Centro Sviluppo Materiali S.p.A.

## RFCS “JOINTEC” RESEARCH PROGRAM

# FULL-SCALE TEST PROGRAM

# Trial test on 508mm OD pipe



*Fredensborg, 4 June 2009*

# INTRODUCTION

**A trial full scale test was carried out on a 508 mm OD plain pipe without any connection, in order to fulfill two main scopes, aimed to prepare the actual tests on real connections and make them (hopefully) more reliable and straightforward:**

- **define and verify an adequate welding procedure (WPS) to connect the test specimen to the machine grips**
- **set up and verify the control parameters of the testing machine**

# Test specimen

# Test specimen

# TEST SPECIMEN INSTRUMENTATION

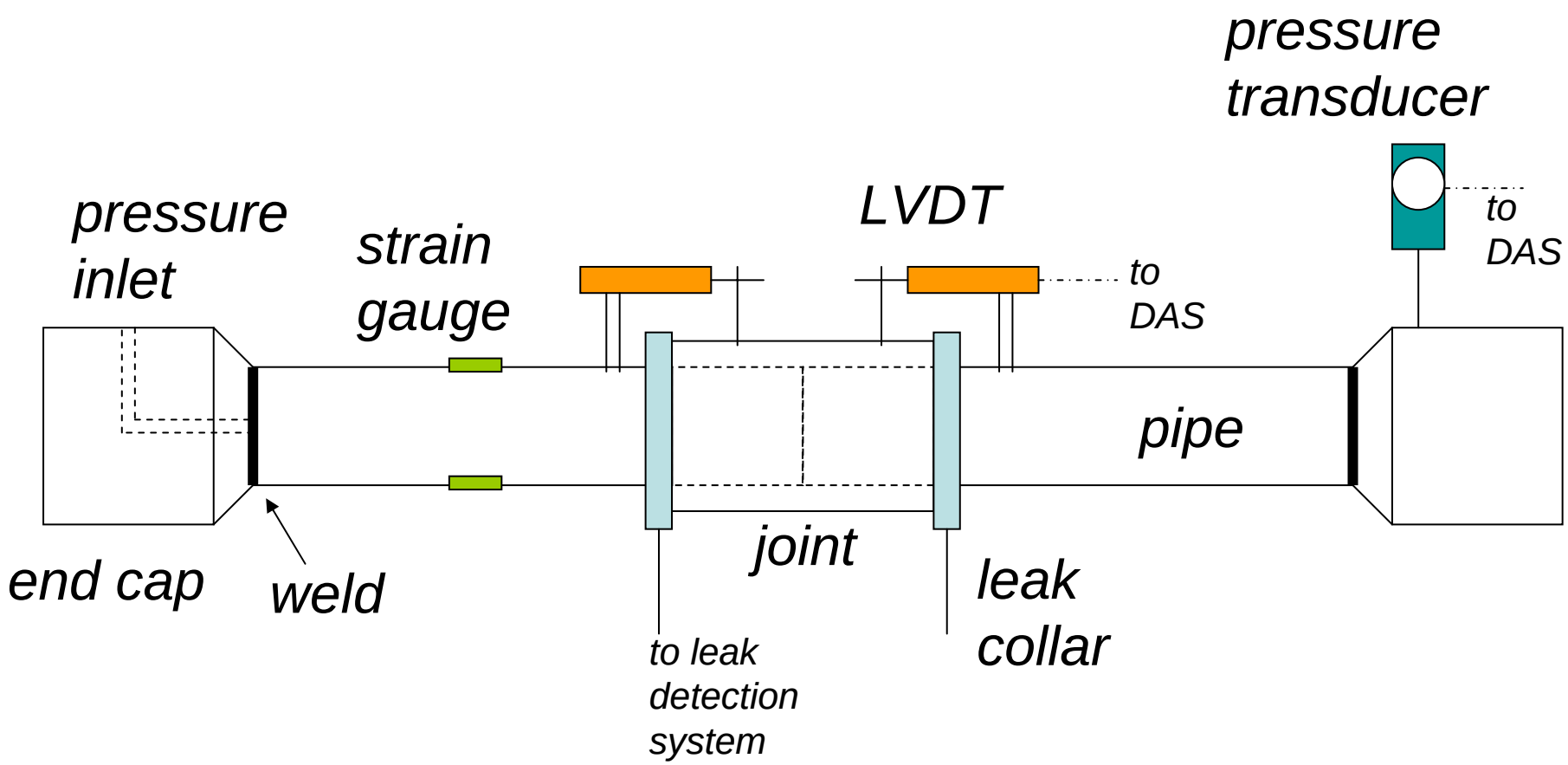
The test specimen was instrumented with several sensors, in order to control and verify the load application:

