

Angular Impact Test Overview

For 24" x 0.688" PIN & BOX Protectors

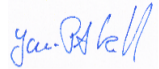

Tests performed based on API 5CT 10th Ed., Annex I and with modified Exquip values (higher values for Exquip standard) for the size range 18 5/8" to 24 1/2"

Temp °C	Impact Load Joules	Result
-36	Test 1 (PIN): 555	OK, no connection damage
-36	Test 2 (PIN): 777	OK, no connection damage
-36	Test 3 (BOX): 555	OK, no connection damage
-36	Test 4 (BOX): 777	OK, no connection damage

Test summary Angular Impacts:

All angular impact test have been performed according to the relevant standard and Exquip-internal standard. Exceeding from standard, protectors have been tested at -36°C* but multiple times (2 tests per Protector; 1st: API value, 2nd: EXQUIP value - on the same test-sample). All test have been performed successfully – according to all relevant standard and picture evidence, the protectors passed the Angular Impact Tests.

Hamm, 27-10-2020

	Name	Position	Signature
Tested by	J.-P. Kroll	Man. Dir. Engineering	
Reviewed by	T.J. Kroll	Managing Director	

*current restriction due to available freezer equipment

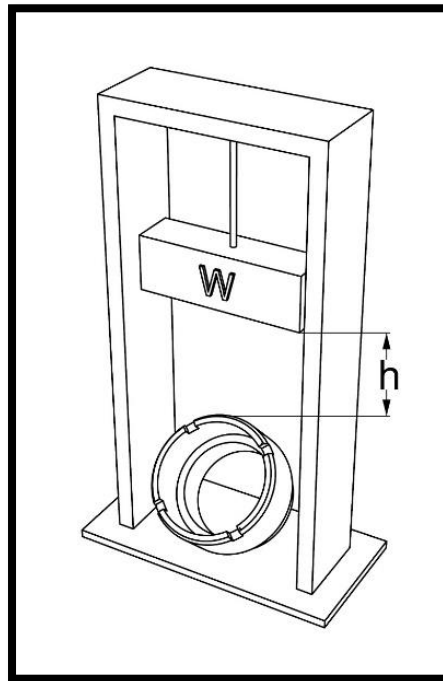
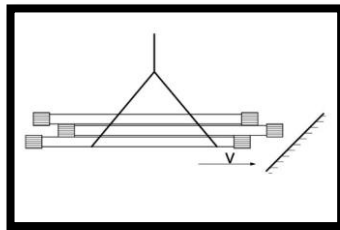
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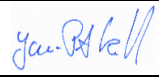
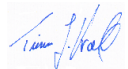
Angular Impact Test @ -36°C (Cold Weather)

Tested protectors: 24" x 0.688" PIN Protector (Exquip)
 Protector Material: Exquip Polypropylene
 Issue Date: 27-OCT-2020
 Revision: 0

Validation Procedure:

Angular Impact Test at cold temperature, hammer weight (W): 188,5 kg;
 protectors cooled down to a min. -36°C in a freezer for a min. of 4 hours.



	Name	Position	Signature
Tested by	J.-P. Kroll	Man. Dir. Engineering	
Reviewed by	T.J. Kroll	Managing Director	

Angular Impact Test for PIN at -36°C

Tests performed based on API 5CT 10th Ed., Annex I and with modified Exquip values (higher values for Exquip standard) for the size range 18 5/8" to 24 1/2"

Temp °C	Impact Load Joules	Result
-36	Test 1: 555	OK, no connection damage
-36	Test 2: 777	OK, no connection damage



