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 ½”

Temp °C	**Impact Load** Joules	**Result**
+ 21	Test 9 (BOX): 1017	**OK, no connection damage**
+ 21	Test 10 (BOX): 1424	**OK, no connection damage**
+ 66	Test 11 (BOX): 1017	**OK, no connection damage**
+ 66	Test 12 (BOX): 1424	**OK, no connection damage**
+ 21	Test 13 (PIN): 1017	**OK, no connection damage**
+ 21	Test 14 (PIN): 1424	**OK, no connection damage**
+ 66	Test 15 (PIN): 1017	**OK, no connection damage**
+ 66	Test 16 (PIN): 1424	**OK, no connection damage**

Test summary Axial Impacts:

All angular 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 Angular Impact Tests.

Hamm, 14-02-2020

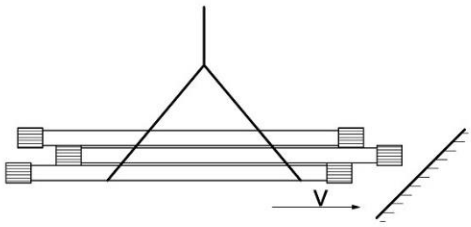
	Name	Position	Signature
Tested by	J.-P. Kroll	Man. Dir. Engineering	
Reviewed by	T.J. Kroll	Managing Director	

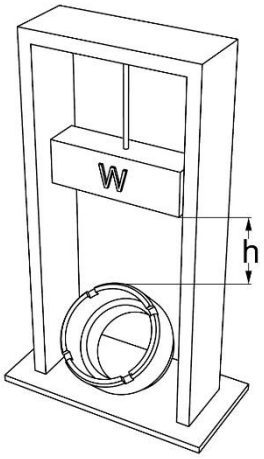
Angular Impact Test @ 21°C (Ambient)

Tested protectors:	24” x 0.688” PIN Protector (Exquip)
Protector Material:	Exquip Polypropylene
Issue Date:	13-FEB-2020
Revision:	2

Validation Procedure:

Angular 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	

Angular 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 9: 1017	OK, no connection damage
+ 21	Test 10: 1424	OK, no connection damage

Test 9: Hammer height: 0.41m

Test 10: Hammer height: 0.58m

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 0.41 m for the API value (1017 Joules) and 0.58 meters height to achieve an impact energy of min. 1424 Joules (Exquip value).

TEST 1 (API/OMS): E = m(W) x g x h | 1017 Joules = 253 kg x 9,81 m/s² x 0,41 m

TEST 2 (EXQUIP): E = m(W) x g x h | 1424 Joules = 253 kg x 9,81 m/s² x 0,58 m


Test 9: Protector after impact

Test 10: Protector after impact


Test 9: Connector after impact


Test 10: 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)

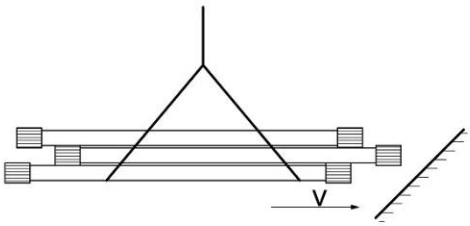
  (https://www.exquip.de/en/quality/23-general-technical-information-for-exquip-protectors)
- IADC/SPE 17209 & 11396

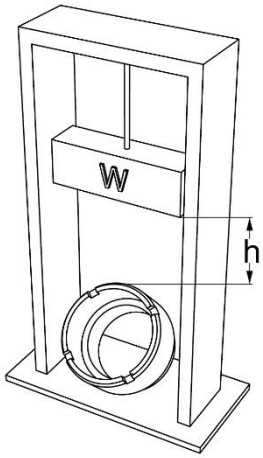
Angular Impact Test @ 66°C (hot conditions)