- strain gauges, to verify both bending and axial loads
- displacement transducer, to verify specimen curvature
- pressure transducer to monitor applied internal pressure

The application of scheduled loads (axial, bending, internal pressure) is controlled with the specific instrumentation of the machine

Additional devices will be put on actual specimens to verify connection behaviour (displacement transducer, leak collars)

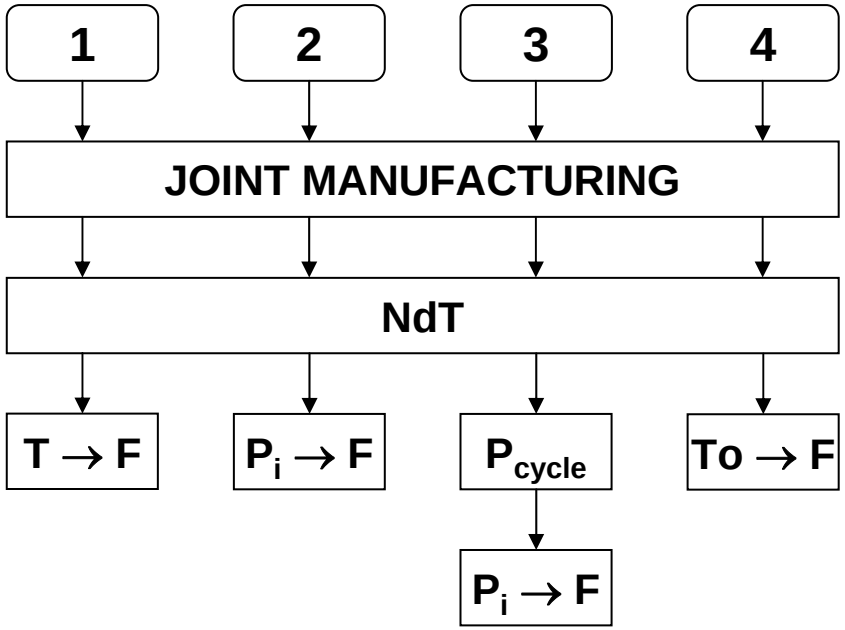
# TEST SPECIMEN INSTRUMENTATION FOR ACTUAL TESTS



# Trial test specimen loaded into the testing machine

# PROPOSED TEST PROCEDURE - SUMMARISED PROCEDURE

## SZMF



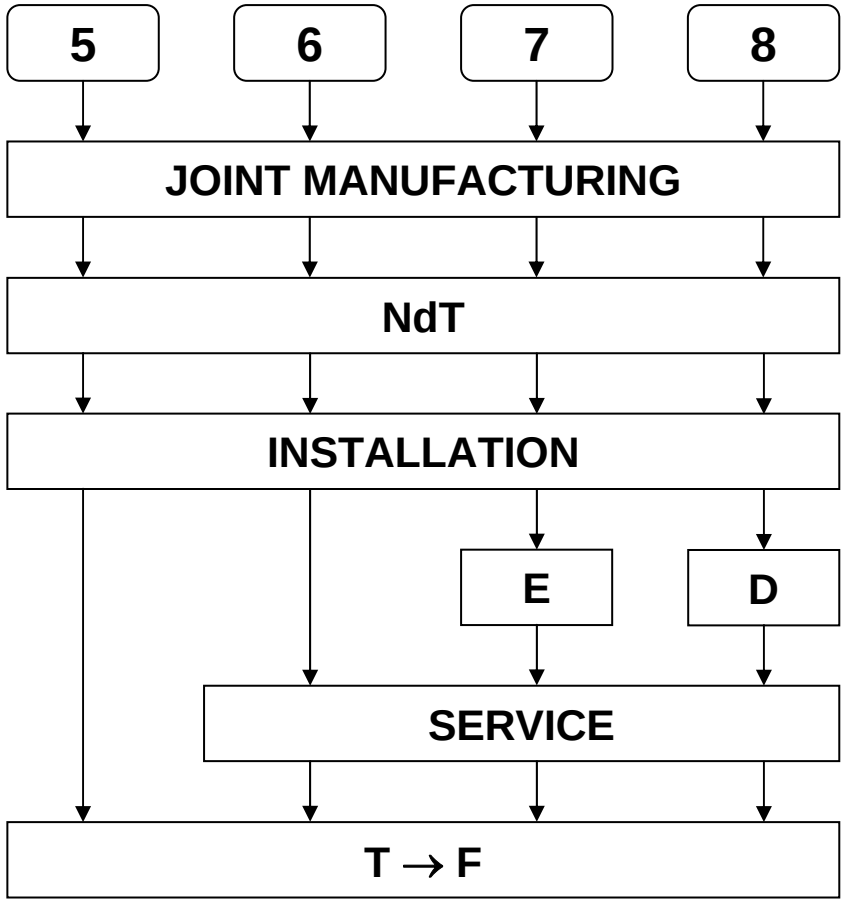