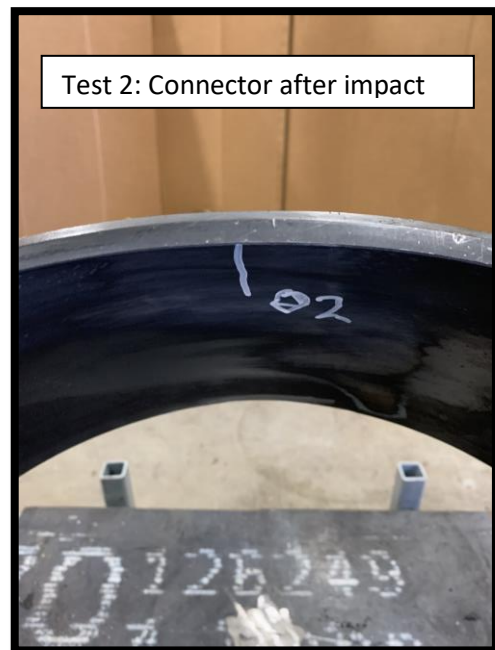
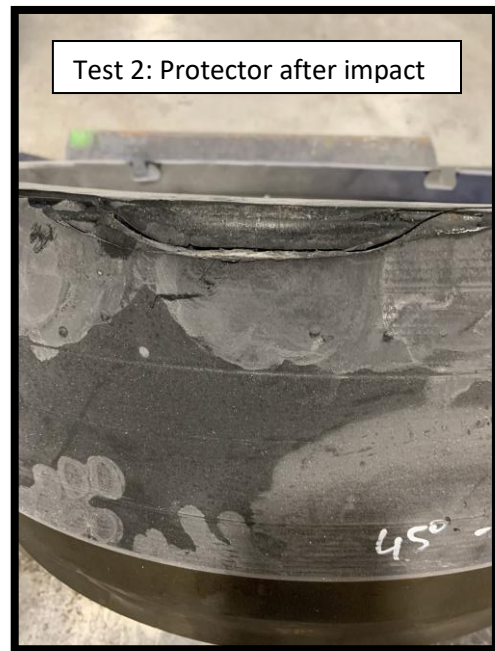
Test description:

Protector was taken out of the freezer @-36°C and was installed with 180 Nm (min). The connector with the protector has been placed under our test guillotine, actual hammer weight: 188,5 kg. The hammer was pulled to 0.3 m for the API value (555 Joules) and 0.42 meters height to achieve an impact energy of min. 777 Joules (Exquip value).

$$\text{TEST 1 (API): } E = m(W) \times g \times h \mid 555 \text{ Joules} = 188,5 \text{ kg} \times 9,81 \text{ m/s}^2 \times 0,3 \text{ m}$$

$$\text{TEST 2 (EXQUIP): } E = m(W) \times g \times h \mid 777 \text{ Joules} = 188,5 \text{ kg} \times 9,81 \text{ m/s}^2 \times 0,42 \text{ m}$$

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Test results:

After both impacts, the protector could be deinstalled with a bar using the dovetail slots of the protector. The protector showed signs of the impact and some cracks after Test 2, but the material absorbed the impact and left the connector completely undamaged after both tests.

References

- API Specification 5CT, 10th Edition, Annex I
- General technical information for Exquip protectors (Exquip standard)
(<https://www.exquip.de/en/quality/23-general-technical-information-for-exquip-protectors>)
- IADC/SPE 17209 & 11396

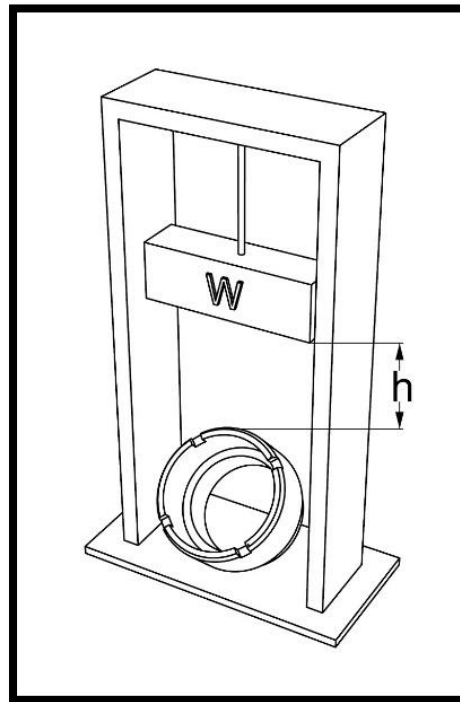
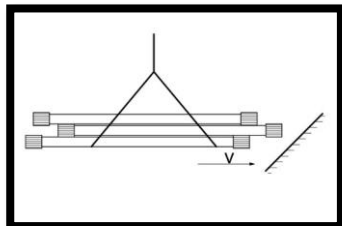
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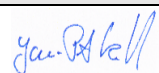
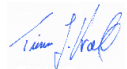
Angular Impact Test @ -36°C (Cold Weather)

Tested protectors: 24" x 0.688" BOX Protector (Exquip)
 Protector Material: Exquip Polypropylene
 Issue Date: 27-OCT-2020
 Revision: 1 (29-OCT-2020)

Validation Procedure:

Angular Impact Test at cold temperature, hammer weight (W): 188,5 kg;
 protectors cooled down to a min. -36°C in a freezer for a min. of 4 hours.



