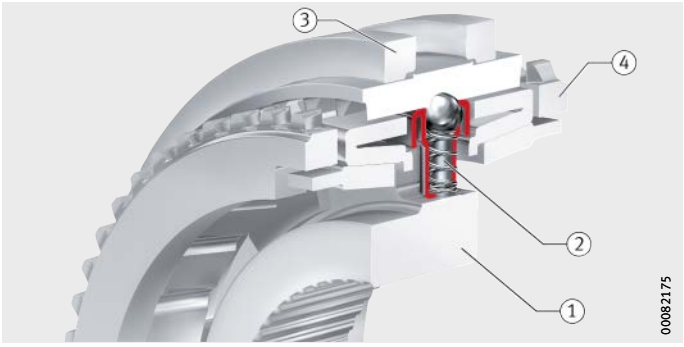
Detent struts for presynchronisation in mobile machinery

Features

Axially movable detent struts are used for presynchronisation in manual gearboxes. The detent struts are located in recesses around the circumference of the synchroniser hub, *Figure 1*. The detent strut element is preloaded by a spring against a recess in the selector sleeve.



① Synchroniser hub
② Detent strut
③ Selector sleeve
④ Synchro ring

Figure 1
Synchronisation system

Detent struts ARRES

Detent struts ARRES are products developed by Schaeffler. In addition to the standard design ARRES-B, other designs are available, for example with particularly small section heights.

Single-piece design

A detent strut ARRES consists of three components, *Figure 2*, page 2. The components are rigidly connected to each other during production. Due to the single-piece design, very little work is involved in gearbox assembly. Furthermore, there is no need for holes in the synchoniser hub and stockholding costs are reduced.

Materials

Detent struts ARRES are made from high quality materials. The steel parts can be black oxide coated and the plastic bases can be produced in any colour.

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Wear

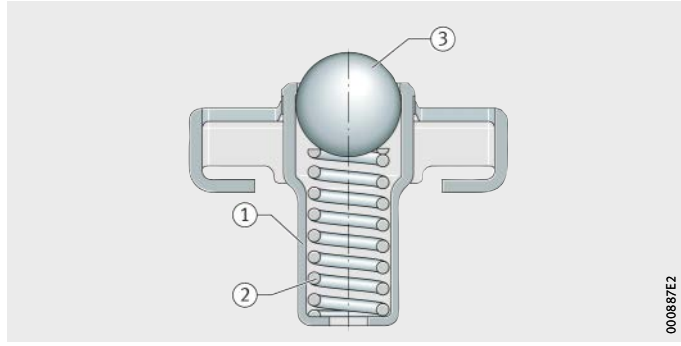
Wear of the guide surfaces leads to a deterioration in synchronisation behaviour. The materials and surfaces developed for the synchronisation system keep wear to a very low level. This allows consistent function over the whole life of the gearbox.

Quality

All the components are manufactured by Schaeffler and are thus subject, from individual part production through to assembly, to continuous and complete quality control.

Gearshift feel

The displacement force curve that is decisive for gearshift feel is determined by the compression spring. In the case of a detent strut ARRES, the spring force can be set at any point over a wide range. The desired gearshift feel can thus be set even shortly before the start of volume production.



① Sleeve
② Compression spring
③ Locking element

Figure 2
Detent strut ARRES-B

ARRES-B

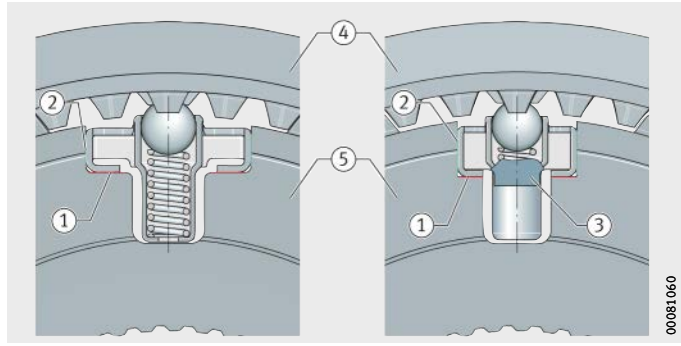
These easy-to-fit detent struts have proved themselves millions of times in practice.

Guidance

Good guidance in the synchroniser hub is achieved by means of the large guidance surfaces, *Figure 3*.

Mounting retainer

A mounting retainer can be integrated in order to ensure that the almost rectangular detent struts are mounted quickly and in the correct position, *Figure 3*.

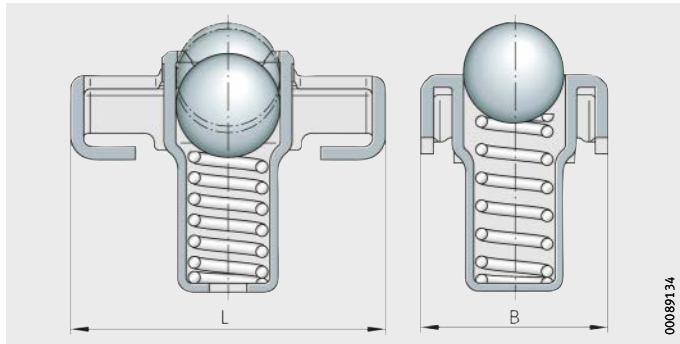


① Contact surfaces
② Guidance surfaces
③ Mounting retainer
④ Selector sleeve
⑤ Synchroniser hub

Figure 3
Guidance surfaces, retainers

Economical variants

Where detent struts are made completely from steel and only the dimensions L and B are changed, this can be accommodated by only a partial change to the tooling, *Figure 4*.



