



Improving the Integrity Assurance of Bolted Joints

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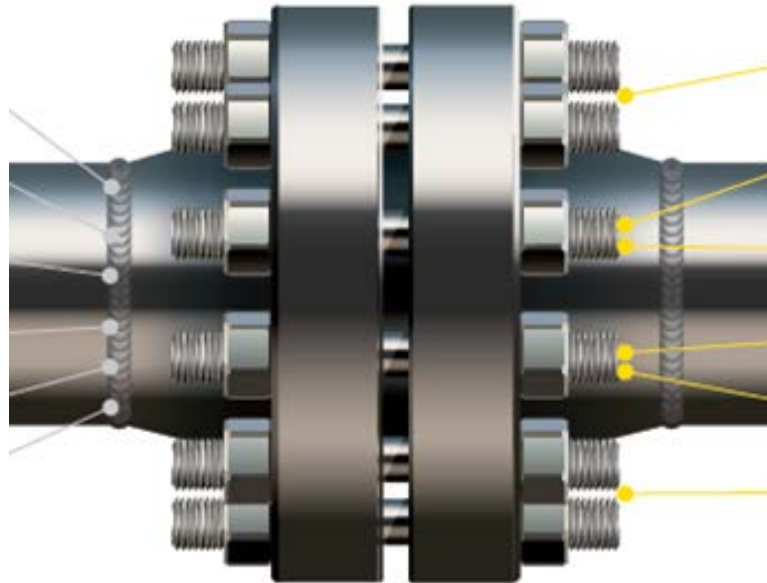
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Themes.....

- Bolted Joints do not need to be Weak Points
- Bolted Joint Integrity Programs can be Developed
- Focus on Joint Integrity improves Safety & Plant Performance

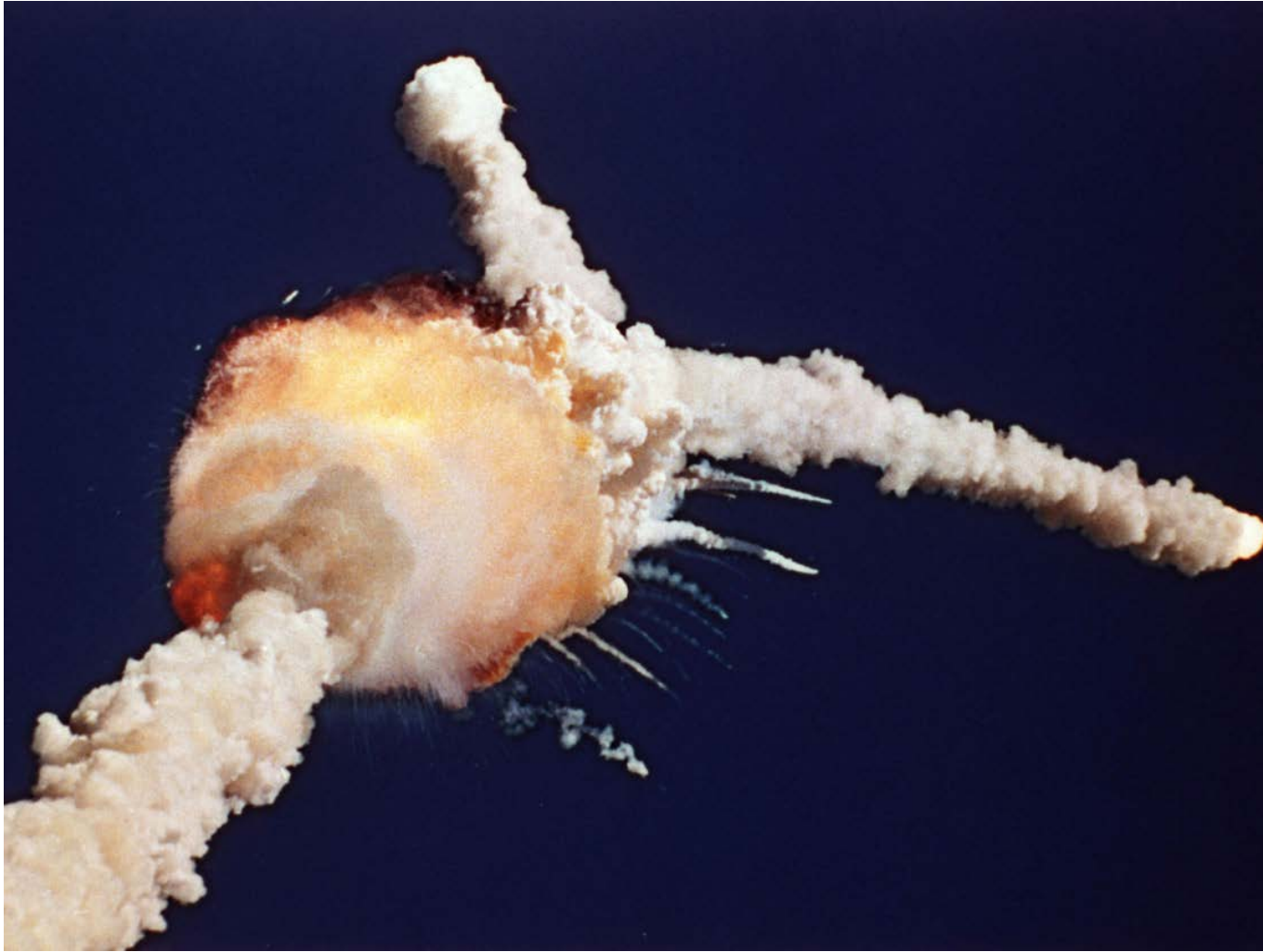
Some Thoughts.....

