Axial 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 ½”

Temp °C	**Impact Load** Joules	**Result**
+ 21	Test 1 (BOX): 2034	**OK, no connection damage**
+ 21	Test 2 (BOX): 2848	**OK, no connection damage**
+ 66	Test 3 (BOX): 2034	**OK, no connection damage**
+ 66	Test 4 (BOX): 2848	**OK, no connection damage**
+ 21	Test 5 (PIN): 2034	**OK, no connection damage**
+ 21	Test 6 (PIN): 2848	**OK, no connection damage**
+ 66	Test 7 (PIN): 2034	**OK, no connection damage**
+ 66	Test 8 (PIN): 2848	**OK, no connection damage**

Test summary Axial Impacts:

All axial impact test have been performed according to the relevant standard and Exquip-internal standard. Exceeding from standard, protectors have been tested 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 Axial Impact Tests.

Hamm, 27-01-2020

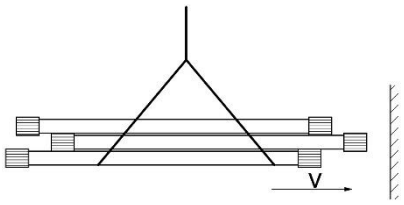
	Name	Position	Signature
Tested by	J.-P. Kroll	Man. Dir. Engineering	
Reviewed by	T.J. Kroll	Managing Director	

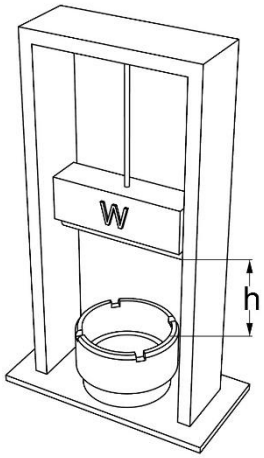
Axial Impact Test @ 21°C (Ambient)

Tested protectors:	24” x 0.688” BOX Protector (Exquip)
Protector Material:	Exquip Polypropylene
Issue Date:	25-JAN-2020
Revision:	2

Validation Procedure:

Axial Impact Test at ambient temperature, hammer weight (W): 253kg





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

Axial Impact Test for BOX at 21°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 ½"

Temp °C	Impact Load Joules	Result
+ 21	Test 1: 2034	OK, no connection damage
+ 21	Test 2: 2848	OK, no connection damage


Test 1: Hammer height: 0.82m


Test 2: Hammer height: 1.15m

Test description:

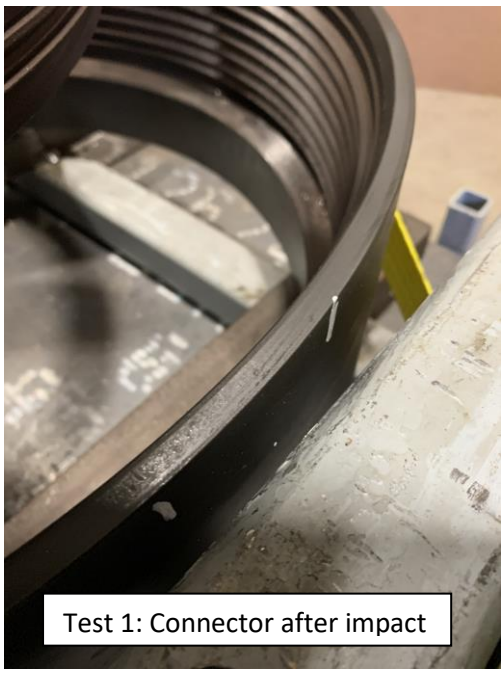
Protector was installed with 180 Nm (min). The connector with the protector has been placed under our test guillotine, actual hammer weight: 253 kg. The hammer was pulled to 0.82 m for the API value (2034 Joules) and 1,15 meters height to achieve an impact energy of min. 2848 Joules (Exquip value).

TEST 1 (API): E = m(W) x g x h | 2035 Joules = 253 kg x 9,81 m/s² x 0,82 m

TEST 2 (EXQUIP): E = m(W) x g x h | 2854 Joules = 253 kg x 9,81 m/s² x 1,15 m


Test 1: Protector after impact


Test 2: Protector after impact


Test 1: Connector after impact


Test 2: Connector after impact

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.

