

LABORATORY TEST REPORT

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Subject of study: Testing the mechanical properties of the surface topping elements of gullies and manholes made of recycle plastics	Research based on: PN-EN 124-1:2015-07	Test date: 11.2020

1. Subject of research

The tests were performed on the elements provided by the client. All elements are part of the Lauridsen Solution manhole cap system.

Scope and methods of research:

- Testing the deformation of manhole covers under static load.
- Periodic test of manhole covers under dynamic load.

Strength tests were performed in a universal testing machine, class 1A (ISO 5893)

with a force sensor with a range of 20 kN. Temperature and humidity conditions at the test site - temperature 21 ° C and 50% air humidity. In order to apply the load to the covers, an intermediate steel element was used in accordance with the PN-EN 124-1: 2015-07 standard (Fig. 1). During the test, the covers were placed on relieving cones in accordance with the system solution.

The study of the deformation of manhole covers under static load was performed by increasing the load gradually by 1.0 kN. The load was increased at a speed of 30 N / s. At each threshold, the force was maintained for 30 seconds, during this time, the bottom inspection was carried out for permanent damage. The load was increased until significant damage was achieved on the lower part of the cover or up to 15 kN declared by the manufacturer.

In cyclic tests of well covers, 50 load-unloading cycles were performed for each sample. The load was carried out at a constant speed of 1.2 kN / s both during loading and unloading. The samples were loaded to the value of about 80% of the load estimated on the basis of static tests as destructive for a given type of well.

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The number of test pieces is shown in Table 1.

Table 1. Number of elements subjected to strength tests

Well type	Number of samples	
	Static test	Dynamic test
Flat cover LHI P 315 mm	4 pcs	2 pcs
Cover with a lower cylinder LHI F 315 mm	4 pcs	2 pcs
Flat cover LHI P 425 mm	4 pcs	2 pcs
Cover with a lower cylinder LHI F 425 mm	4 pcs	2 pcs



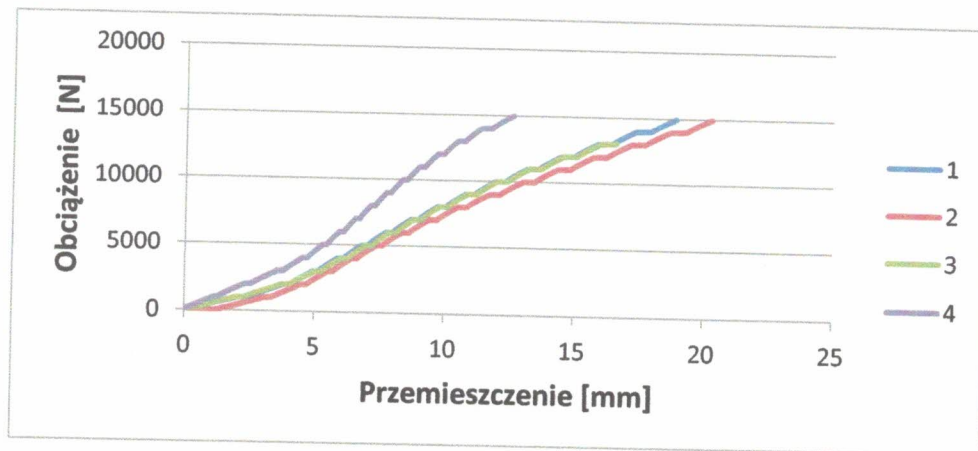
Rys. 1. Stand for testing manhole covers

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2. Research results

The test results for all components are presented below.