T → F: Tension to Failure

$P_i$ → F: Internal Pressure to Failure

To → F: Torsion to Failure

$P_{cycle}$: n cycles 0-$P_i$

## CSM



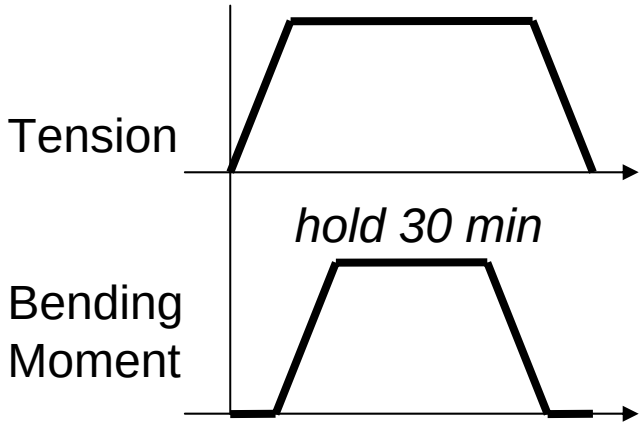

E: Environment

D: Damage

# PROPOSED TEST PROCEDURE – SCHEMATIC LOADING MODES

## INSTALLATION

**Tension and Bending Moment to maximum values typical of installation**




## ENVIRONMENT

**24h @ 80 °C *(moisture not a problem due to insulation)***

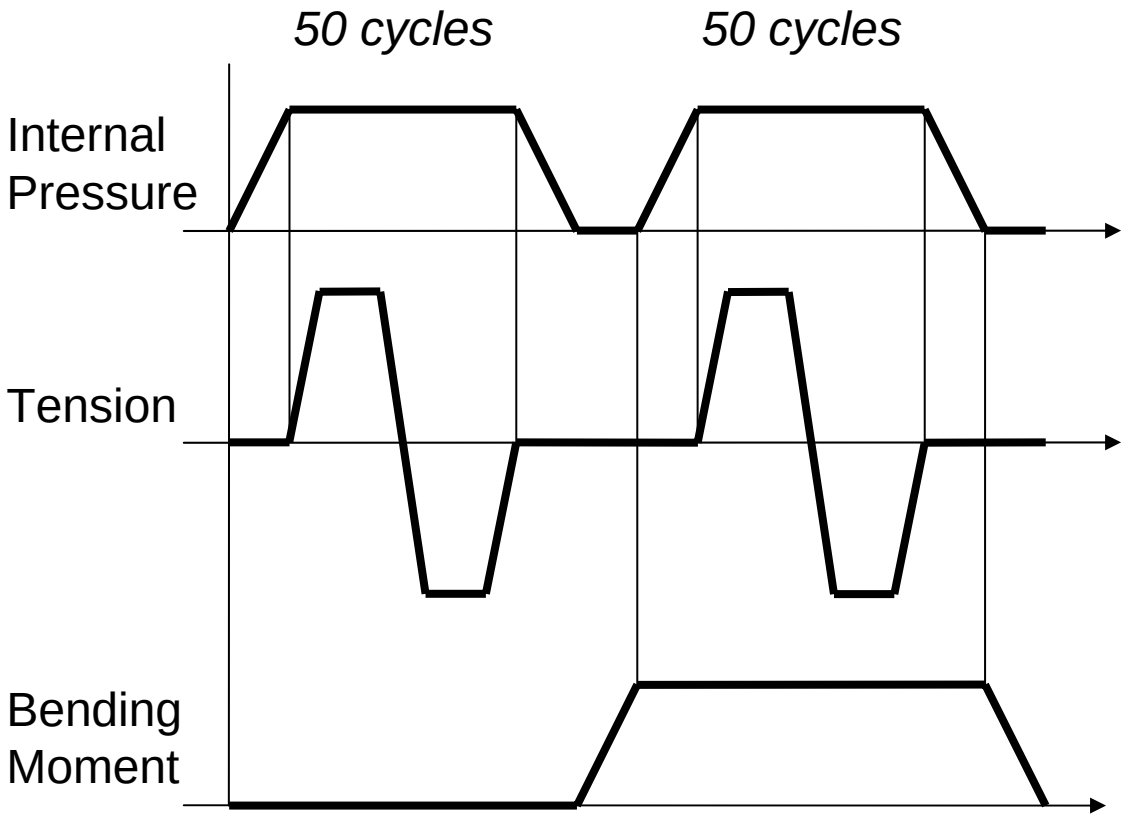
## DAMAGE

**Dent and gouge from typical excavator on the connection *(to be verified for 6 5/8")***

# PROPOSED TEST PROCEDURE – SCHEMATIC LOADING MODES

## SERVICE

**Tension, Internal Pressure and Bending