References

- API Specification 5CT, 10th Edition, Annex I
- General technical information for Exquip protectors (Exquip standard)

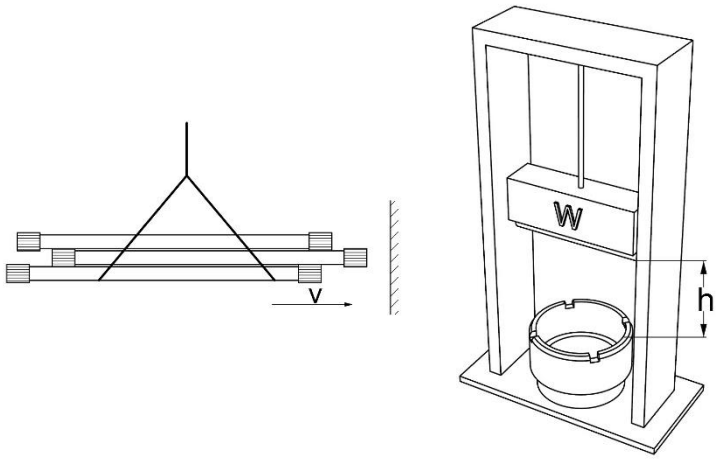
  (https://www.exquip.de/en/quality/23-general-technical-information-for-exquip-protectors)
- IADC/SPE 17209 & 11396

Axial Impact Test @ 66°C (hot conditions)

Tested protectors:	24” x 0.688” BOX Protector (Exquip)
Protector Material:	Exquip Polypropylene
Issue Date:	25-JAN-2020
Revision:	2

Validation Procedure:

Axial Impact Test at hot temperature, hammer weight (W): 253kg, protector heated in water bath at +66°C



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

Axial Impact Test for BOX at 66°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 ½"

Temp °C	Impact Load Joules	Result
+ 66	Test 3: 2034	OK, no connection damage
+ 66	Test 4: 2848	OK, no connection damage

Test 3: Hammer height: 0.82m

Test 4: Hammer height: 1.15m

Test description:

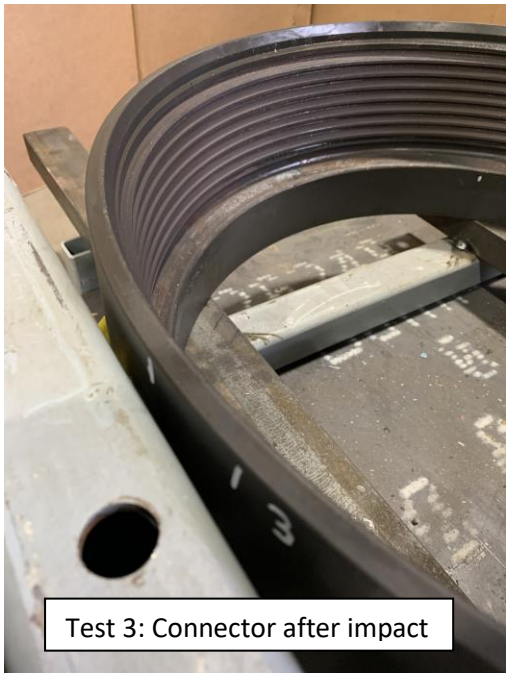
Protector was taken out of hot water bath @+66°C and installed with 180 Nm (min). The connector with the protector has been placed under our test guillotine, actual hammer weight: 253 kg. The hammer was pulled to 0.82 m for the API value (2034 Joules) and 1,15 meters height to achieve an impact energy of min. 2848 Joules (Exquip value).

TEST 3 (API): E = m(W) x g x h | 2035 Joules = 253 kg x 9,81 m/s² x 0,82 m

TEST 4 (EXQUIP): E = m(W) x g x h | 2854 Joules = 253 kg x 9,81 m/s² x 1,15 m


Test 3: Protector after impact

Test 4: Protector after impact


Test 3: Connector after impact


Test 4: Connector after impact

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.