2.1. Type well covers LHI P 315



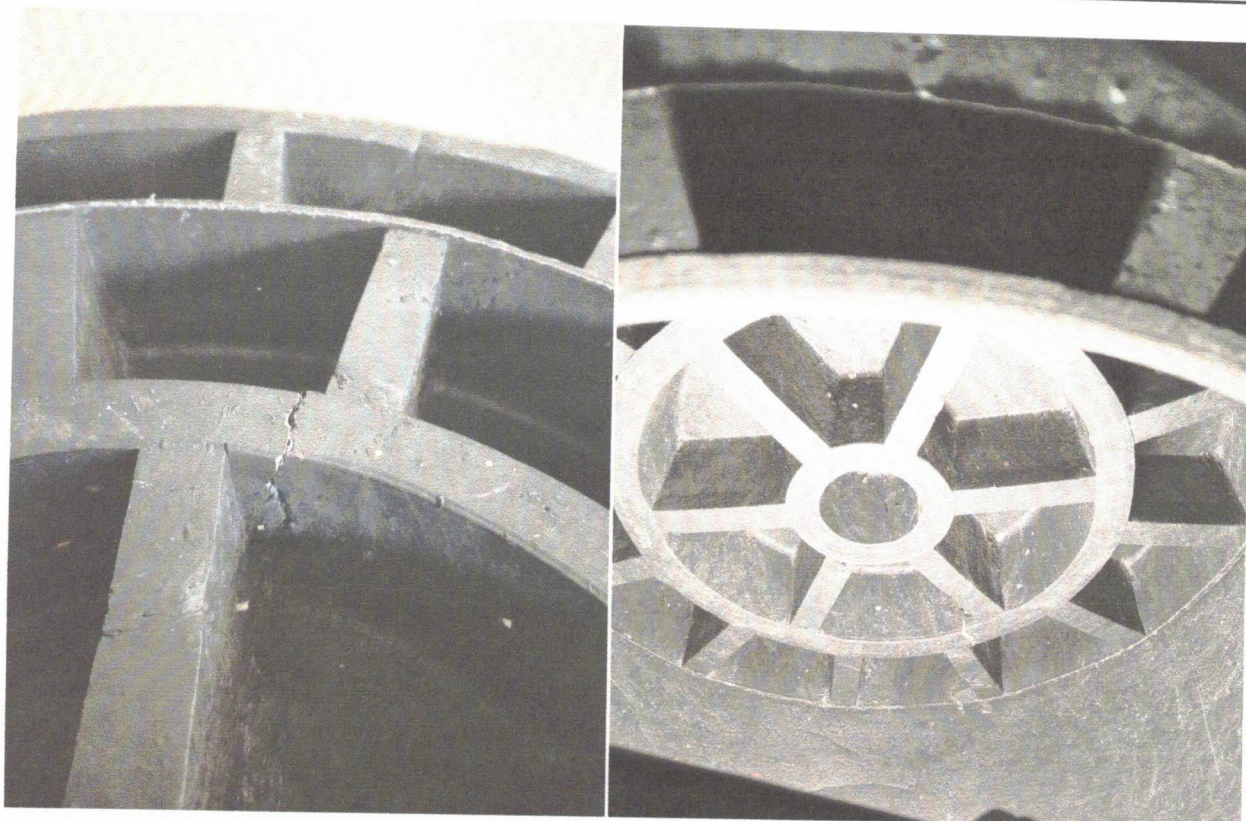
Rys. 1. Diagram of the displacement-load relationship for LHI P 315 flat covers

Table 2 shows the results of the visual inspection of the sample during the test. The value of the force in the table corresponds to the load at which the damage was noticed.

Tabela 2. Number of elements subjected to strength tests

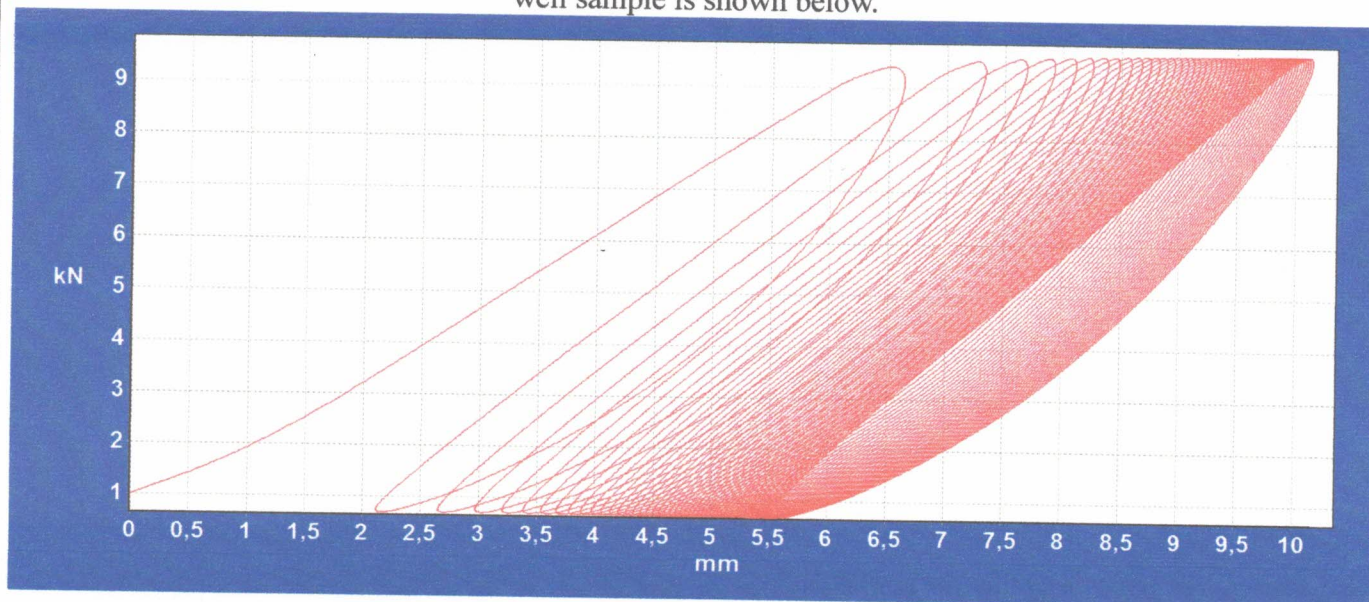
Sample No.	strength [kN]	Description of the damage
1	700	No damage
	900	Scratch
	1200	Cracked inner cylinder, significant scratches on other components
2	700	No damage
	900	Scratch
	1200	Cracked inner cylinder, significant scratches on other components
3	700	No damage
	1100	Scratch
	1300	Cracked inner cylinder, significant scratches on other components
4	700	No damage
	900	Scratch
	1000	Cracked inner cylinder

