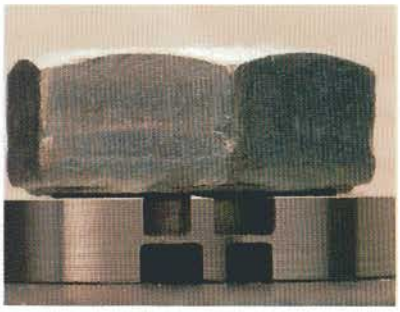
PATLOC – lockwasher

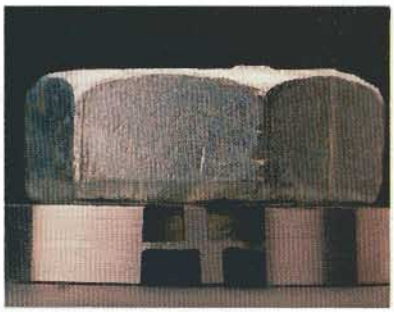
. . . the perfect solution for innumerable applications

- Vibration-safe lockwasher for all bolt/nut connections.
- Technically unique. Cost reducing.
- Simple to use. Inspection-friendly.
- Incorrect assembly impossible.
- Large loadsurfaces.

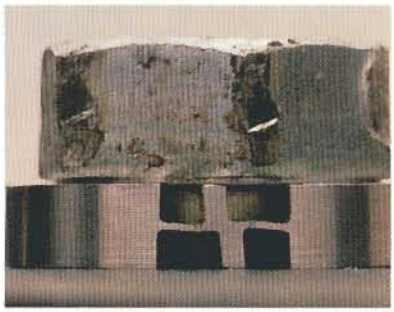
PATLOC – function & principle



Unloaded



Loaded



In locked position

PATLOC – specifications

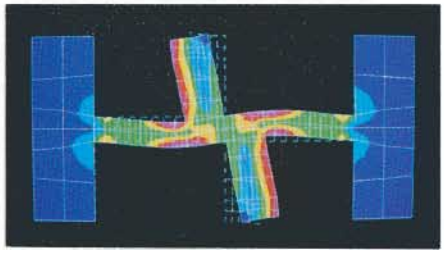
Confirms to the following standards:
DIN 522, ISO 4759/3, NS 4759/3
Material strength class: 12.9

Dimensions (mm)

Bolt-diam	8	10	12	16	20	24	30
Thickness	4	4	6	6	8	8	10

PATLOC – testresults

Design and stress calculations in cooperation with "Engineering Analysis Consultants".
Photo shows stress distribution in loaded condition.



Comprehensively tested in critical vibration mode by "Norsk Forsvarsteknologi A/S".

Generalconsultant:
Technological Institute, Norway.

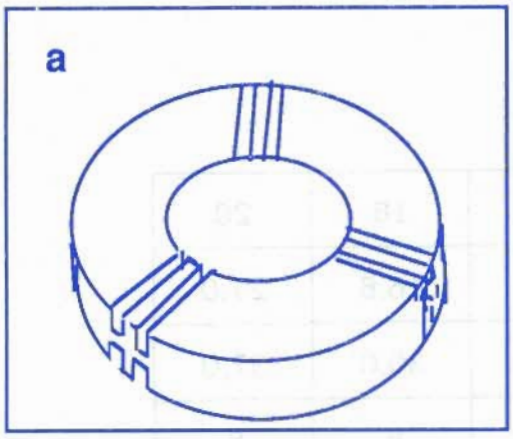
SCANLOC BERAX LTD. A/S

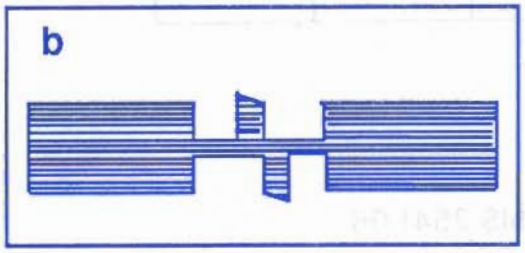
N - 4930 VEGÅRSHEI – Tel. 041-68411 – Fax 041-68441

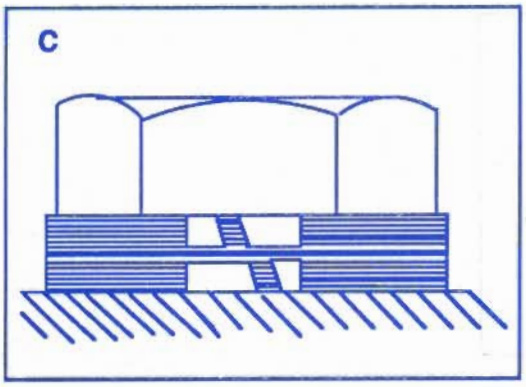
Trykk: Thv. Olsen – Litho: Kr.sand Litho-Klisje A/S