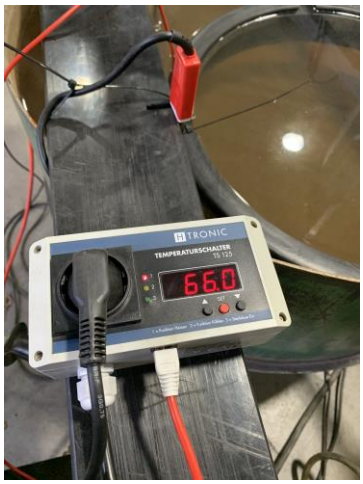
Tested protectors:	24” x 0.688” PIN Protector (Exquip)
Protector Material:	Exquip Polypropylene
Issue Date:	13-FEB-2020
Revision:	2

Validation Procedure:

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







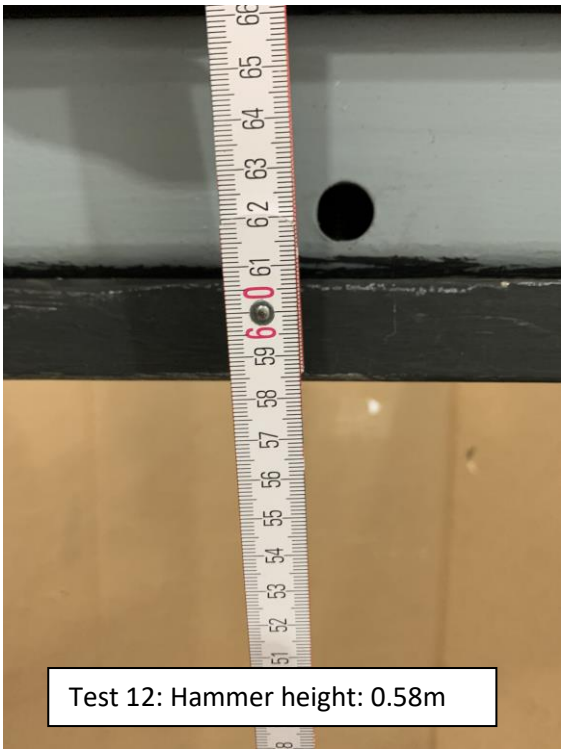
	Name	Position	Signature
Tested by	J.-P. Kroll	Man. Dir. Engineering	
Reviewed by	T.J. Kroll	Managing Director	

Angular 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 11: 1017	OK, no connection damage
+ 66	Test 12: 1424	OK, no connection damage

Test 11: Hammer height: 0.41m



Test 12: Hammer height: 0.58m

Test description:

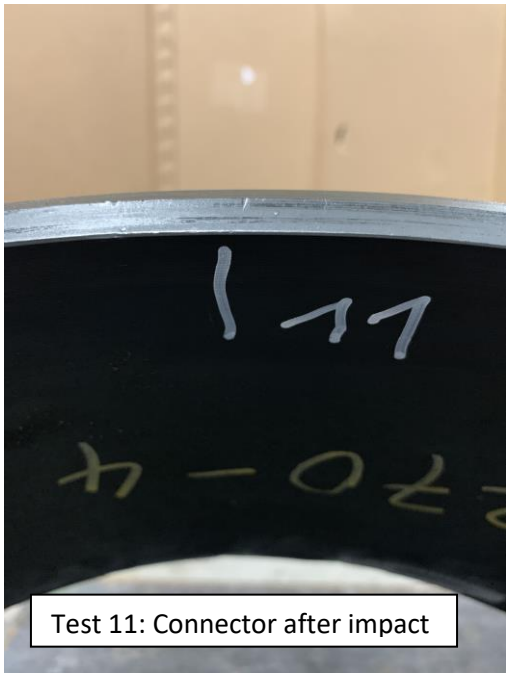
Protector was taken out of hot water bath @+66°C and installed with 180 Nm (min). The connector with the protector has been placed under our test guillotine, actual hammer weight: 253 kg. The hammer was pulled to 0.41 m for the API value (1017 Joules) and 0.58 meters height to achieve an impact energy of min. 1424 Joules (Exquip value).

