BDF. Handle

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TECHNICAL REPORT

DEVICE FOR THE MANUAL APPLICATION OF BRAKES AND THE ACCELERATOR FOR USE IN VEHICLES WITH AN AUTOMATIC GEAR-BOX

DEVICE FOR THE MANUAL APPLICATION OF BRAKES AND THE ACCELERATOR, FOR INSTALLATION IN VEHICLES WITH AN AUTOMATIC GEAR-BOX

B.D.F. DEVICE SERIAL NUMBER:

VEHICLE MANUFACTURER:

TYPE:

NUMBER OF CHASSIS:

DESCRIPTION OF THE OPERATION OF THE DEVICE

The device is designed in such a way that by moving a lever, by hand, the brakes can be applied or the accelerator pushed down, and what is most important for safety is that both functions cannot be applied at the same time. When the device is installed the driving of the car does not, as a whole, change, since access to the acceleration pedal and to the brake pedal in not affected. The device is installed in such a way that, after it is removed, the vehicle returns to its original state, and no damage occurs to the linings or other parts of the vehicle.

PUSHING DOWN THE ACCELERATOR

In the case when the driver wishes to accelerate he pulls the lever towards himself, in which case, depending on how far the lever is pulled, gas is added. If the lever is quickly pulled by the driver towards himself, to its maximum extent (kick-down, if the vehicle is so fitted), then the gear box changes to a lower gear and the vehicle starts to accelerate quickly.

APPLYING THE BRAKES

When the driver wishes to apply the brakes he pushes the lever away from himself, and depending on the manual force used a corresponding braking force acts on the vehicle.
The device is welded onto a special load-bearing frame, which is bolted underneath the slides of the driver's seat. In order to ensure that this frame is stable it is fixed onto the front left and right bolt of the mountings of the seat. In each type of vehicle the design of the frame is different. It is, however, in all cases fixed at two points, which means that any movement of the device is prevented.
The material which is used for the construction of the frame is a steel plate with the dimension 35.5 mm, of material grade S235JR+AR.

Figure showing the device as installed

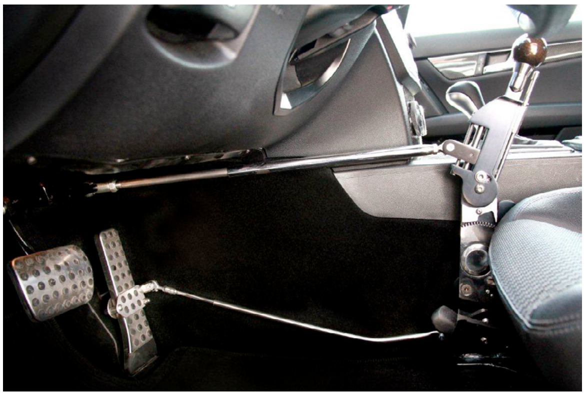
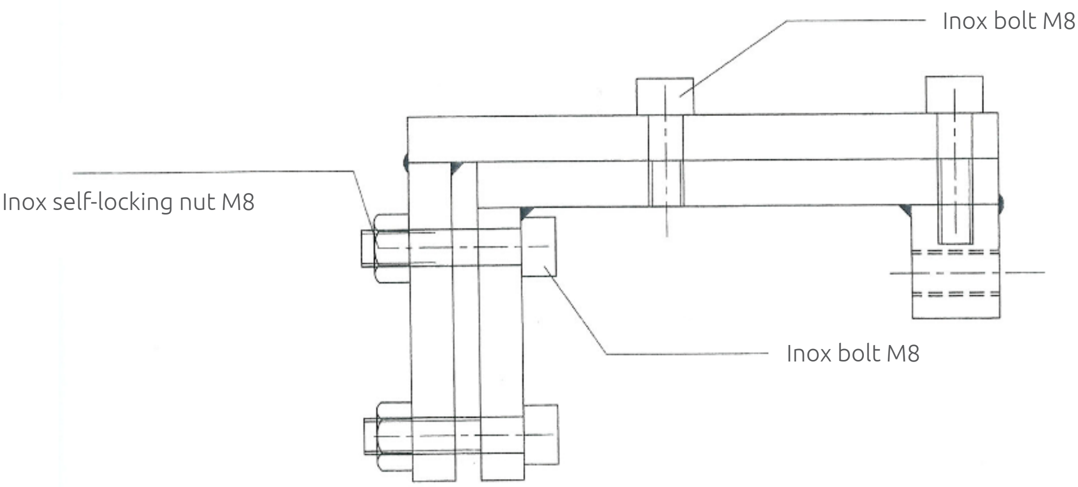