- Simple Structures
- Critical Function



- Treatment **HAS TO** Reflect the Function
- Every Intervention Introduces Risk

Challenger Space Shuttle 1986



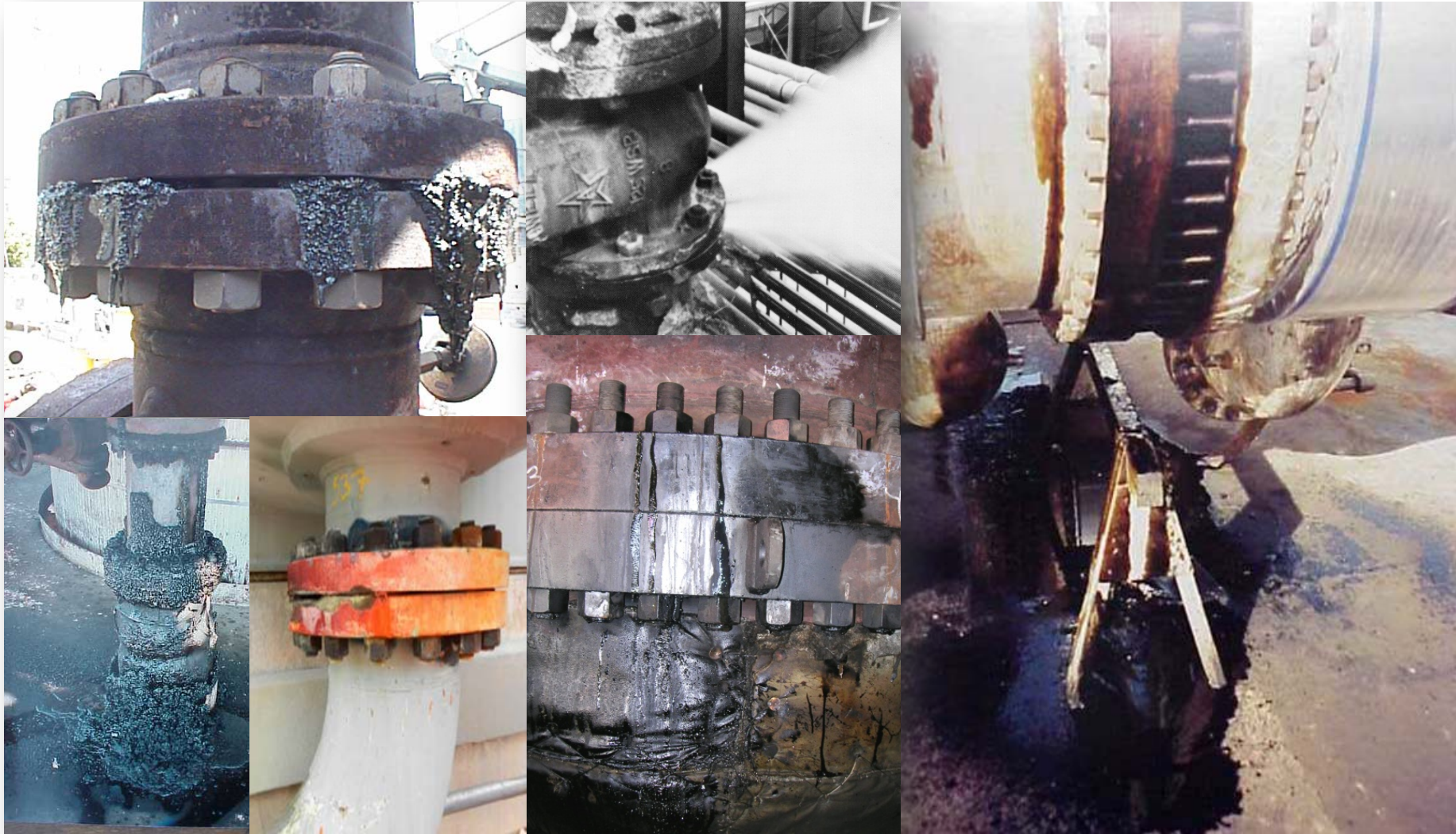
Joint Failures Cost Money.....