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Rys. 2. Examples of damage to LHI P 315 flat covers

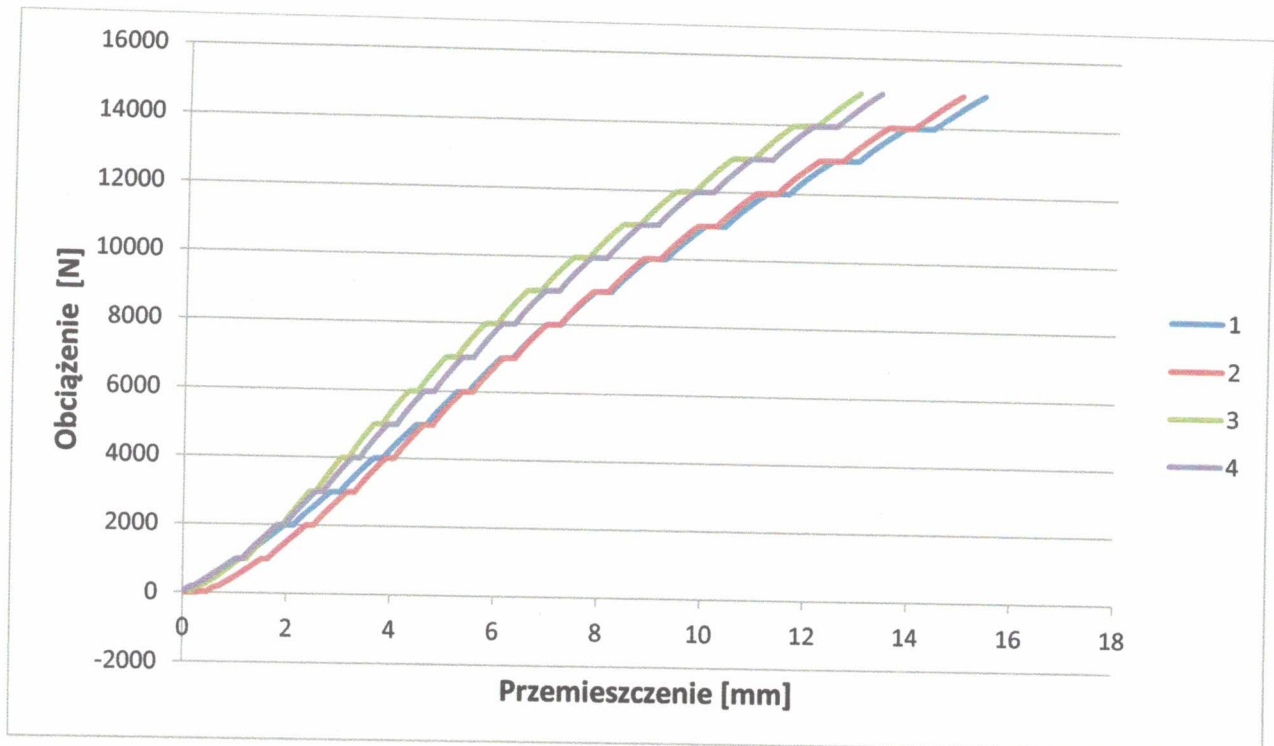
The maximum load of 9.6 kN was assumed for the cyclic test. A displacement-load plot for a LHI P 315 well sample is shown below.



