GEISLINGER
GESILCO® SHAFT

LIGHTWEIGHT

TORSIONAL VIBRATION CENTER

GEISLINGER®
POWERTRAIN SOLUTIONS. BUILT TO LAST.

GEISLINGER GESILCO® SHAFT

The Geislinger Gesilco® shaft product range is based on more than 20 years' experience in developing fibre composite couplings and shafts. The maintenance-free Gesilco® shaft lines are made of advanced composite material and are characterized by their single-piece manufacturing and their integrated carbon fibre flange connection. The Gesilco® shafts can easily be adapted to the specific requirements of your application. Complete packages with in-house produced steel adapters, bearings, bulkhead seals and additional composite Gesilco® misalignment couplings are available. Their outstanding shock capabilities and good acoustic attenuation further underline the use of Geislinger shafts for high-speed vessels.

DESCRIPTION

Geislinger Gesilco® shafts are produced in one piece, meaning that the flange is not additionally linked to the shaft but is already a part of it. This unique design reduces the weight by approximately 50%. Due to its modular concept, the Gesilco® shaft can be adjusted and tailored to applications depending on their specific requirements especially in terms of transmitted power, length, bending stiffness and torsional stiffness. The stiffness levels of the shafts can be adjusted by altering the angles of the carbon fibre filament windings.
The Gesilco® shafts can measure up to 10 meters in length. The lightweight shaft-lines show high chemical resistance and superior stability throughout their lifetimes.
From designing and manufacturing to calculating the rotation properties of the Gesilco® shaft lines, the entire production is carried out in an in-house process which ensures high quality products and solutions.

ADVANTAGES

- Lightweight
- Maintenance free
- Long bearing distance
- Electrically insulating
- Non-magnetic
- Accommodation of radial misalignments
- No aging, resistant to heat, frost and oil
- Easy installation

APPLICATIONS

- Marine
- Wind power
- Power generation

TECHNICAL DATA

- Torque range: 1 kNm – 700 kNm
- Ambient temperature: -45°C to 100°C
- Diameters: 80 mm – 600 mm

Significant weight reduction through integrated flange

Easy combination with different misalignment couplings

Carbon fibre filament windings at different angles and stiffness levels

Preamble

This catalog replaces all old catalog versions.

The content of this catalog is indicative and - based on new developments - Geislinger reserves the right to change the content without prior notice.

Should you have questions, remarks or inquiries please contact us per e-mail (info@geislinger.com) or telephone (+43 662 66999-0).

The latest version of all Geislinger catalogs can be found on our website Geislinger.com.

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Gesilco Shaftline Description

Gesilco Shaftline Application

A Gesilco shaftline is a complete system comprising advanced composite material drive shafts and accessory parts specifically designed for lightweight drivelines. Gesilco shaftlines offer outstanding weight advantages in comparison to steel shafts.

The lower density of Gesilco composite shafts results in higher critical speeds than conventional steel shaft solutions and allows for twice the spacing between support bearings. The installation of Gesilco shaftlines in the high-speed section of the driveline, e.g. between engine and gearbox, takes special advantage of these features.

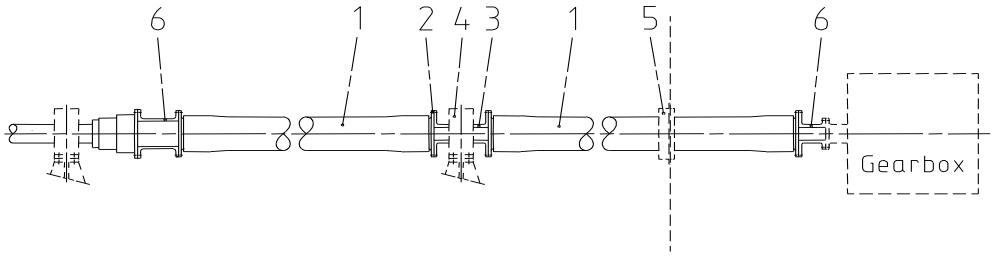
Depending on the type of reinforcing fiber, the weight of the composite Gesilco shaft is approximately 15% of a solid steel shaft and approximately 30% of a hollow steel shaft. However, the overall weight of a Gesilco shaftline must take into account other steel flanges and intermediate shafts for bearings.

Due to the extended support bearing distances, the radial stiffness of the Gesilco shaft system is significantly reduced. Therefore, hull deformations and engine transverse / vertical deflections can be accommodated by Gesilco shaftlines. Gesilco shaftlines, in combination with Gesilco couplings, offer outstanding design solutions for lightweight drivelines with excellent deflection compensation capabilities (see chapter Examples).

Shaftline Design and Materials

The Gesilco shaftline (Fig. 1) is a highly integrated system consisting of: (1) Gesilco shafts with integrated flanges or (2) steel flanges, (3) steel intermediate shafts, (6) steel adapters, (4) bearings, (5) bulkhead seals and conceivably additional Gesilco misalignment couplings.