This Joint passed a Nitrogen Helium Leak test but leaked 3 years later causing an explosion.

The cause -fitting a Carbon Steel Seal Ring instead of a Stainless one. (\$30m in damage)

“Our Joints Don’t Leak...!!.....”



Leaks Cause Fires – Fires Are Expensive



Fire presumed to start from a safety valve; the bolting was believed to be incorrectly tightened.



Because of joint leakage, the process was altered leading to fires in four columns

Examples of Hydrocarbon asset losses:

- *USA* - \$80m
- *Mexico* - \$136m
- *Italy* - \$65m
- *Saudi* - \$60m

Source :-Marsh Report

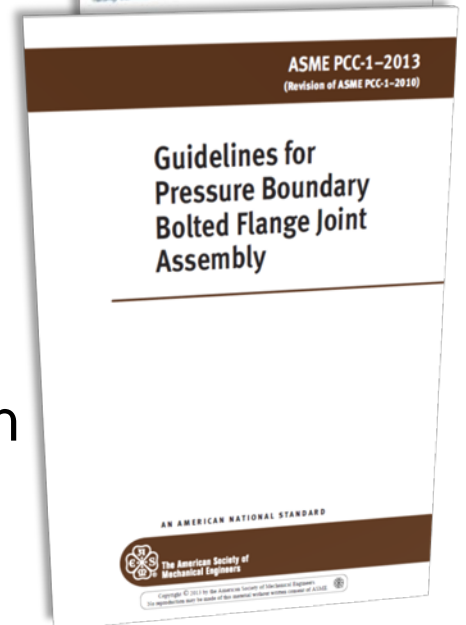
2013 – A Great Year for the Bolted Joint.....

CEN EN 1591 – 4: Flanges and their joints – Part 4: Qualification of personnel competency in the assembly of the bolted connections of critical service pressurized systems.

Sets a performance standard for technician competency.

ASME PCC-1 2013: Guidelines for Pressure Boundary Bolted Flange Joint Assembly.

Defines a performance standard for bolting assemblers & provides comprehensive guidance on the execution & assurance of joint integrity.



Competence

- Training \neq Competence
 - Safe and Correct Practice
 - Assessment
 - Over Time



The ASME PCC-1 2013 stated Guiding Principle.....