Rys. 3. Diagram of the displacement-load relationship for the LHI P 315 flat cover test for the cyclic test

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2.2. Manhole covers tests LHI R 315



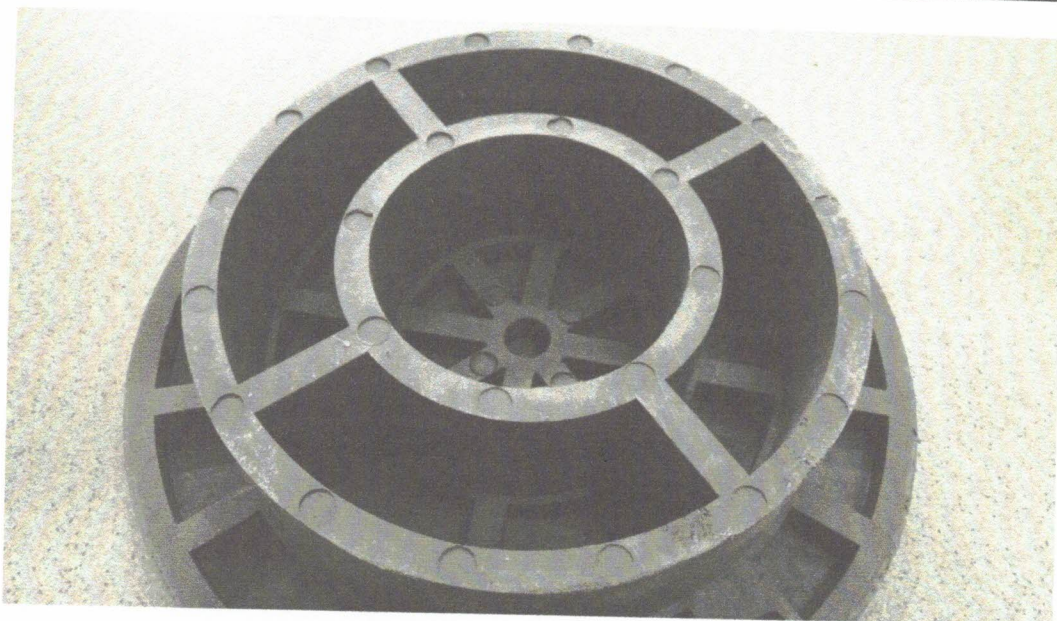
Rys. 4. Displacement - load diagram for LHI P 315 flat covers

Table 3 shows the results of the visual inspection of the sample during the test. The force value corresponds to the threshold at which damage / failures were noticed.

Tabela 3. Number of elements subjected to strength tests

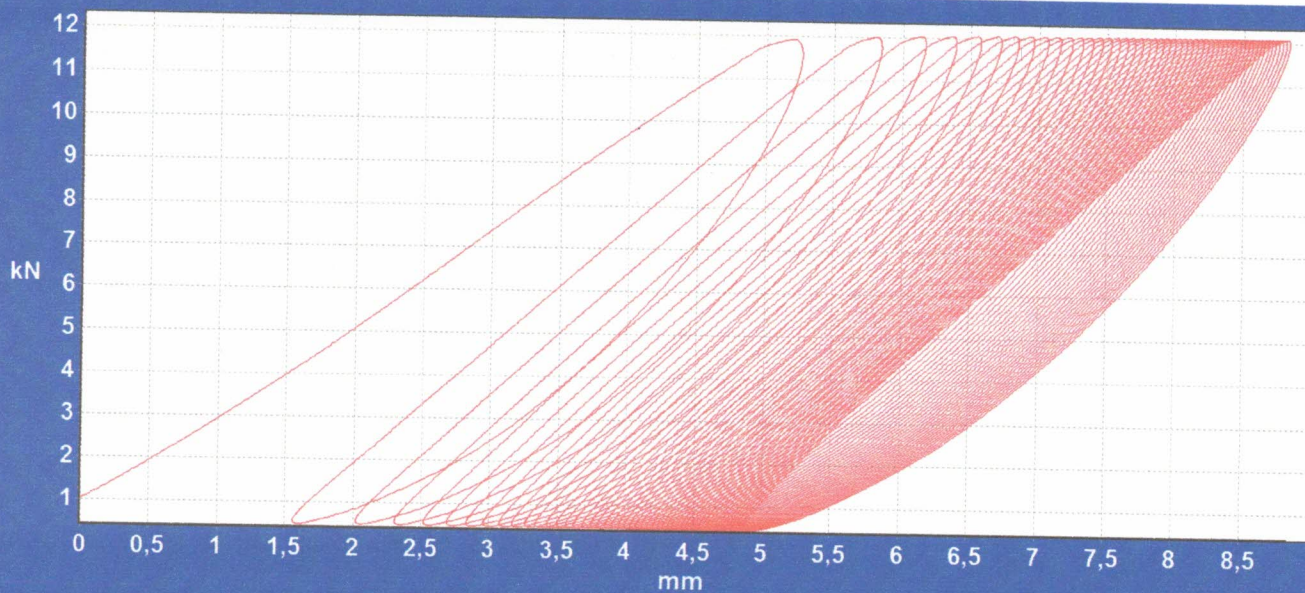
Sample No.	strength [kN]	Description of faults / damage
1	1500	No damage
2	1500	No damage
3	1500	No damage
4	1500	No damage