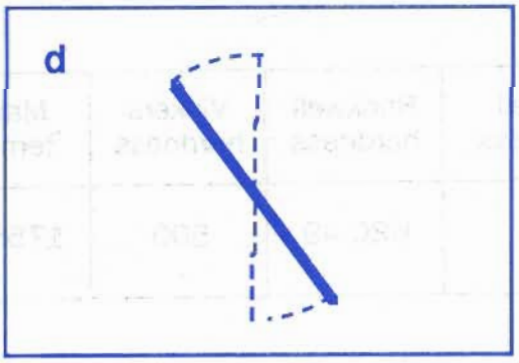
PATLOC® – Lockwasher

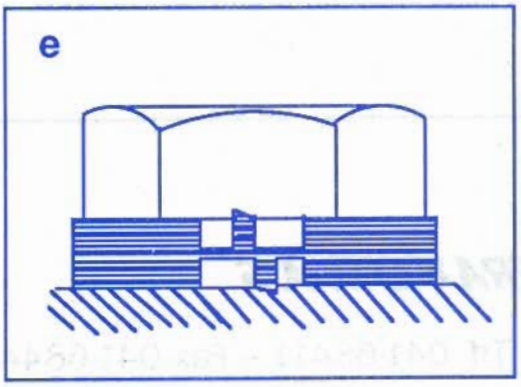
PATENT











Function and Principle

The lockwasher has the basic shape of an ordinary washer – with a thickness permitting the threads of the bolt to end in the washer instead of in the part of the bolt which enters the joint.

The loadsurfaces are disrupted with a special profile with a relative distance of 120 degrees (a). This special profile consists of four lowered tracks, two on each side of the washer. Between these tracks there is a pillar which rises above the loadsurface (b) in a certain proportion.

The nut being tightened, the pillars are bent sideways (c). The pillars remain strained within the elastic zone, so that two aims are achieved:

- The metal will not rest in the new shape caused by the bending.
- The spanforce working against the nut, in combination with the frictional force arising when the nut is about to loosen, leads to the pillars trying to get back to their original position.

The movements of the pillars have two different effects – which together contribute to a further locking of the connection:

- When the pillars are erected, they get higher (d), pressing the nut against the threads of the bolt. The friction between the nut and the bolt increases proportionally with this movement.
- The friction between the pillar on the washer, and the nut, respectively the joint, will lead to a physical grip between the pillars and the material of the joint (e).

PATLOC® – lockwasher SPECIFICATIONS

PATENT

Dimensions (mm)

Bolt dimension	8	10	12	16	20
Inner diameter	8,3	10,4	12,5	16,6	21,0
Outer diameter	16,0	20,0	24,0	30,0	37,0
Thickness	4	4	6	6	8

Technical specifications

Cr-Ni-Mo-alloy heattreatmentsteal – Swedish standard SIS 2541-06

SSAB
DOMEX 034 B
Werkstoff:
28MnCr B4

C:	0,25 – 0,30	%
Si:	0,20 – 0,35	%
Mn:	1,0 – 1,3	%
S:	0,010	% max
Cr:	0,15 – 0,25	%
B		

Material strength class	Breaking point	Yield point/ breaking point	Brinell hardness	Rockwell hardness	Vickers hardness	Max. temp.
12,9	1650	0,8	470	HRC 49	500	175°C

Extension (A5) 13%
Contraction 55%

SCANLOC BERAX LTD. A/S

N - 4930 VEGÅRSHEI – NORWAY – Tlf. 041-68411 – Fax 041-68441

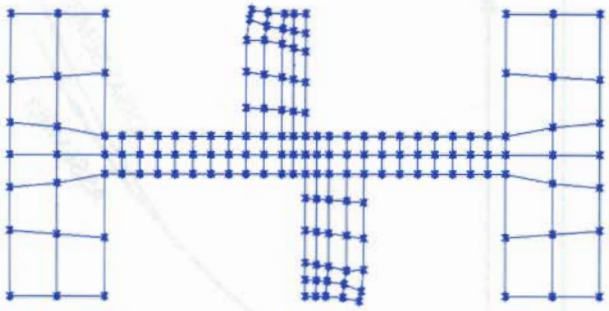
THV. OLSENS TRYKKERI

Productanalysis PATLOC®

PATENT

Phase 1: Design and stress calculations

In order to achieve the function which PATLOC holds (see separate sheet: «Function and Principle»), it was necessary to do a complete theoretical analysis on the behaviour of the washer when brought under stress. This analysis was executed by means of FEM (Finit Element Method) by the consultantcompany EAC in Kongsberg.