Figure showing how the device is attached to the two pedals

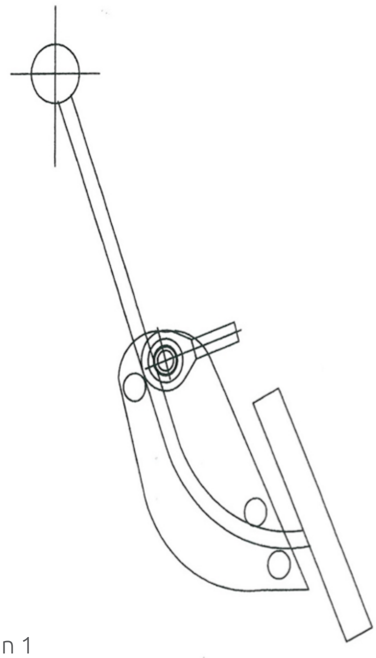


When connecting the device to the brake pedal, a welded steel frame of the type shown in the diagram above is used.

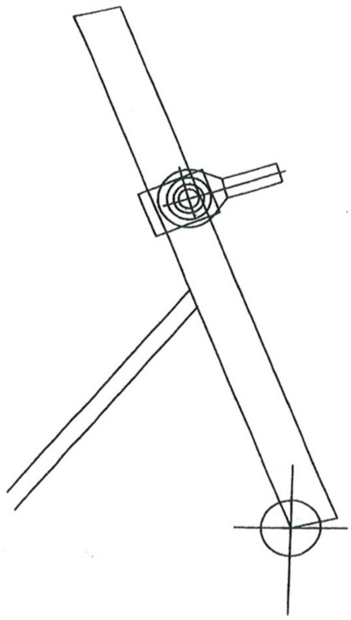
In the case of the steel frame which is used for the brake pedal, a flat steel bar with the dimensions 30x10 mm, of material grade S235JR+K, is used. The bolts are made of stainless steel with the dimensions M10 and M8, of quality 1.4304, which is also the quality of the corresponding self-tightening nuts.

In the case of the accelerator pedal, in general two types of pedal design are encountered. In one case the accelerator pedal moves together with the push-rod, whereas in the other case the pedal is fixed to the chassis of the vehicle so that it can only move radially.

Both of these versions are shown in the diagrams provided below.



Version 1



Version 2

MATERIALS USED FOR THE MANUFACTURING OF THE B.D.F. DEVICE

The basic steel frame: 30x5 S235JR+Ar

The whole device: AlMgSi1 (6082)
Stainless steel: 1.4301
The lever: wooden – beech

The steel element for the brake pedal: 30X10 S235JR+K

The steel element for the accelerator pedal: AlMgSi (6082) or stainless steel 1.4301.

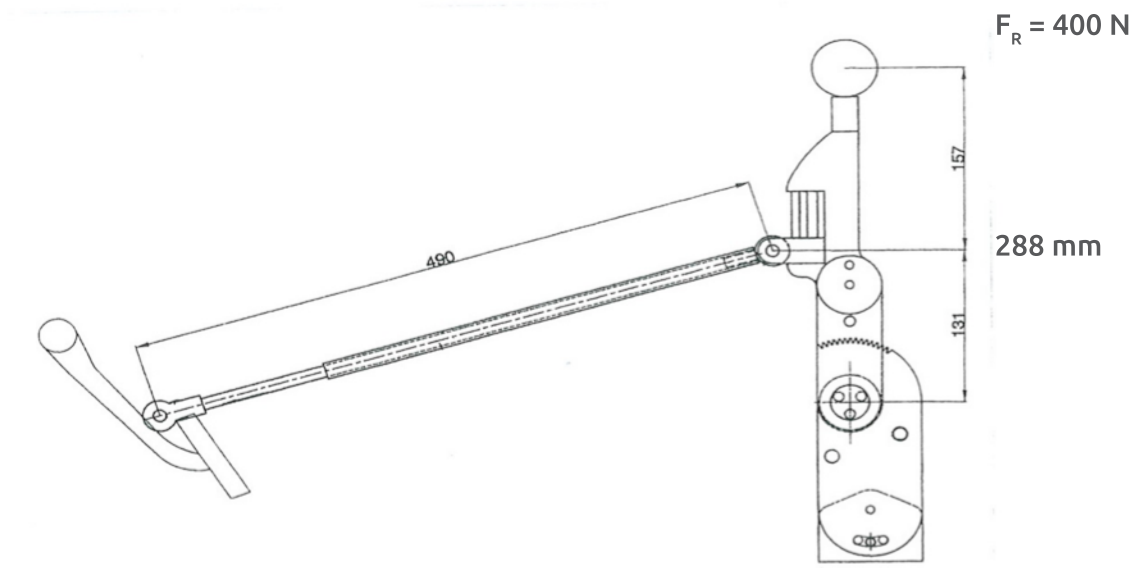
The connection between the device and the brake pedal consists of a pipe with dimensions of Ø 14X1.5 mm and a cold drawn stainless steel rod with a diameter of Ø 10 mm, of material grade 1.4301.