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Rys. 5. Manhole cover after static test. No damage to the LHI F 315 lower cylinder covers

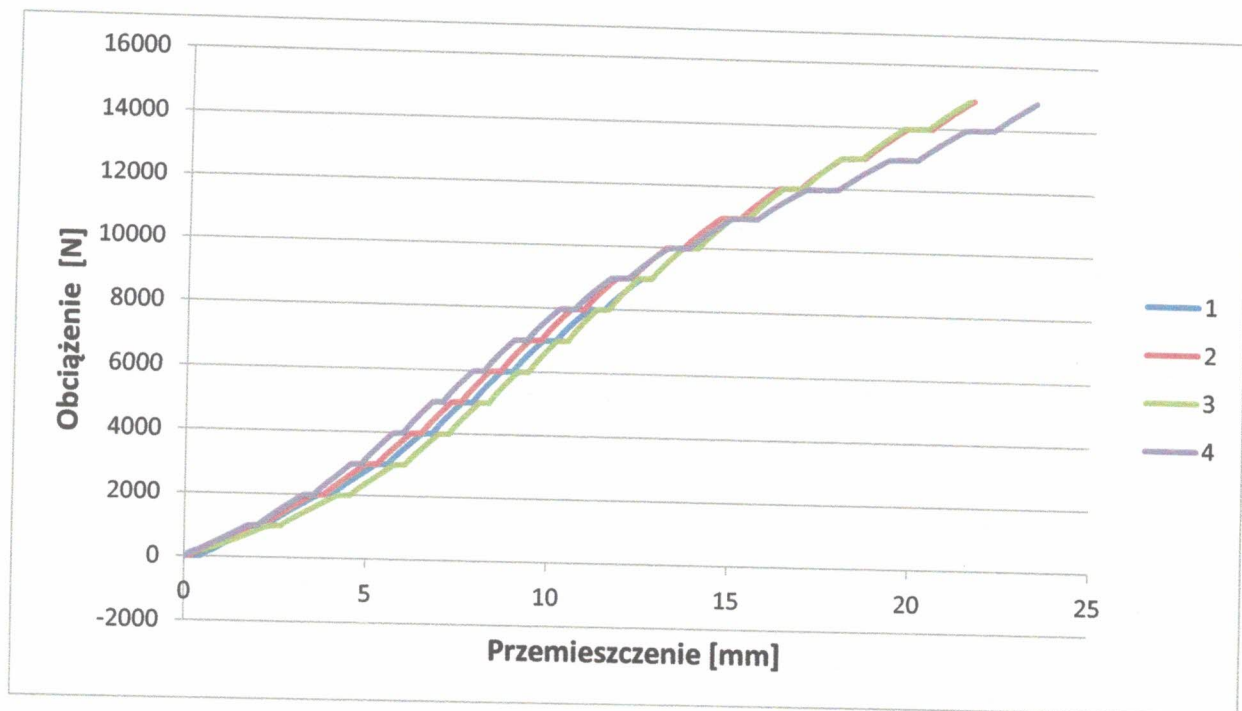
A maximum load of 12.00 kN was assumed for the cyclic test. The displacement-load plot for the LHI F 315 well sample is shown below



Rys. 6 Diagram of the displacement-load relationship for the LHI F 315 flat cover test for the cyclic test

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2.3 Badania pokryw LHI P 425