Moment to values typical of service life for a characteristic (and reasonable) number of cycles**




***Hold 5 min @ ET and $P_i$ without and with bending***

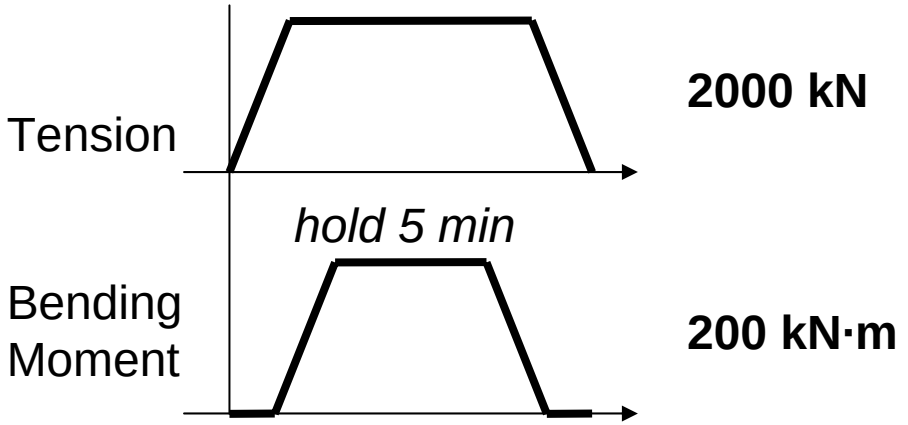
***Verifying sealing integrity during holding periods (20" with water and 6 5/8" with gas)***

***LVDT on joint sides, to monitor debonding***

# TRIAL TESTS – LOADING SCHEDULE

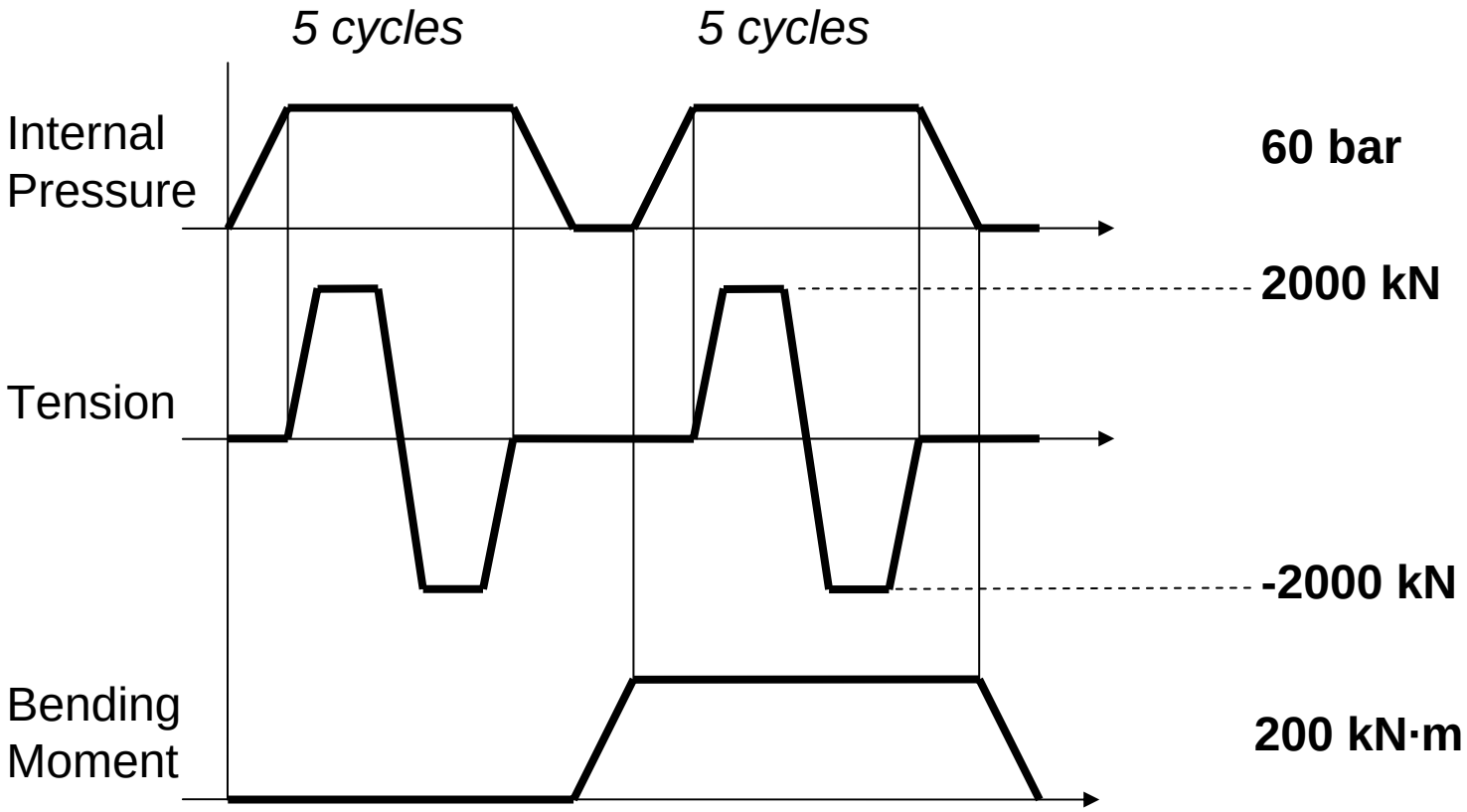
**While the loading sequence has been agreed, the actual loading values need to be verified. As a consequence, the trial test was carried out adopting the agreed loading modes but with load values assumed in order to maintain te pipe within the elastic limits**