Fig. 1



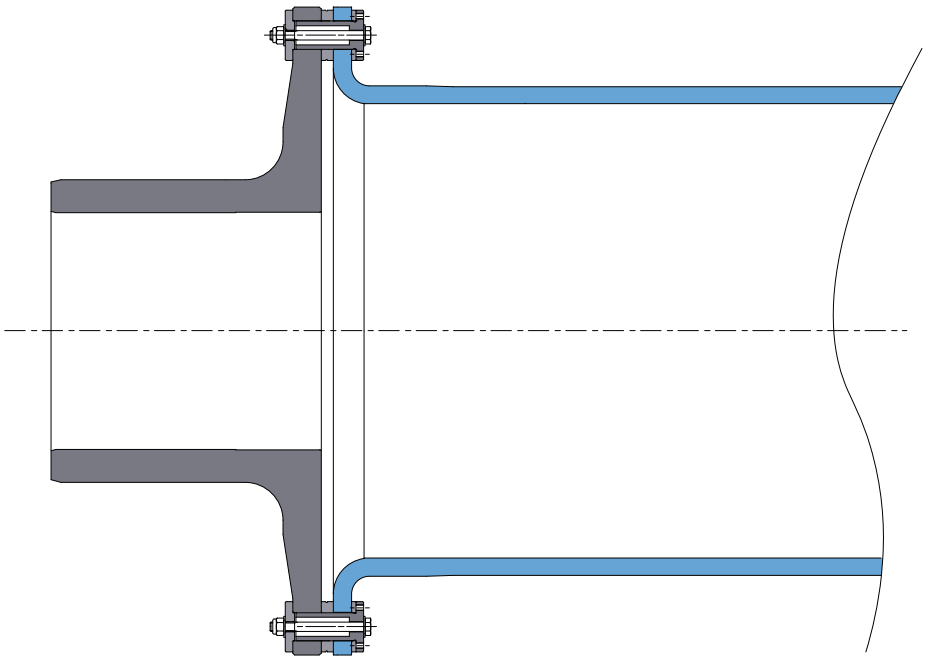
The Gesilco shaft (1) is produced, by filament winding technology, from carbon fibers and epoxy resin. The epoxy resin is cured at a high temperature, resulting in a service temperature of up to 100° C. It is possible to produce many fiber orientation angles, within the shaft laminate, by using the computer controlled filament winding technology. Fiber orientation controls the strength and stiffness properties of the shaft (i.e. torque and bending stiffness properties).

For standardization purposes, Geislinger presents two types of reinforcing fibers with two different fiber orientations. Special designed shafts, with application specific optimized fiber orientations and fiber types, can be designed and delivered by Geislinger on request.

The Gesilco shaft (1), with its steel flanges (2) or integrated flanges, is connected to intermediate shafts (3) (for bearing support) and customer flanges. The joint, connecting the composite shaft (1) and the steel flanges (2) or integrated composite flanges, is made by mechanical load transfer. Either a bolted or press fitted joint is used for the connection. This design provides high level of resistance to temperature and other environmental conditions.

The patented Gesilco shaft design is characterized by its single-piece manufacturing and of the integrated composite flange connection (Fig. 2).

Fig. 2



A standard range of diameters is available for Gesilco shafts, covering nearly all applications in ship drivelines and other applications. Diameters vary between 80 mm and 600 mm with a corresponding nominal torque up to 700 kNm. Gesilco shafts with a higher nominal torque are available on request. The diameters of the Gesilco shafts and the steel intermediate shafts are designed to fit commercially available bulkhead seals and bearings. If requested, seals, bearings and other components can be selected and offered by Geislinger. The entire development, design work and production is done at Geislinger Austria.

Gesilco shafts can be supplied with a special fire resistant outer layer. In combination with a sprinkler system mounted above the Gesilco shaftline, SOLAS® fire resistance requirements can be met without the need for an additional housing.

Shaftline Installation

Gesilco shaftlines can be adapted to standard installation requirements. As described above, Gesilco shaftlines are capable of accommodating radial misalignments. Additional misalignment capacity can be implemented if needed.

Geislinger Calculation Services

As a manufacturer of torsionally elastic damping couplings, Geislinger has a long history of experience with Torsional Vibration Calculations (TVC). Geislinger will perform and supply to its customers TVC's for Geislinger shaftlines using proprietary software.

In case of required accommodation of radial misalignments, Geislinger performs additional calculations such as Whirling- and Finite Element-Analysis.

Approvals

Gesilco shaftlines have been developed in line with ISO 9001. Gesilco shaftlines can be delivered with certificates from any of the major Classification Societies.