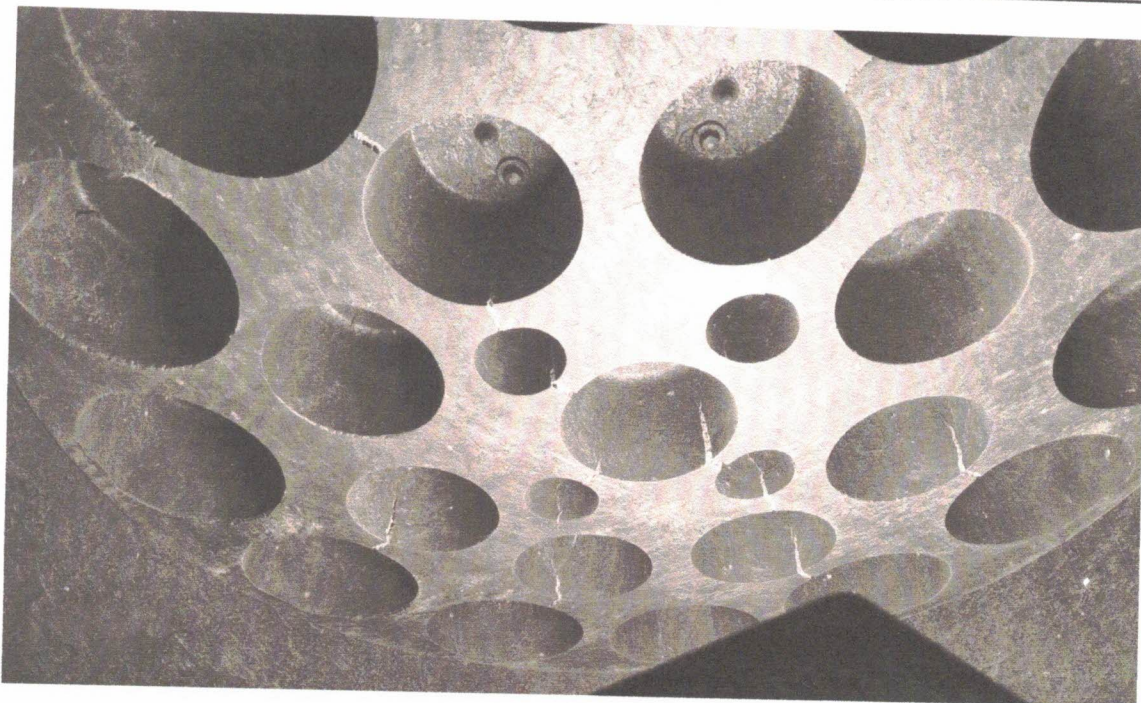
Rys. 7. Displacement - load diagram for LHI P 425 flat covers

Table 4 shows the results of the visual inspection of the sample during the test. The force value corresponds to the threshold at which damage / failures were noticed. It should be assumed that the damage occurred with less force, but not more than 1 kN.

Tabela 4. Number of elements subjected to strength tests

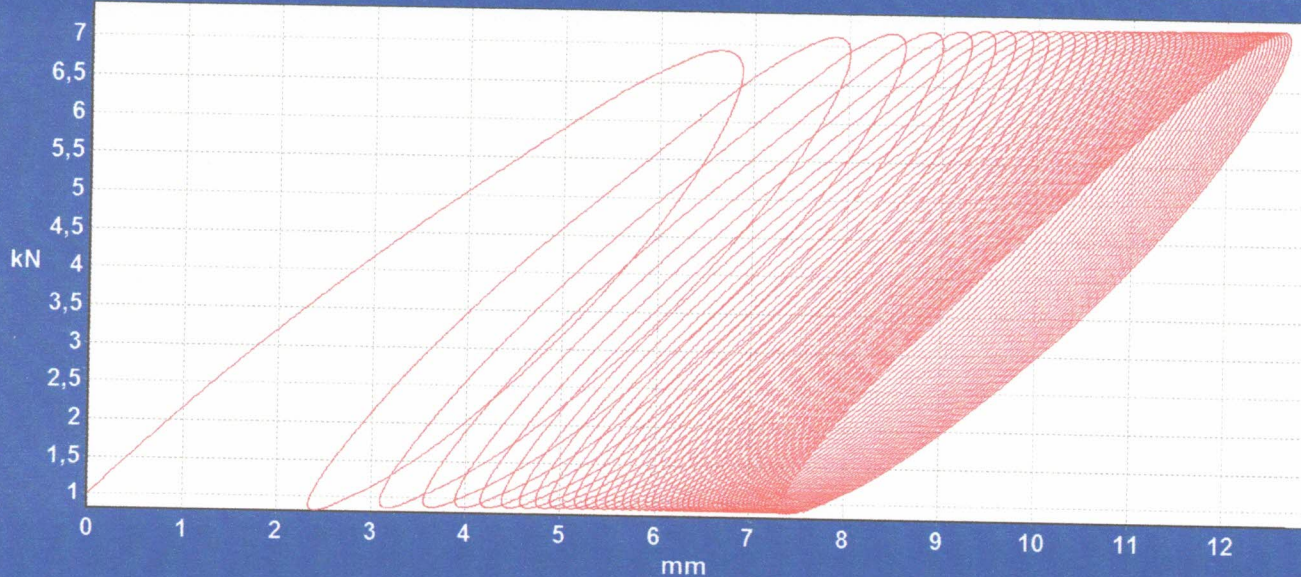
Sample No.	strength [kN]	Description of faults / damage
1	700	Scratch - No damage
	800	Destruction of an element
2	700	Scratch - No damage
	1200	Destruction of an element
3	1000	Scratch - No damage
	1200	Destruction of an element
4	700	Scratch - No damage
	900	Destruction of an element

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Rys. 8. Examples of damage to the LHI P 425 flat cover

