

66th International Astronautical Congress 2015

MATERIALS AND STRUCTURES SYMPOSIUM (C2)  
Interactive Presentations (IP)

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DESIGN AND VERIFICATION OF HIGH PRESSURE HIGH PURITY GAS DELIVERY SYSTEMS  
FOR INTERNATIONAL SPACE STATION

**Abstract**

DTM since 1994 designed, manufactured and qualified some of the gas supply systems delivered and integrated on the International Space Station. Material and Science Laboratory (MSL, prime Airbus D&S), Plasma Kristall-4 (PK4, prime OHB-KT) and Electro Magnetic Levitator (EML, prime Airbus D&S) are ISS facilities relying on DTM gas delivery systems.

The design of pressurized systems for ISS manned missions is driven by the project requirements, in terms of functionality and performances, and by ECSS rules. Also the launchers, ISS and rack requirements had to be taken into account.

With specific regard to EML, DTM was in charge, under Airbus D&S coordination, for the definition of the structural and design verification plans, for the Fracture control spectra as well as for the welding plan (welds required to meet the ultra high purity requirements). Both the plan and fracture spectra have been tailored to cope with multiple scenarios for launchers. An insight of the activities performed to harmonize all the different requirements will be provided.

Acceptance approach for the pressurized items followed the leak proof leak approach, i.e. all the pressurized items had to under go leak test, proof at 1,5x MDP, and leak test as well as withstanding vibration test with spectra depending on the launch and descent scenario. Afterwards, a final Helium leak test at MDP has been performed.

Usage of custom pressurized tanks has additional challenges: to provide highest operational time it has been requested to procure and qualify light-weight tanks with 200 bar MDP (maximum design pressure). Approach for the tank design and qualification had to follow ANSI-AIAA-S-080 or MIL-STD-1522. The compliance with ECSS fracture control rules required to perform additional verifications both in terms of non destructive inspections (NDI) as well as structural and fracture analysis.

It will be provided a general overview of the strategies implemented for the design and qualification of ultra high purity gas delivery systems, as well as the challenges experienced during the projects development up to the final acceptance.