**INSTALLATION**



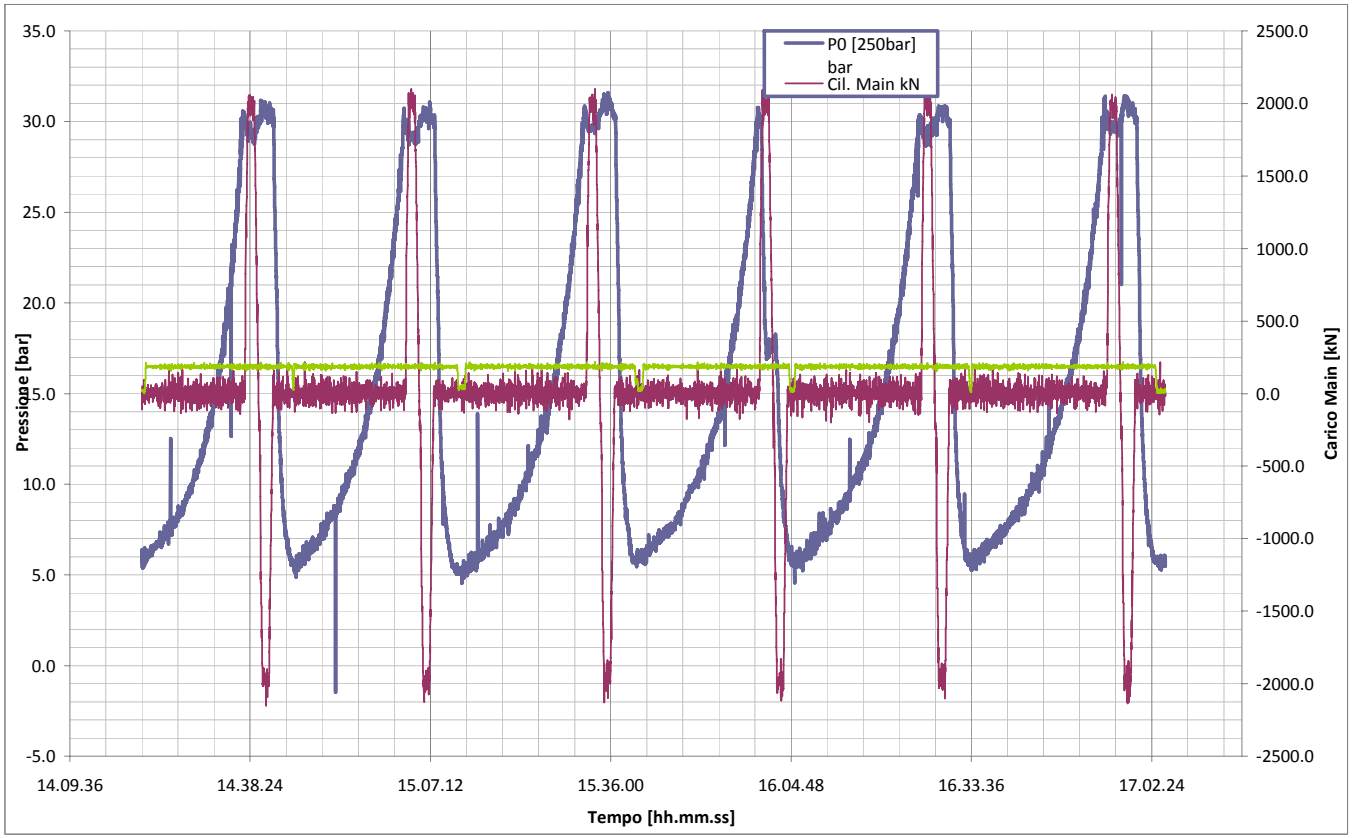
# TRIAL TESTS – LOADING SCHEDULE

**SERVICE**



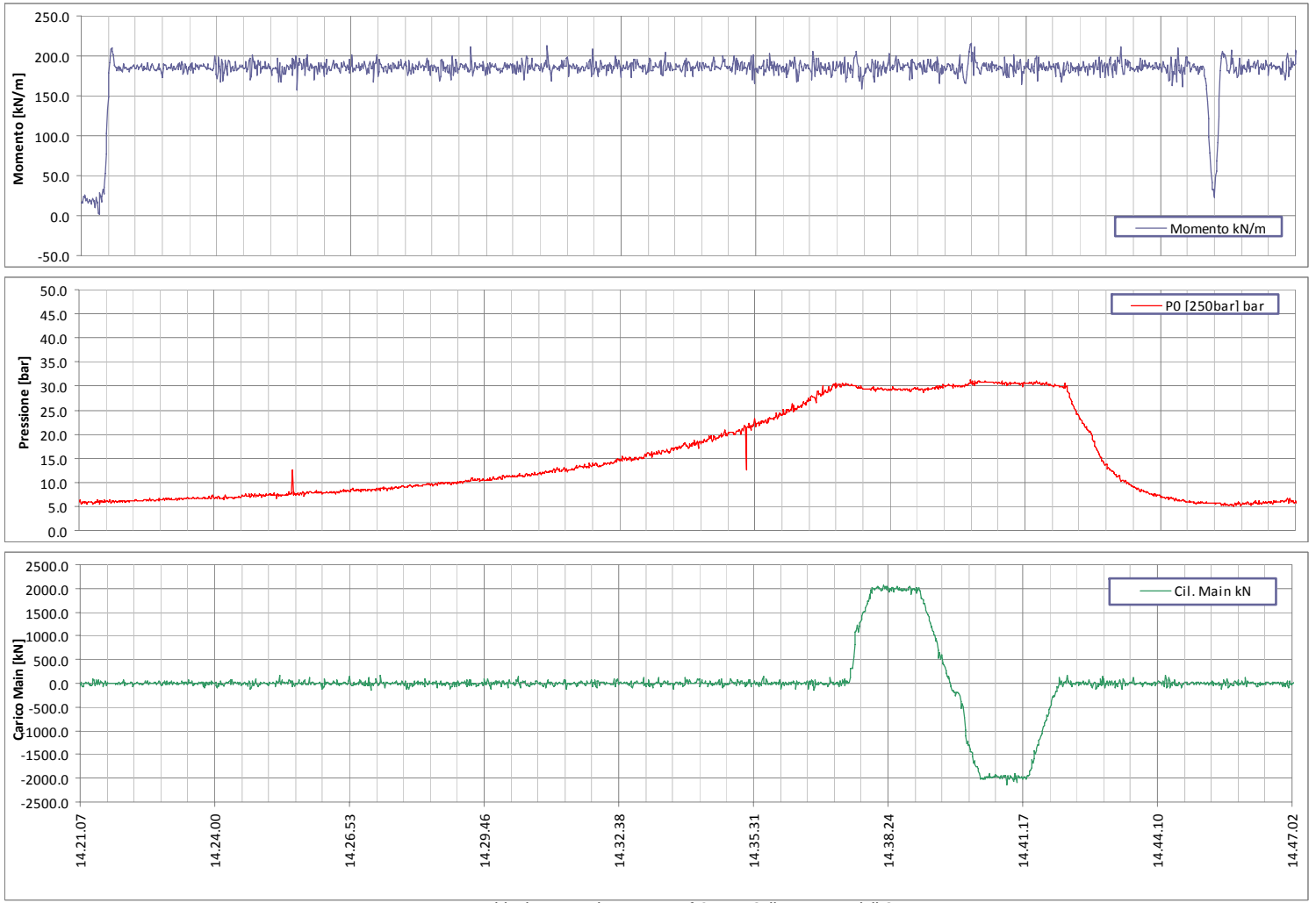
# TRIAL TESTS – OUTPUT EXAMPLE

## SERVICE – Constant bending moment, cycling axial load (tension/compression) and internal hydraulic pressure



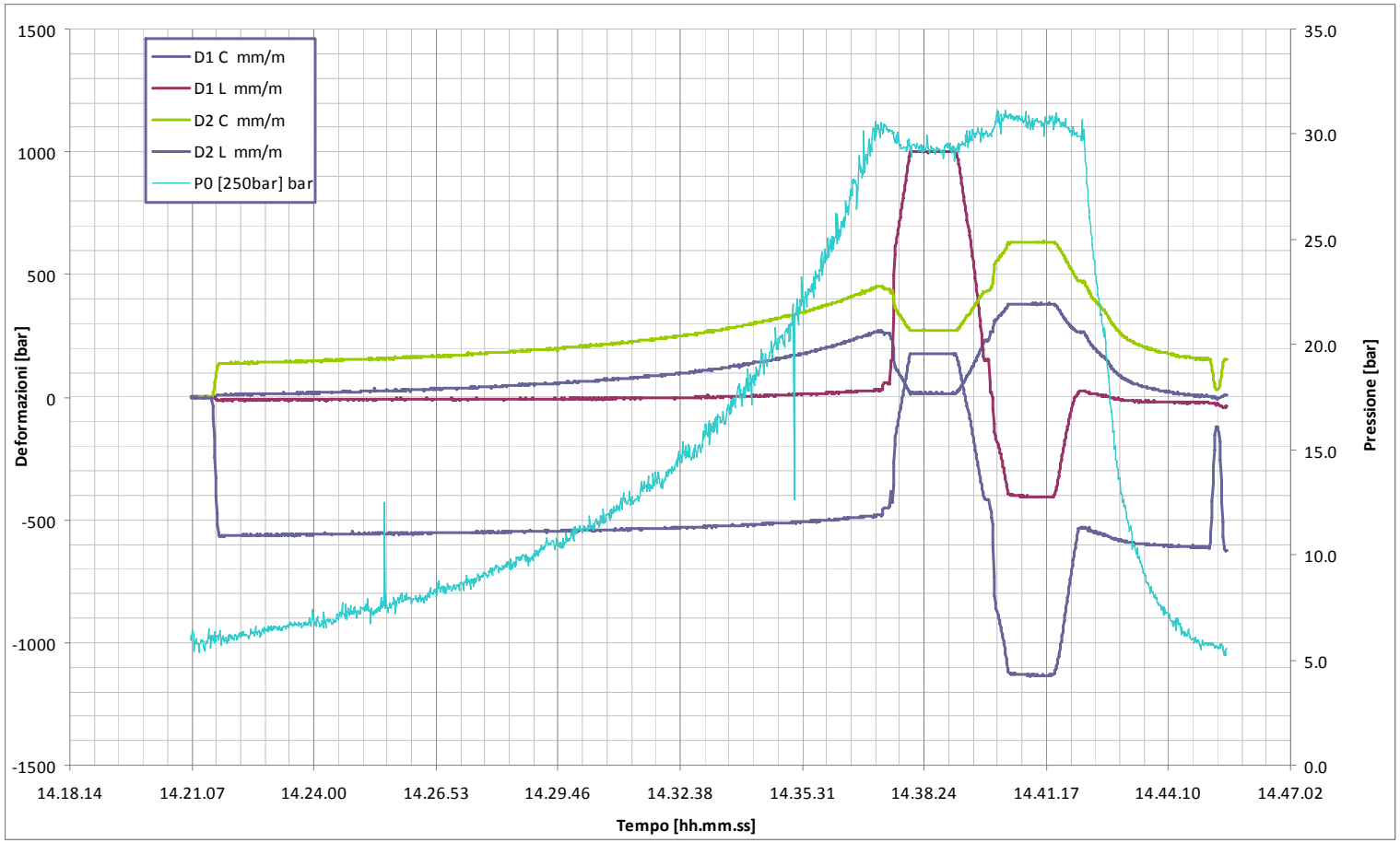