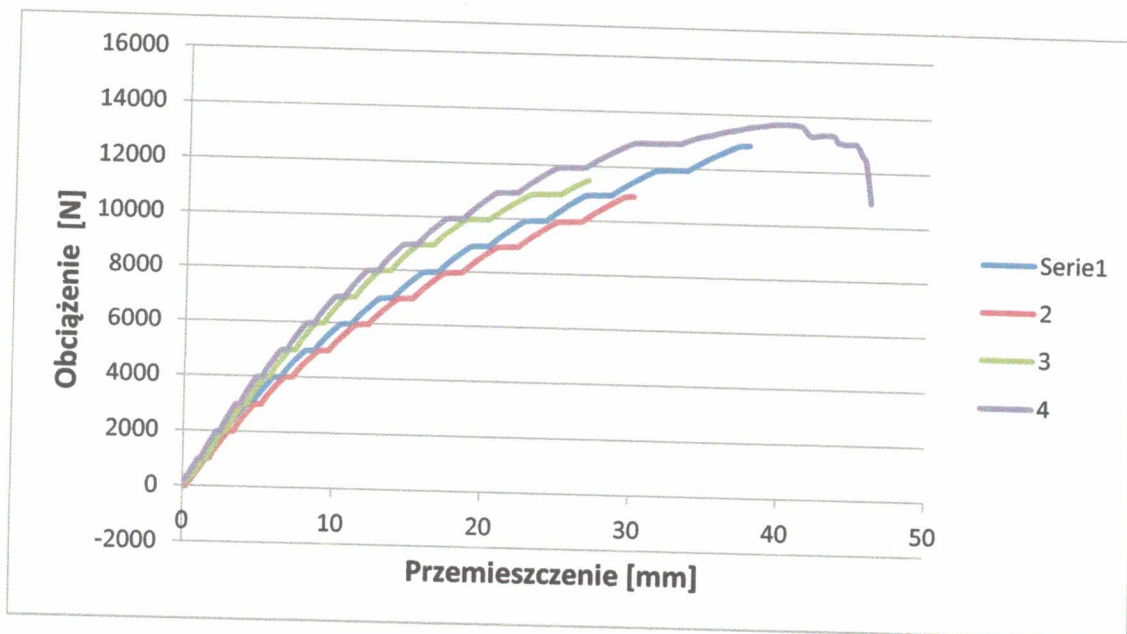
A maximum load of 7.2kN was assumed for the cyclic test. A displacement-load plot for a LHI P 425 well sample is shown below.



Rys. Diagram of the displacement-load relationship for the LHI P 425 flat cover test for the cyclic test

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2.3 Badania pokryw LHI F 425



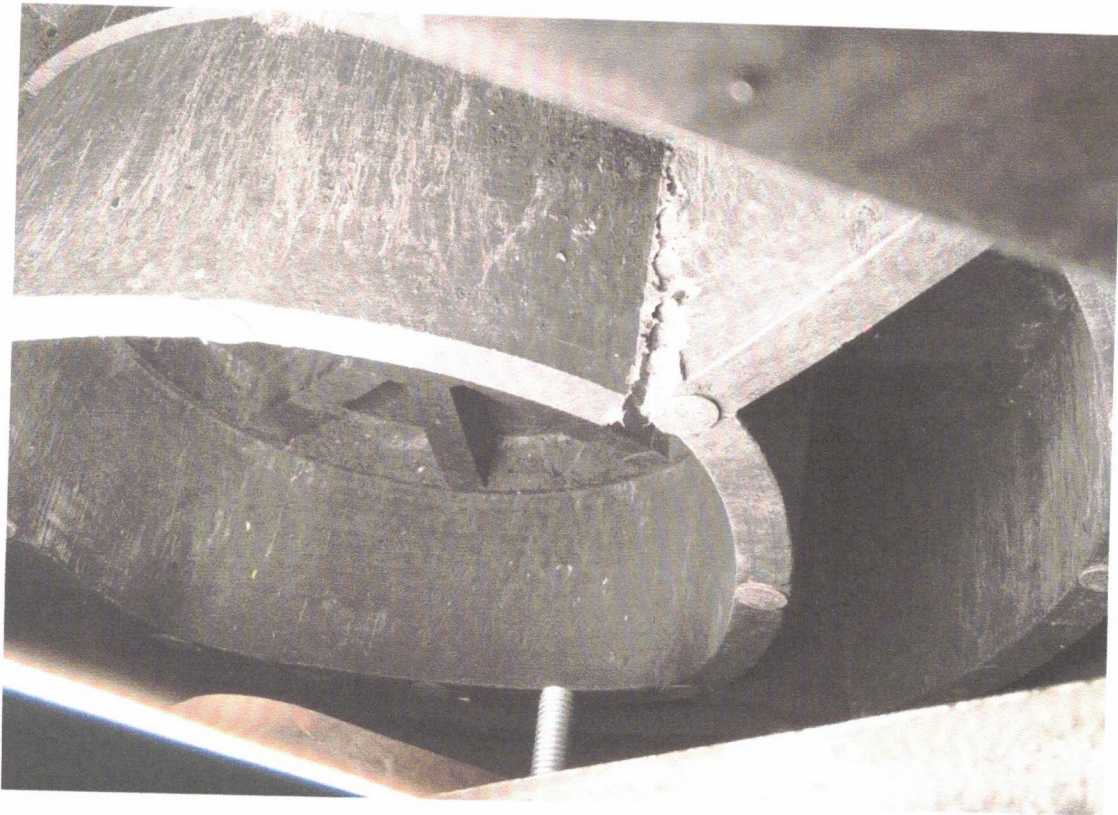
Rys. 10. Displacement - load diagram for LHI P 425 flat covers

