

Project Title: **Pre-normative research on resistance to mechanical impact of composite overwrapped pressure vessels**

Project acronym: **HyPactor**

Instrument: **Supporting Actions**

Thematic Priority: **SP1-JTI-FCH.2013.5.6**

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Deliverable name	Technical report on impact testing – WP2 step1 vessel number : SN2670-021;026;027;028;031;032;033;034;035;037
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1. Executive summary

This technical report presents the impacts tests that have been performed for WP2-step1 study. The results about the first 4 vessels tested are presented in document D2.4 – vessel number : SN1366-031 ; SN1378-057 ; SN1597-002 ; SN1597-011.

All the impact tests are described in deliverable D2.3 (Impact test matrix). The test matrix is divided into two steps:

- 1) Screening impacts and identification of threshold with respect to immediate failure,
- 2) Parameters study.

The aim of the step1 is:

- 1) to create various damages that will be characterized by different NDT methods (T2.4),
- 2) to define the impact energy range of the test matrix.

A summary of the test matrix of WP2-step1 is presented here below:

Vessel number	Loading	Impact	
Immediate failure related to inner pressure : for each inner pressure, increase speed to produce immediate failure			
HYP-36L-IF-PSG1	700 bars gas	Φ=60mm ; R 30mm (hemispherical) ; m=1,2kg ; from 2 kJ to failure 2 - 4 - 5 - 6 - 7 kJ	HYCOMP 1597/002
HYP-36L-IF-PMIN1	20 bars N2	Φ=60mm ; R 30mm (hemispherical) ; m=1,2kg ; from 1 kJ to failure 1 - 2 - 3 - 4 - 5 - 6 - 6 - 7 - 8 kJ	HYCOMP 1597/011
HYP-36L-IF-PSG2	700 bars gas	Φ=60mm ; R 30mm (hemispherical) ; m=1,2kg ; 7 kJ	2670/021
HYP-36L-IF-PMIN2	20 bars N2	Φ=60mm ; R 30mm (hemispherical) ; m=1,2kg ; 8 kJ	2670/026
HYP-36L-IF-E1	empty	Φ=60mm ; R 30mm (hemispherical) ; m=1,2kg from 1 kJ to 9 kJ of 1 kJ	2670/027
HYP-36L-IF-E2	empty	Φ=60mm ; R 30mm (hemispherical) ; m=1,2kg ; 9 kJ	2670/028
HYP-36L-IF-PSH1	700 bars water	Φ=60mm ; R 30mm (hemispherical) ; m=1,2kg ; no endoscopy ; from 1 kJ to immediate failure by step of 1 kJ	HEX13
HYP-36L-IF-PSH2	700 bars water	Φ=60mm ; R 30mm (hemispherical) ; m=1,2kg ; speed to get immediate failure of HYP-36L-IF-PSH1 : repeatability	HEX14

Vessel number	Loading	Impact	
Energy level tests : for each energy level, projectile weight, diameter and speed will change => impact data base			
No inspection or test between two impacts			
Impactor dimensions = hemispherical (1,2 kg ; 50 kg ; 100 kg), conical (50kg ; 100 kg), flat (50 kg ; 100 kg)			
center line : hemispherical 1,2 kg - 50 kg - 100 kg			
left line : 50 kg hemispherical, conical, flat			
right line : 100 kg hemispherical, conical, flat			
HYP-36L-EMIN1	empty	3 kJ ; 9 impacts with 3 impactor dimensions	2670/031
HYP-36L-EMED1	empty	5 kJ ; 9 impacts with 3 impactor dimensions	2670/032
HYP-36L-EMAX1	empty	7 kJ ; 9 impacts with 3 impactor dimensions	2670/033
repeatability of HYP-36L-EMAX1, HYP-36L-EMIN1, HYP-36L-EMED1			
HYP-36L-EMIN2	empty	3 kJ ; 9 impacts with 3 impactor dimensions	2670/034
HYP-36L-EMED2	empty	5 kJ ; 9 impacts with 3 impactor dimensions	2670/035
HYP-36L-EMAX2	empty	7 kJ ; 9 impacts with 3 impactor dimensions	2670/037
Objectives of HYP-36L-EMIN3 and HYP-36L-EMIN4 to be defined.			
HYP-36L-EMIN3	875 bars N2	immediate failure ?	HEX15
HYP-36L-EMIN4	875 bars N2	repeatability of immediate failure ?	HEX16

The tests with yellow cells are included in D2.4 – vessel number: SN1366-031 ; SN1378-057 ; SN1597-002 ; SN1597-011. The tests with orange cells are not included in this report.

A test sheet has been established for each impact test by the CEA. This sheet gives:

- the name of the test,
- the vessel number,
- the characteristics of the impact,
- pictures at the impact and at the maximum penetration,
- pictures of the external damage and of the video-endoscopy.

The testing facilities and visual inspection devices are detailed in the first part of the document. In the second part, are included all the sheets of the corresponding impact testing. The conclusion sums up the results of the impact test, in terms of projectile characteristics and actual impact energy.

Sixty-six (66) impact testing and visual characterization are presented in this document. Some have been performed using drop tower and others using gas launcher.

After impact, the vessels have been sent to IS for NDT analyses and characterization of the damage (D2.5).