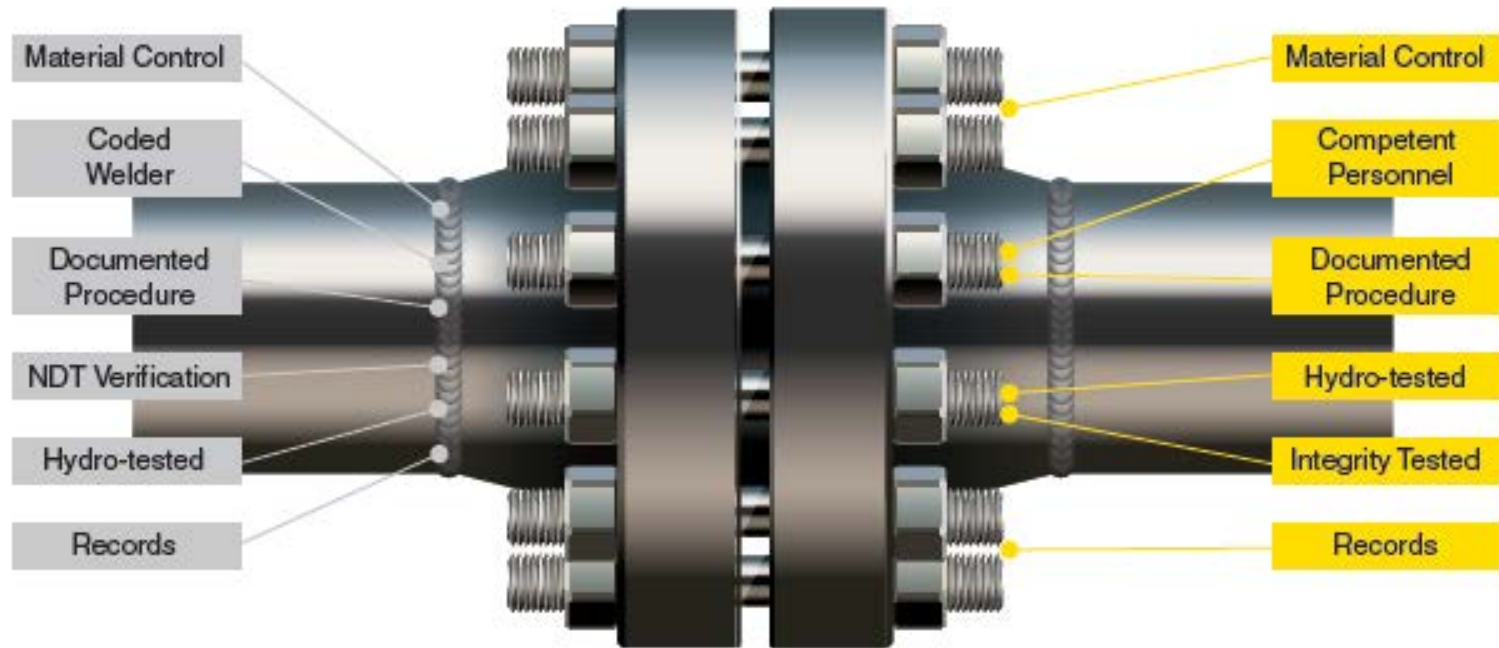
ASME stated principle:
Treat every bolted joint as though it were a welded joint

Welded Joint

Material Control
Coded Welder
Documented Procedure
NDT Verification
Hydro-tested
Records

