361_4 (03.14)



Multiple Systems

AVEVA PDMS – New addition
AUTOCAD
AUTOCAD Architechure
AUTOCAD Revit
CADdy
CATIA 5
Cimatron E
Inventor
Mechanical Desktop
Mega CAD
One Space Designer
ProEngineer
Solid Edge
Solid Works
Top Solid
Vector Works
Multiple extensions: dgw/dxf

Features

- Data Packages with all drawings of a system
- Complete CAD Library with more than 25.000 drawings
- Includes pipes, fittings, valves, measurement and control
- 3D and 2D graph view of the data
- Optimized user interface
- Direct insertion driver for the most common CAD systems
- Fast access

Your benefits

- Use globally available products in designing
- Complete thermoplastic materials library from 1 source
- Maximise project quality, helps "right first time" design
- Save and share CAD files with DWG drawings
- Create part and complete drawings easily
- Continuously check your designs against cost targets

Your contact
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New Information on Fitting Bag

Manufacturer

Trade name

Product symbol

Dimension

Batch-No.

Traceability

EAN-code

Manual

Fusion data

QR-Code

NEW!

Fusion

barcode

New QR Codes


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Learn more about our range of Electro Fusion Fittings
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ELGEF Plus Saddles
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ELGEF Plus Electrofusion Couplers
ELGEF Plus electrofusion couplers are grouped into various size ranges. In this way, individual dimension requirements are fully satisfied. In the smaller sizes a coupler is available which especially fulfils service line conditions. Couplers up to ø63 mm can be easily matched with all GF Piping Systems threaded transition adapters.
The active reinforcement used for large couplers compensates for large differences in outer diameter tolerances. The extra large clearance permits easy assembly and accomodates the pipe ovality often found in practice.
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Technical data
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Training video
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ELGEF Plus Electrofusion Couplers
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Water and gas distribution
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Transport lines, distribution lines, house connections
Advantages
Technical data
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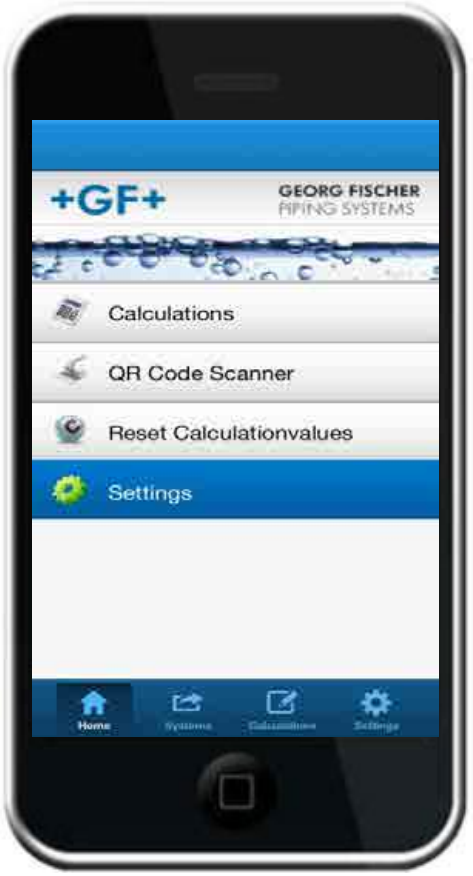
New Apps



Pipe Engineering App

FlowCalc App

New Apps

9900 Transmitter App

New Social Networks

Facebook/GeorgFischerCorporation

Twitter/georgfischer

LinkedIn/GeorgFischer

Xing/GeorgFischer

youTube/GeorgFischerCorp

GF Piping Systems

Worldwide

>200 years of successful corporate history

>50 years of proven production technology, experience and know-how in plastics

>100 countries supported with international experience and local market know-how

>60,000 products and a comprehensive range of systems

>100 applications along the entire water cycle

∞solutions

for your individual needs

Thank you

We ensure

Exclusive Agent

15 years in Utility business in KSA

Three branch's (Riyadh – Jeddah – Dammam)

Accredited Machine Service Center – Riyadh

GF Accredited and Certified Personnel to train and certify welders

Training center in Riyadh Al Hair Rd – Deep technical expertise in PE solutions.

- Welder Training
- Inspector Training / Setting Quality procedure GAS