Table 2 shows the results of the visual inspection of the sample during the test. The force value corresponds to the threshold at which damage / failures were noticed. It should be assumed that the damage occurred with less force, but not more than 1 kN.

Tabela 5. Number of elements subjected to strength tests

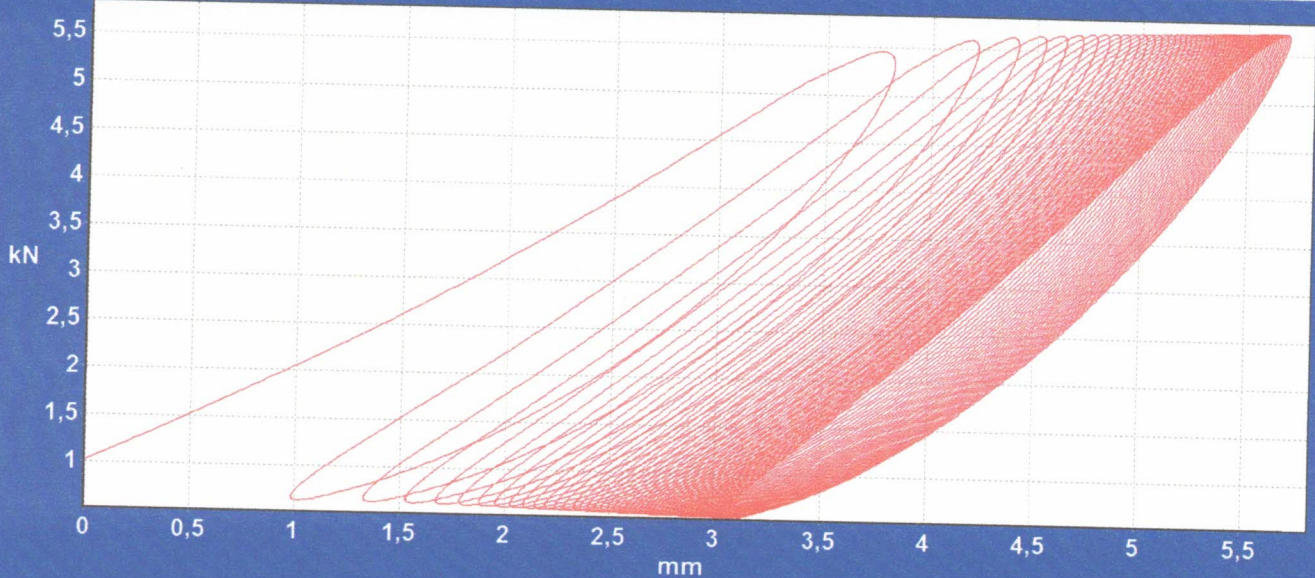
Sample No.	strength [kN]	Description of faults / damage
1	700	No damage
	900	Scratch on the inner cylinder
	1100	Destruction of an element
2	700	No damage
	800	Destruction of the element, the rib torn off the inner cylinder
3	600	Scratch on the inner cylinder - No damage
	1000	Destruction of an element
4	600	Cut the rib between the inner and outer cylinders
	900	Scratch on the inner cylinder
	1100	Destruction of the element, the rib torn off the inner cylinder

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Rys. 11. Example of destruction of the cover with the lower cylinder LHI F425

A maximum load of 5.7kN was assumed for the cyclic test. A displacement-load plot for a LHI F 425 well sample is shown below.



Rys. 12. Diagram of the displacement-load relationship for the LHI P 425 flat cover test for the cyclic test

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3. Comments

- At the assumed maximum loads for cyclic tests, the tested samples did not get scratched
- LHI F 425 type manhole covers have been damaged irregularly. No repeatability of the form of element destruction.

The report was made:

Wyniki zgodne z oryginalnym raportem
Tłumaczenie z języka oryginalnego
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Złnowski

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