Bolted Joint

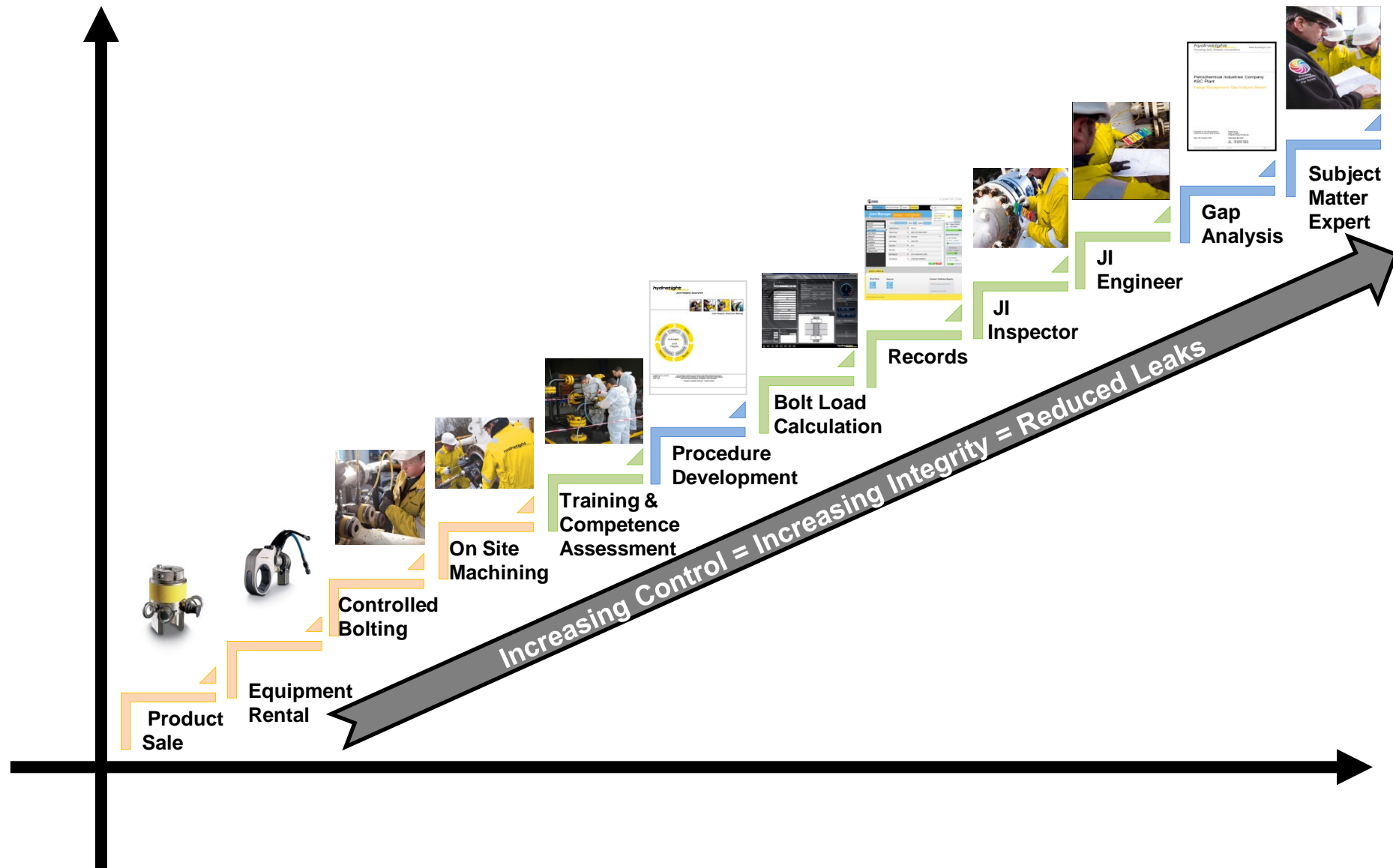
Material Control
Competent Personnel
Documented Procedure
Hydro-tested
Integrity Tested
Records



Essentials for JI/Flange Management



Joint Integrity Assurance™: A Step by Step Process

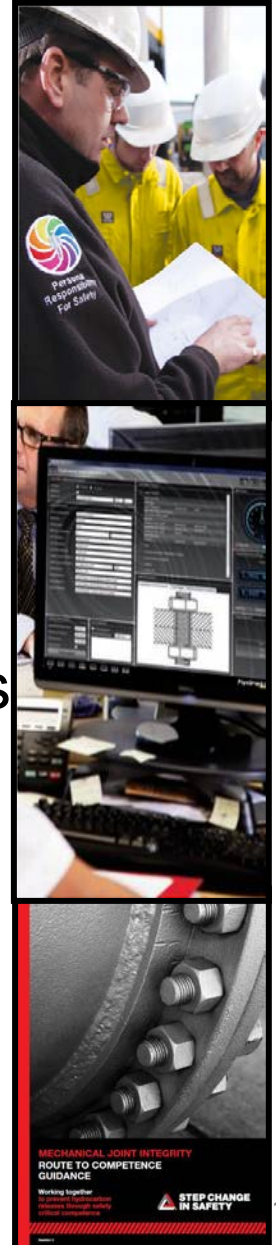


Joint Integrity Assurance: Benefits

- Fewer Leaks during Testing ahead of Start-Up
- Lower Repair Costs and Testing Costs
- Safer Start-Up & Operations
- Faster Start-Up
- Fewer Unplanned Outages