TEST 1 (API/OMS): E = m(W) x g x h | 1017 Joules = 253 kg x 9,81 m/s² x 0,41 m

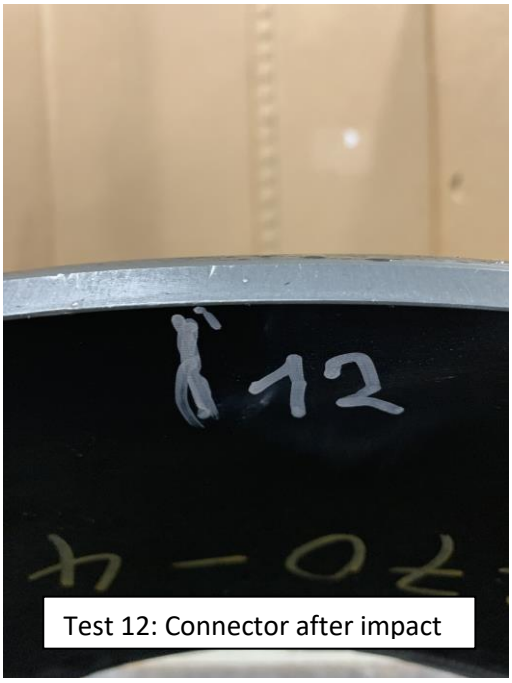
TEST 2 (EXQUIP): E = m(W) x g x h | 1424 Joules = 253 kg x 9,81 m/s² x 0,58 m


Test 11: Protector after impact


Test 12: Protector after impact



Test 11: Connector after impact



Test 12: 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)

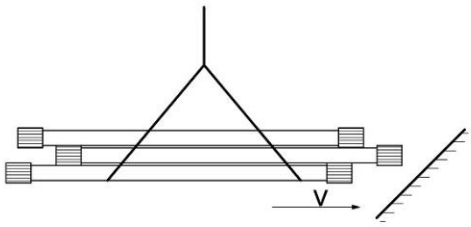
  (https://www.exquip.de/en/quality/23-general-technical-information-for-exquip-protectors)
- IADC/SPE 17209 & 11396

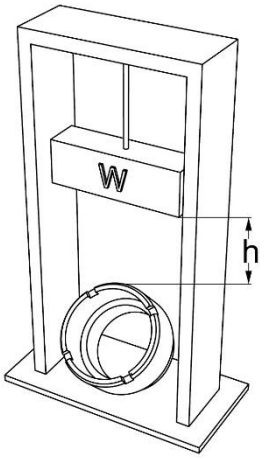
Angular Impact Test @ 21°C (Ambient)

Tested protectors:	24” x 0.688” BOX Protector (Exquip)
Protector Material:	Exquip Polypropylene
Issue Date:	14-FEB-2020
Revision:	1

Validation Procedure:

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





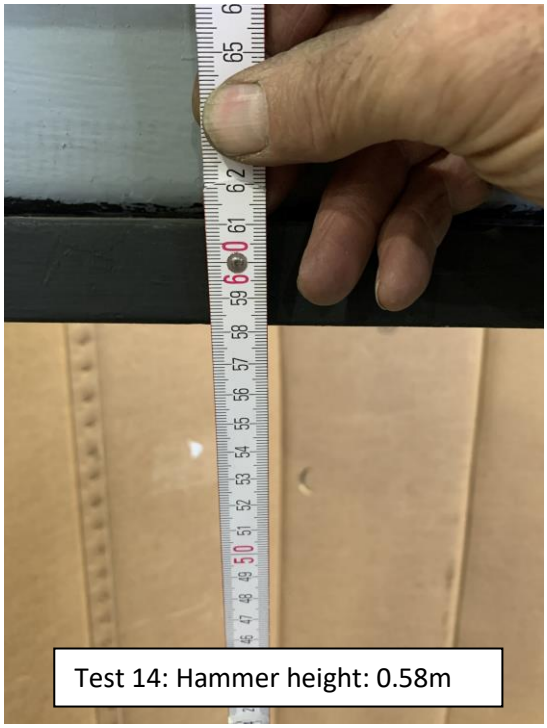
	Name	Position	Signature
Tested by	J.-P. Kroll	Man. Dir. Engineering	
Reviewed by	T.J. Kroll	Managing Director	