The connection between the device and the accelerator pedal consists of a pipe with dimensions of Ø 10X1.5 mm and a cold drawn stainless steel rod of diameter Ø 6 mm, of material grade 1.4301.

In the case of the connection between the device and the brake pedal, spherical bearings having the designation M10 SIKAC and M10 SAKAC are used.

In the case of the connection between the device and the accelerator pedal spherical bearings having the designation M6 SIKAC and M6 SAKAC are used.

STRENGTH CALCULATIONS OF THE DEVICE FOR THE BRAKE PEDAL



Calculation of the force acting on the brake pedal

$$Fp = \frac{F_R*288}{131} = \frac{400\ N*288\ mm}{131\ mm} = 879,4\ N$$

Checking the compressive stress in the steel rod with a diameter of Ø 10 mm

$$\sigma = \frac{F}{S} = \frac{879,4\ N}{78,53\ mm^2} = 11,198\ N/mm^2$$

$$S = \frac{\pi*d^2}{4} = \frac{\pi*10^2}{4} = 78,53\ mm^2$$

d = diameter of the rod Ø 10 mm

The compressive stress in the rod is less than the permissible compressive stress by a factor of several times.

Checking of the flexural stress in the bolt M10, which carries the spherical bearing on the steel element of the brake pedal.

$$M = F \cdot I = 879{,}4 \cdot 0{,}010 = 8{,}794\ Nm$$

$$W = \frac{\pi * d^3}{32} = \frac{\pi * 10^3}{32} = 98{,}17\ mm^3$$

$$\sigma = \frac{M * e}{i} = \frac{M}{W} = \frac{8{,}794 * 10^3}{98{,}17} = 89{,}579\ N/mm^2$$

The stress in the bolt is less than the permissible stress.

Checking the buckling stress of the rod with a diameter of Ø 10 mm

$$i_{min} = \frac{\pi * d^4}{64} = \frac{\pi * 10^4}{64} = 490{,}87\ mm^4$$

The cross-section is

$$S = \frac{\pi * d^2}{4} = \frac{\pi * 10^2}{4} = 78{,}53\ mm^2$$

The radius of the moment of inertia amounts to

$$i = \sqrt{\frac{i_{min}}{S}} = \sqrt{\frac{490{,}87}{78{,}53}} = 2{,}5001\ mm$$

L_0 = length of the steel rod Ø 10 mm

$$\lambda = \frac{L_0}{i} = \frac{490}{2{,}5} = 196$$

$$\sigma_k = \frac{F_k}{S} = \frac{\pi^2 * E}{\lambda^2} = \frac{\pi^2 * 210000}{196^2} = \frac{2072616{,}9}{38416} = 53\ N/mm^2$$

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The actual buckling stress according to the ω procedure is

$$\frac{F}{S} * \ \omega = \sigma = \frac{879{,}4}{78{,}53} * 6{,}75 = 75{,}85\ N/mm2$$

ω = 6,75

This stress, too, is less than the permissible value. It should also be mentioned that the rod with a diameter of Ø 10 mm travels along a tube with dimensions Ø 14x1,5 mm, and thus is conducted, and is not actually exposed to such buckling as has been calculated.

In conclusion it can be stated that the rod with a diameter of Ø 10 mm is satisfactory for loadings of this kind.

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Ljubljana, April 2012