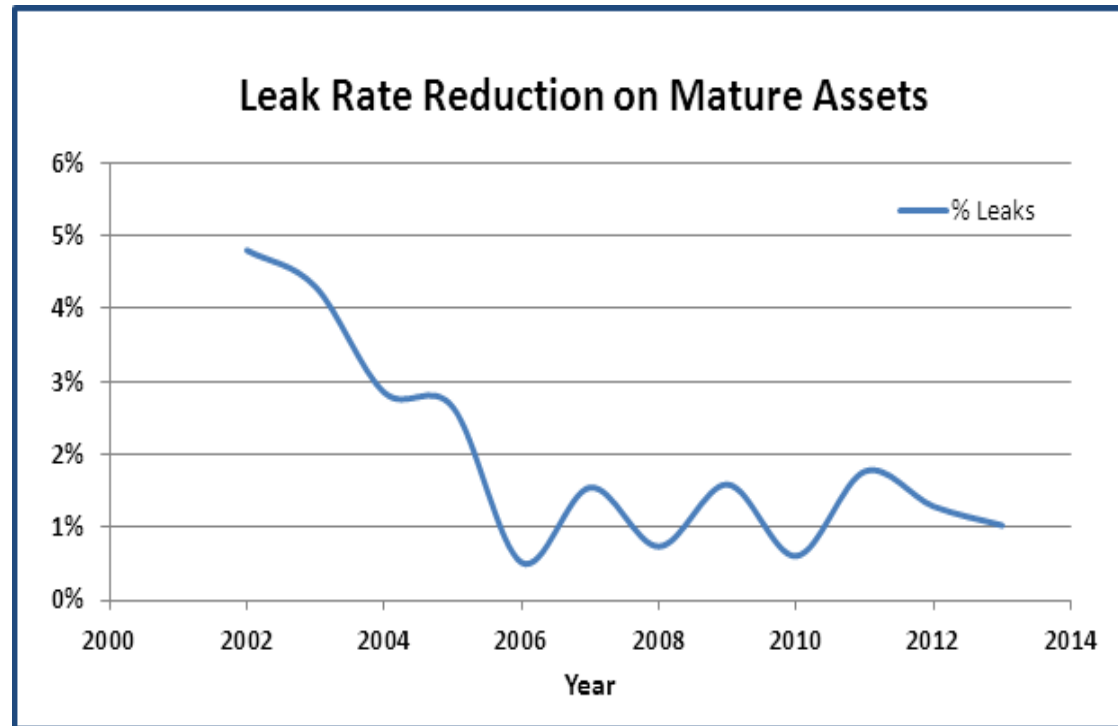
Joint Integrity Assurance: Real Results

- Review of All Procedures
- Adoption of Updated Bolt Loads
- Pre-Shutdown Awareness Campaigns
- Mandatory Training of **ALL** Mechanical Contractors
- Close Monitoring/Supervision/Inspection



Joint Integrity Assurance: Real Results

- **Pre-Campaign – up to 5% Joints Leaked under Test**
- **Examinations – Need to Understand Why?**
- **Pre-Campaign – Average of 1.4 Tests per System**
- **Implement Improvements**



- **Post-Campaign – Less than 1% Joints Leaked under Test**
- **Post-Campaign - Average of 1.1 Tests per System**

Joint Integrity Assurance: Summary

- Shutdowns Cause Leaks: Leaks Cause Shutdowns
- Increasing Global Focus on Bolted Joints
- Be Aware of the Latest Information Available
- Understand Your JI Process – Introduce/Validate/Seek Help
- Leak Free Start-Up is Achievable

Questions?