Angular 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 13: 1017	OK, no connection damage
+ 21	Test 14: 1424	OK, no connection damage


Test 13: Hammer height: 0.41m


Test 14: Hammer height: 0.58m

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 0.41 m for the API value (1017 Joules) and 0.58 meters height to achieve an impact energy of min. 1424 Joules (Exquip value).

TEST 1 (API/OMS): E = m(W) x g x h | 1017 Joules = 253 kg x 9,81 m/s² x 0,41 m

TEST 2 (EXQUIP): E = m(W) x g x h | 1424 Joules = 253 kg x 9,81 m/s² x 0,58 m

Test 13: Protector after impact

Test 14: Protector after impact

Test 13: Connector after

Test 14: 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)

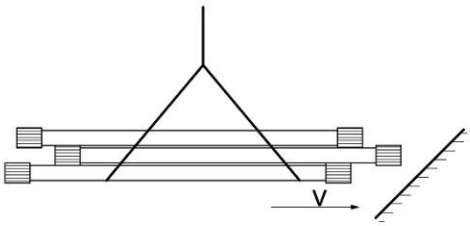
  (https://www.exquip.de/en/quality/23-general-technical-information-for-exquip-protectors)
- IADC/SPE 17209 & 11396

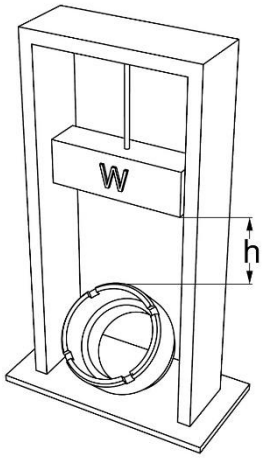
Angular Impact Test @ 66°C (hot conditions)

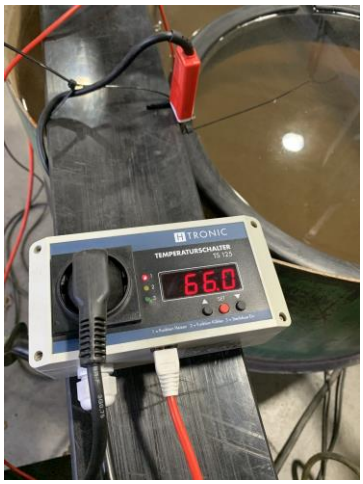
Tested protectors:	24” x 0.688” BOX Protector (Exquip)
Protector Material:	Exquip Polypropylene
Issue Date:	14-FEB-2020
Revision:	1

Validation Procedure:

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







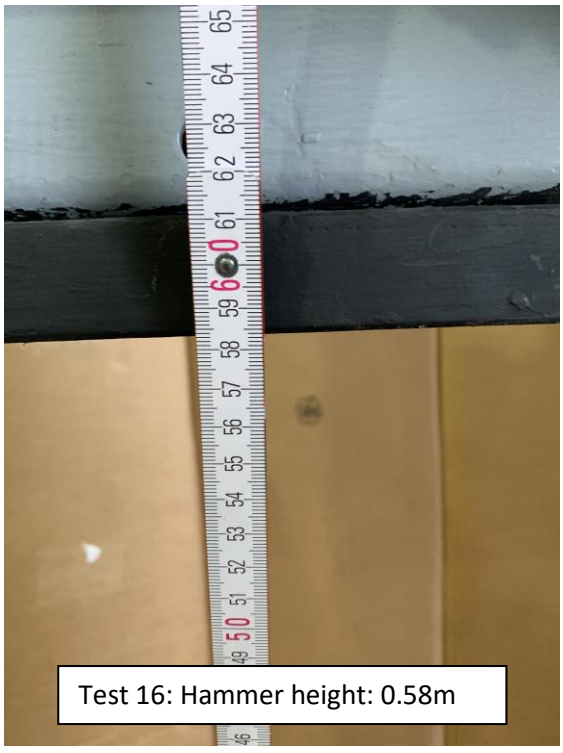
	Name	Position	Signature
Tested by	J.-P. Kroll	Man. Dir. Engineering	
Reviewed by	T.J. Kroll	Managing Director	