L = length
B = width

Figure 4
Economical variants of ARRES-B

Application in mobile machinery

As a development partner and supplier for gearbox components over many years in the automotive industry, Schaeffler has built up extensive know-how. In the light of continuously increasing demands on gearboxes, this can now also be used to considerable benefit for applications in mobile machinery.

Contemporary developments in the mobile machinery sector include the transition from non-synchronised to synchronised gearboxes, principally in Asia, or the introduction of automated gearshift processes due to the new concept of dual clutch gearboxes. Both these developments require a synchronisation function and thus the use of detent struts for presynchronisation.

Advantages

Detent struts ARRES-B from Schaeffler offer numerous advantages in the mobile machinery sector:

- Assembly is made easier by the single piece design
- Joint development projects can be carried out on various issues:
  - design using a special calculation program for displacement and spring forces
- High quality is achieved through seamless quality control of the complete component from a single supplier
- The design is both robust and optimised for cost due to the formed sheet steel housing and integrated, spring-loaded ball
- Existing designs can easily be matched to a specific design envelope
- Gearshift comfort is improved due to the good guidance characteristics of detent struts ARRES-B
- Higher presynchronisation forces are possible through variation of the compression spring preload force.

Available designs

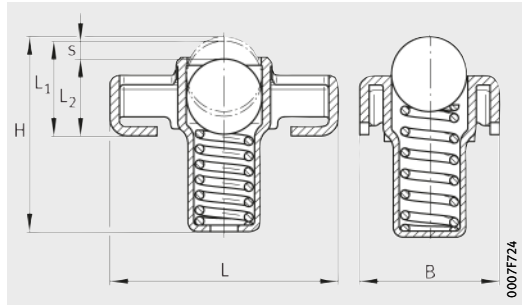
The following dimension table gives an overview of the standard designs of detent struts for presynchronisation, which can be used to cover a wide range of applications.

Further information

- TPI 178, Detents ARRES – Presynchronisation of transmissions
- Further information on the subject of synchronisation: TPI 125, INA Selector Hub Assembly.

Detents ARRES

Standard design



ARRES-B

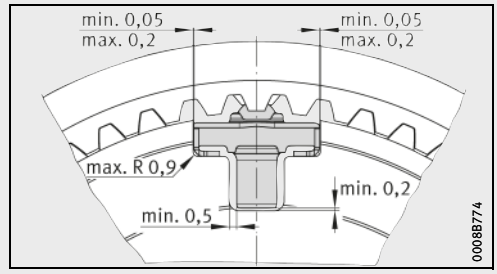
Dimension table · Dimensions in mm

Designation	Mass	Dimension					Forces				Stroke length
	m	L	H	B	L_1	L_2	F_1 [1]		F_2 [2]		s
							min.	max.	min.	max.	
	≈g						N	N	N	N	
ARRES-B1	2,4	15	12,9	9,2	6,3	4,8	10	23	16	46	1,5
ARRES-B2 [3]	2,5	15	12,9	9,2	6,3	4,8	10	23	16	46	1,5
ARRES-B3	2,8	15	12,9	12,3	6,3	4,8	10	10	16	16	1,5
ARRES-B4	3	13,95	12,9	11,45	6,3	4,8	12	12,5	15,6	20	1,5
ARRES-B5	2,5	13,95	12,9	11,45	6,3	4,8	10	12,5	16	20	1,5
ARRES-B6	2,4	14,95	10,9	9,65	6,6	5,4	7,1	16	11,2	29	1,2
ARRES-B7	3	11,8	13,8	10,35	7,25	5,56	7,5	13	15	22	1,69
ARRES-B8 [3]	3	11,8	13,8	10,35	7,25	5,56	7,5	13	15	22	1,69
ARRES-B9	3	13,95	12,9	18,75	6,3	4,8	10	13,5	16	21	1,5
ARRES-B10 [3]	2,5	15	11,7	9,9	7,21	5,84	12	12	22	22	1,37
ARRES-B11	3	13,95	12,5	21,35	5,9	4,65	15	15	22,5	22,5	1,25
ARRES-B14	2,9	15	13,2	18,51	5,1	3,6	15,5	15,5	23,5	23,5	1,5
ARRES-B15	2,4	15	12,9	11,45	6,3	4,8	16,5	16,5	28	28	1,5

1) $\overline{F_1}$ = force at L_1, as a function of the springs used.

2) F_2 = force at L_2, as a function of the springs used.

3) With black oxide coating.



Design envelope proposal for ARRES-B, lateral view

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