A series of analyses were carried out. The intention was to optimize the geometrical shape of the washer, based on the defined qualifications and limitations. The loads were applied with different values both in the x- and in the y-direction. The results of the analyses were very satisfactory:

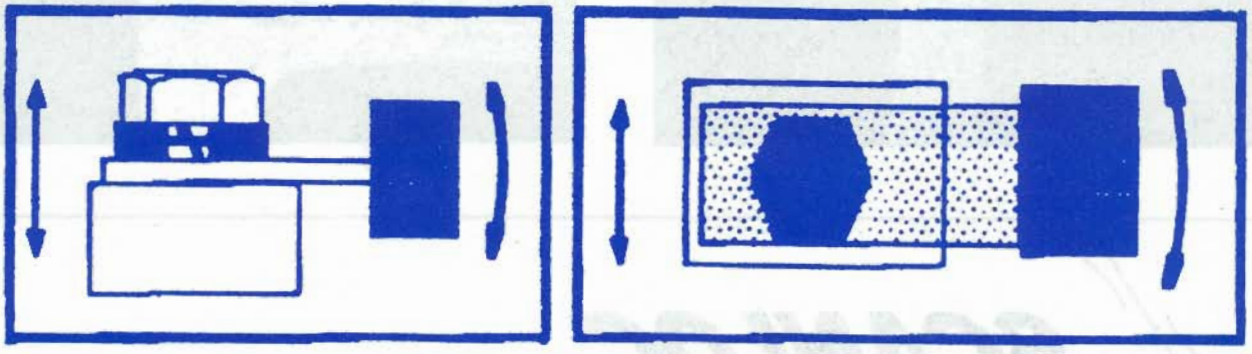
- One reached an optimal shape of the pillar.
- Stress-level lies within yield- and breaking point for the material.

Phase 2: Physical test of PATLOC

At the producttesting-laboratory at NFT in Kongsberg a series of physical tests were carried out, both of dynamic and static character.

The static tests showed that PATLOC mastered the stress which the pillar is exposed to during repeated use of the washer. The geometrical shape of the pillars remained unchanged.

The dynamic tests were executed in a testvibrator, and PATLOC was strapped down in two different ways. The first aim was to analyse the behaviour of the washer during vibrations which had a membrane-effect on the fastening arrangement. In the other case one wanted to see the result of a vibrationtest where the fastening arrangement was exposed to a torsional effect.

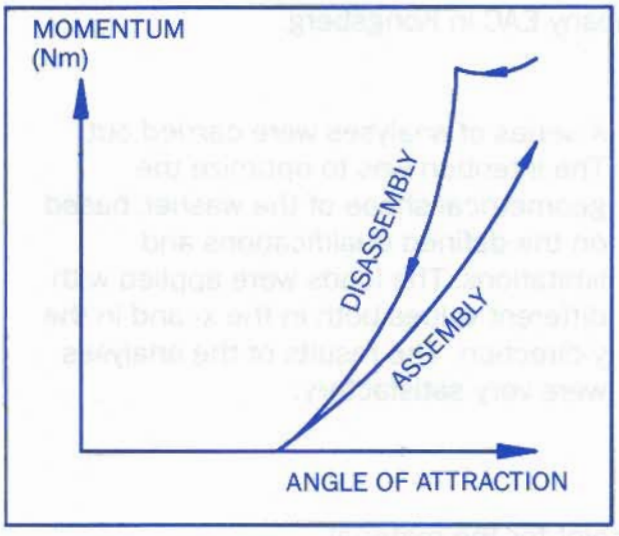


a) Test with membrane effect

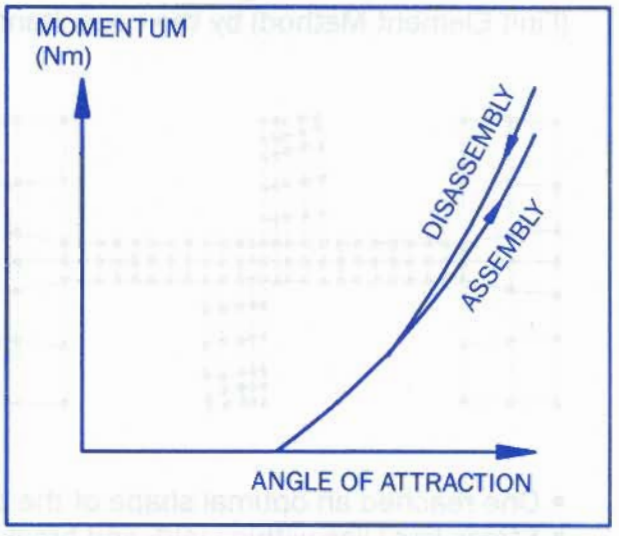
b) Test with torsional effect

In the first part of the vibrationtest one found the resonantfrequency area by means of a function which this testequipment offers. To achieve the most realictic result, the test continued for several hours in this area.

When tightening, one made use of the given momentum for this material strength class. When the vibrationtest was completed, one noted the momentum which was necessary in order to loosen the bolt. As a result of several tests, one could clearly establish that the principle of the washer always came into force. To compare the lockability of PATLOC with an ordinary washer, this was tested parallel:



PATLOC LOCKWASHER



ORDINARY WASHER

Phase 3: Testing of materials

In order to analyse the effect which the stress had on the washers during the vibrationtests, these were sent to the materialtesting-laboratory at NFT. The washers were cut and the surfaces analysed chemically and through a microscope. One could conclude that there was no sign of deformation, neither on the pillar nor on the elastic strings. Also no cracking.