Angular 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 15: 1017	OK, no connection damage
+ 66	Test 16: 1424	OK, no connection damage


Test 15: Hammer height: 0.41m

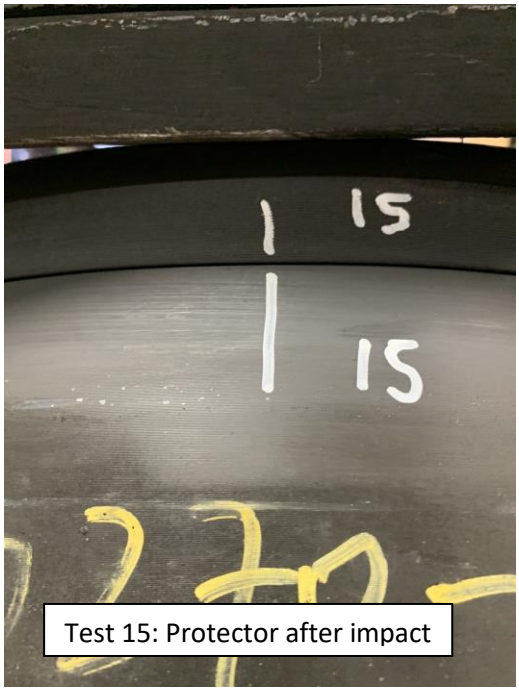

Test 16: Hammer height: 0.58m

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 0.41 m for the API value (1017 Joules) and 0.58 meters height to achieve an impact energy of min. 1424 Joules (Exquip value).

TEST 1 (API/OMS): E = m(W) x g x h | 1017 Joules = 253 kg x 9,81 m/s² x 0,41 m

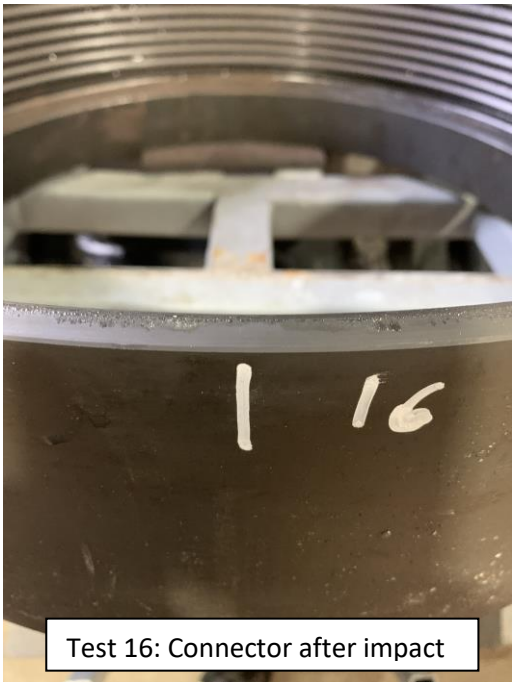
TEST 2 (EXQUIP): E = m(W) x g x h | 1424 Joules = 253 kg x 9,81 m/s² x 0,58 m



Test 15: Protector after impact

Test 16: Protector after impact

Test 15: Connector after impact



Test 16: 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