References

- API Specification 5CT, 10th Edition, Annex I
- General technical information for Exquip protectors (Exquip standard)

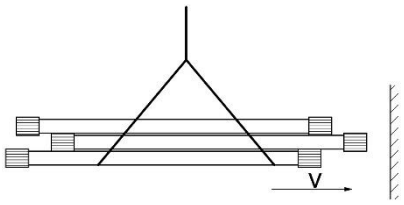
  (https://www.exquip.de/en/quality/23-general-technical-information-for-exquip-protectors)
- IADC/SPE 17209 & 11396

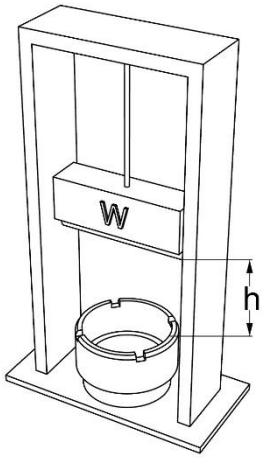
Axial Impact Test @ 21°C (Ambient)

Tested protectors:	24” x 0.688” PIN Protector (Exquip)
Protector Material:	Exquip Polypropylene
Issue Date:	27-JAN-2020
Revision:	1

Validation Procedure:

Axial Impact Test at ambient temperature, hammer weight (W): 253kg





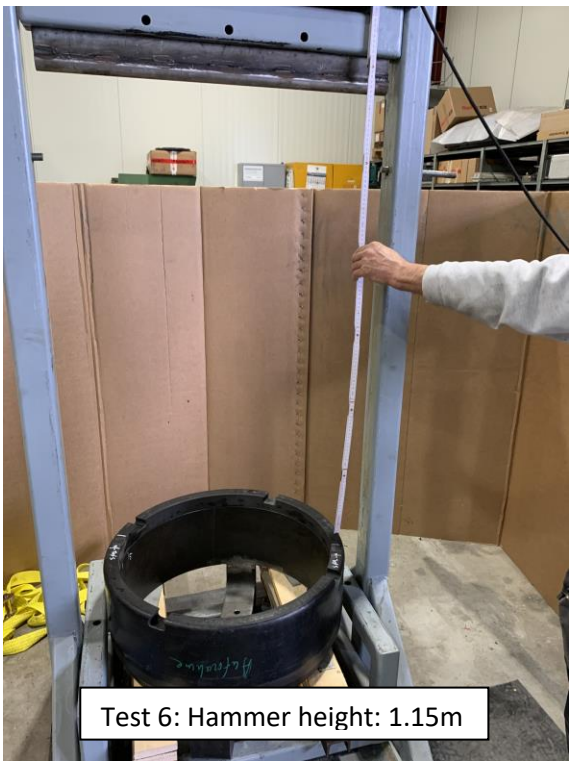
	Name	Position	Signature
Tested by	J.-P. Kroll	Man. Dir. Engineering	
Reviewed by	T.J. Kroll	Managing Director	

Axial Impact Test for PIN at 21°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 ½"

Temp °C	Impact Load Joules	Result
+ 21	Test 5: 2034	OK, no connection damage
+ 21	Test 6: 2848	OK, no connection damage

Test 5: Hammer height: 0.82m



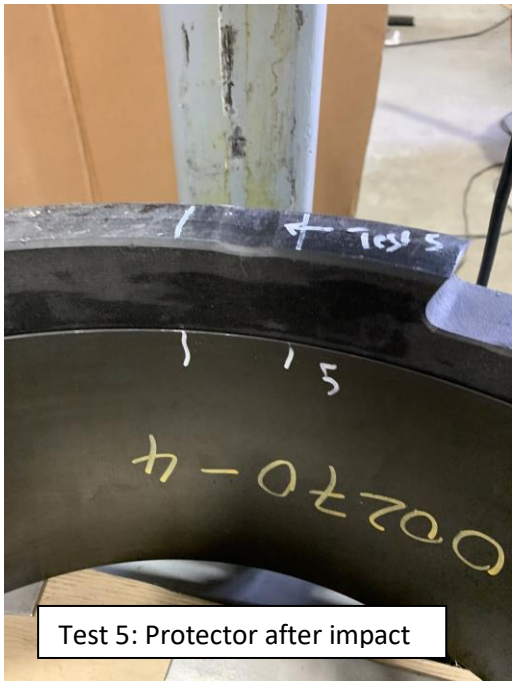
Test 6: Hammer height: 1.15m

Test description:

Protector was installed with 180 Nm (min). The connector with the protector has been placed under our test guillotine, actual hammer weight: 253 kg. The hammer was pulled to 0.82 m for the API value (2034 Joules) and 1,15 meters height to achieve an impact energy of min. 2848 Joules (Exquip value).

TEST 5 (API): E = m(W) x g x h | 2035 Joules = 253 kg x 9,81 m/s² x 0,82 m

TEST 6 (EXQUIP): E = m(W) x g x h | 2854 Joules = 253 kg x 9,81 m/s² x 1,15 m


Test 5: Protector after impact


Test 6: Protector after impact


Test 5: Connector after impact


Test 6: Connector after impact

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.

References

- API Specification 5CT, 10th Edition, Annex I
- General technical information for Exquip protectors (Exquip standard)

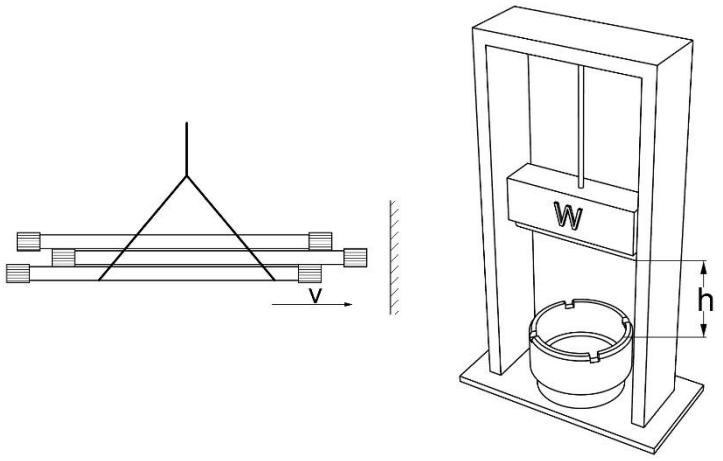
  (https://www.exquip.de/en/quality/23-general-technical-information-for-exquip-protectors)
- IADC/SPE 17209 & 11396

Axial Impact Test @ 66°C (hot conditions)

Tested protectors:	24” x 0.688” PIN Protector (Exquip)
Protector Material:	Exquip Polypropylene
Issue Date:	27-JAN-2020
Revision:	1

Validation Procedure:

Axial Impact Test at hot temperature, hammer weight (W): 253kg, protector heated in water bath at +66°C



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

Axial Impact Test for PIN at 66°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 ½"

Temp °C	Impact Load Joules	Result
+ 66	Test 7: 2034	OK, no connection damage
+ 66	Test 8: 2848	OK, no connection damage


Test 7: Hammer height: 0.82m


Test 8: Hammer height: 1.15m

Test description:

Protector was taken out of hot water bath @+66°C and installed with 180 Nm (min). The connector with the protector has been placed under our test guillotine, actual hammer weight: 253 kg. The hammer was pulled to 0.82 m for the API value (2034 Joules) and 1,15 meters height to achieve an impact energy of min. 2848 Joules (Exquip value).

TEST 7 (API): E = m(W) x g x h | 2035 Joules = 253 kg x 9,81 m/s² x 0,82 m

TEST 8 (EXQUIP): E = m(W) x g x h | 2854 Joules = 253 kg x 9,81 m/s² x 1,15 m


Test 7: Protector after impact


Test 8: Protector after impact


Test 7: Connector after impact


Test 8: Connector after impact

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.

References

- API Specification 5CT, 10th Edition, Annex I
- General technical information for Exquip protectors (Exquip standard)

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- IADC/SPE 17209 & 11396