# TRIAL TESTS – OUTPUT EXAMPLE

## Cycle details



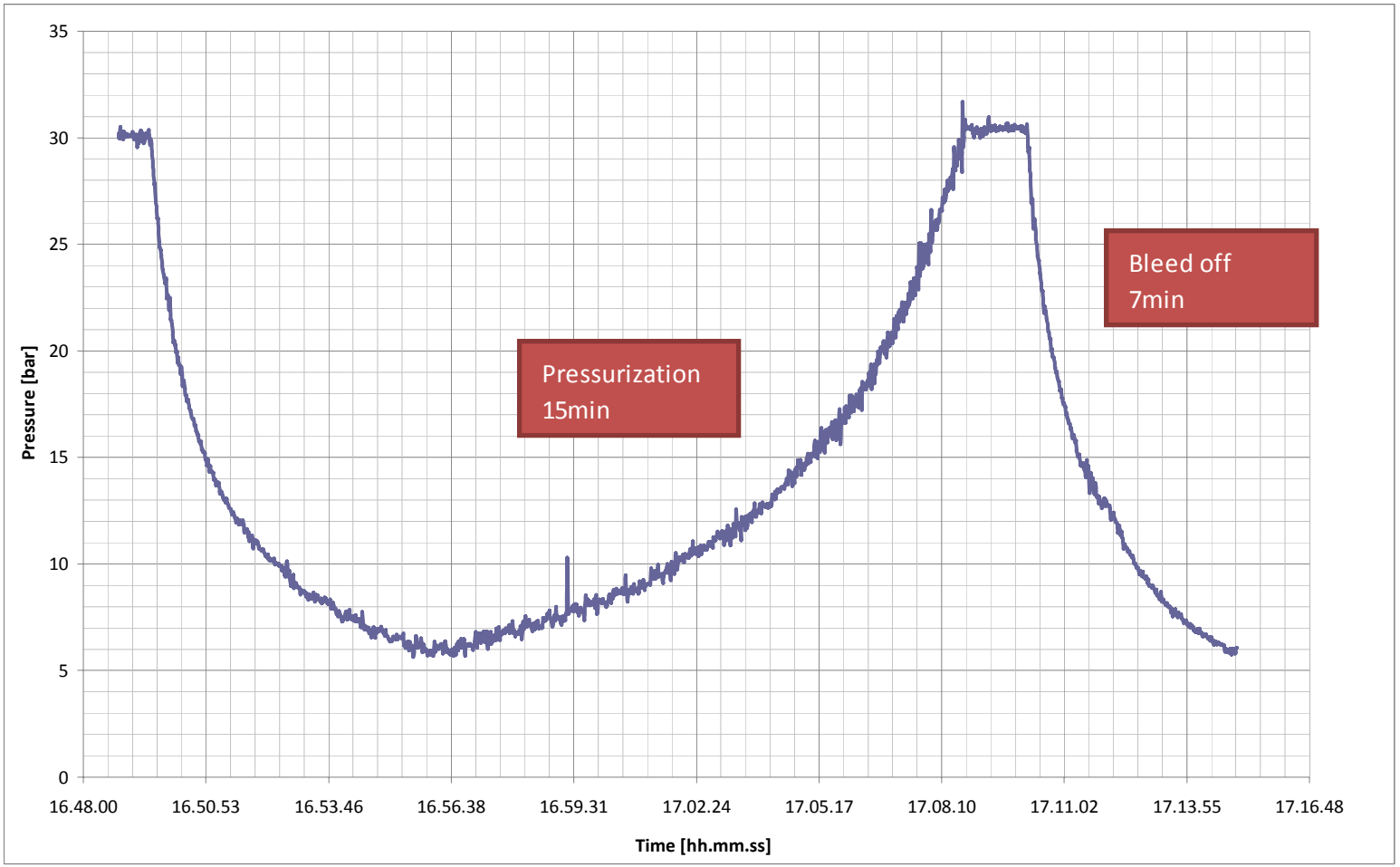
# TRIAL TESTS – OUTPUT EXAMPLE

## Strain gauge readings



# TRIAL TESTS – OUTPUT EXAMPLE

## Pressure cycle



## COMMENTS

- Specimen assembling procedures, instrumentation, machine parameters have been fixed and verified
- Joint design and geometry, also relating to sealing mechanism, to be subject to final verification (discussion) and agreed
- Need of verification (consolidation) of installation and service loads
- For test specimens preparation, there is the need to define and supply the sleeves, the adhesive (delivery schedule to be defied) and to prepare the detailed operating practice
- NdT location to be discussed, to optimise time and costs (moving specimens or equipment?)
- Testing schedule to be finalized, depending on resolution of pending points (including adhesive selection and supply), aiming to conclude the tests within 2009, anyway beyond Project plan