	Name	Position	Signature
Tested by	J.-P. Kroll	Man. Dir. Engineering	
Reviewed by	T.J. Kroll	Managing Director	

Angular Impact Test for BOX at -36°C

Tests performed based on API 5CT 10th Ed., Annex I and with modified Exquip values (higher values for Exquip standard) for the size range 18 5/8" to 24 1/2"

Temp °C	Impact Load Joules	Result
-36	Test 3: 555	OK, no connection damage
-36	Test 4: 777	OK, no connection damage



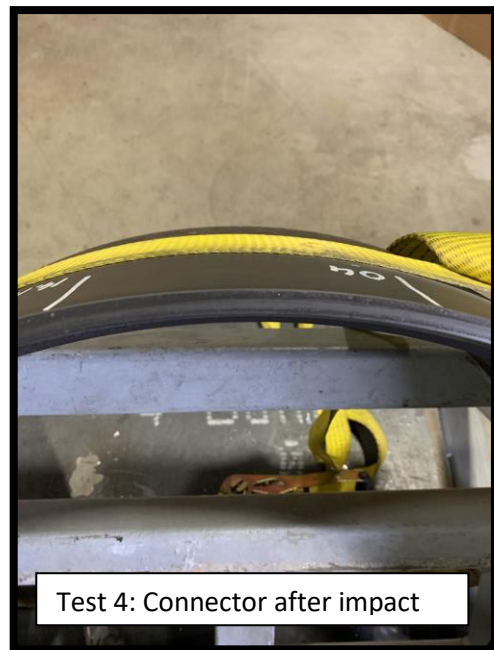
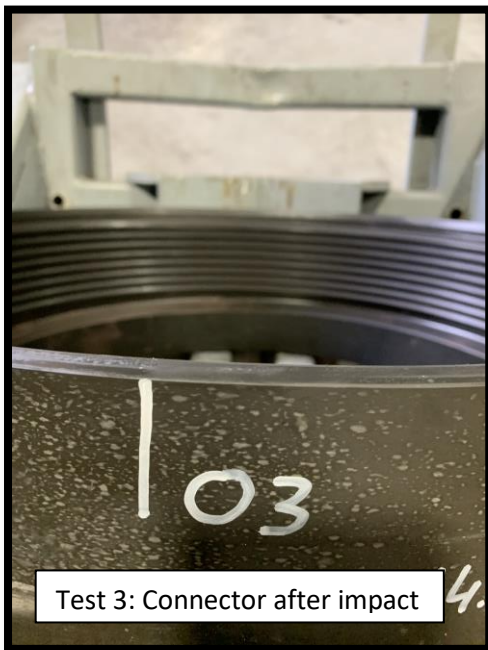
Test description:

Protector was taken out of the freezer @-36°C and was installed with 180 Nm (min). The connector with the protector has been placed under our test guillotine, actual hammer weight: 188,5 kg. The hammer was pulled to 0.3 m for the API value (555 Joules) and 0.42 meters height to achieve an impact energy of min. 777 Joules (Exquip value).

$$\text{TEST 3 (API): } E = m(W) \times g \times h \mid 555 \text{ Joules} = 188,5 \text{ kg} \times 9,81 \text{ m/s}^2 \times 0,3 \text{ m}$$

$$\text{TEST 4 (EXQUIP): } E = m(W) \times g \times h \mid 777 \text{ Joules} = 188,5 \text{ kg} \times 9,81 \text{ m/s}^2 \times 0,42 \text{ m}$$

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Test results:

After both impacts, the protector could be deinstalled with a bar using the dovetail slots of the protector. The protector showed signs of the impact, but the material absorbed the impact and left the connector completely undamaged after both tests.

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