Shaftline Advantages

- Very low mass
- Low thermal expansion
- Accommodation of radial misalignments
- Long bearing distances
- Low radial stiffness system
- Easy installation
- Maintenance free
- No corrosion
- Long service life
- Sound insulating
- Non magnetic

Designation

The Shaft Designation has the following Significance

The Gesilco shafts (in this catalogue) have standard diameters. Each shaft is offered in two different fiber orientations. The following shaft designation will identify these characteristics (see "Technical Data" Table 1).

The fiber orientations are designated as Type 1 and Type 2. Type 1 offers a higher torque resistance at lower bending stiffness and Type 2 a lower torque resistance at higher bending stiffness.

Catalogue designation:

IS 40/116/2C

IS 40 shaft diameter [cm]
116 nominal torque of the Gesilco shaft [kNm]
1 or 2 fiber orientation Type 1 or Type 2
C fiber type (C... carbon fiber)

Final product designation:

IS 40/8662

IS 40 shaft diameter [cm]
8662 nominal installation length in [mm]

Selection

Selection of Gesilco Shaftlines

The technical data for the standard Gesilco shafts mentioned above are given in the 'Technical Data' section (Table 1).

For a given driveline, data from Table 1 and the information bulleted below will help to select and design a Gesilco shaftline with optimal weight and bearing distances.

- nominal torque
- shaft speed
- required bearing distance

The selection of a Gesilco shaft is normally performed according to the sequence listed above and is described in the following chapters.

Nominal Torque T_{KN} of the Gesilco Shaft

The mean torque T of the driveline is calculated from the engine power P and the shaft speed n by the following formula.

$$T = 9.55 \cdot \frac{P}{n}$$

T	mean torque	kNm
P	engine power	kW
n	engine speed	min^{-1}

The Gesilco shaft should be selected so that the nominal torque of the shaft T_{KN} is higher than the mean torque T to be transmitted.

$$T_{KN} > T$$

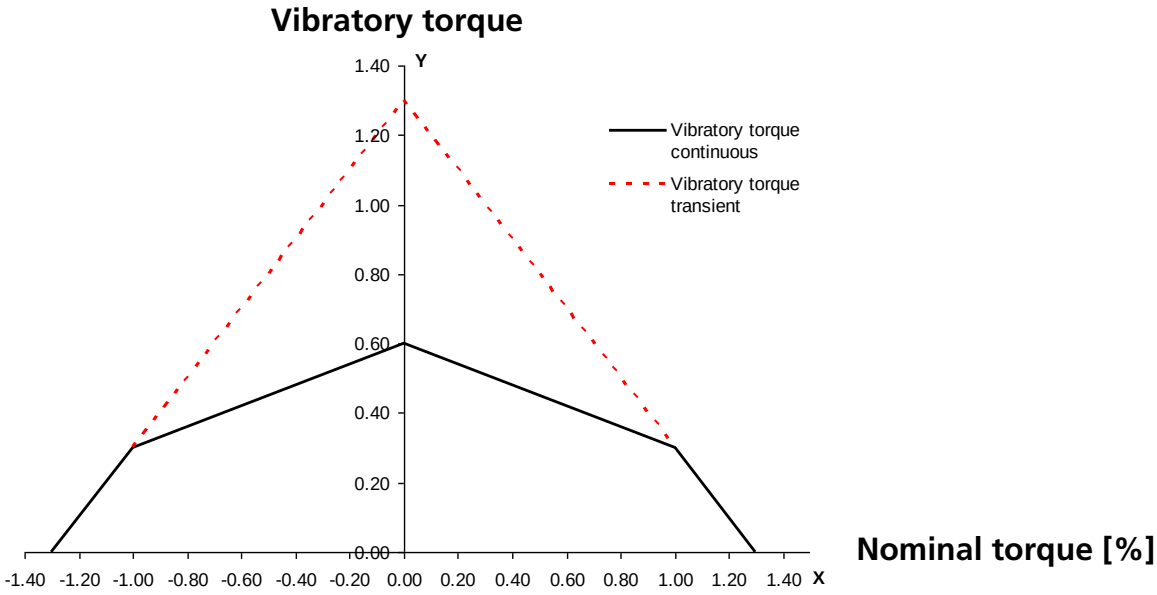
In Table 1 (see Technical Data) a Gesilco shaft can be found with a nominal torque higher than the application's mean torque. For weight optimisation Table 1 offers Gesilco shafts with different diameters having equal nominal torque ratings. For selection of the final diameter shaft speed and weight of the shaftline have to be considered.

Based on the application and customer needs we offer to develop tailor-made solutions based on the shown table.

Permissible Vibratory Torque T_V

In addition to the static nominal torque T_{KN} the Gesilco shaft can transmit vibratory torques. The limit values for transient vibratory torques (e.g. when running through a resonance) and continuous vibratory torques are shown in Fig. 3. The lower the mean torque T is, the higher is the permitted vibratory torque T_V . The limit values, shown in Fig. 3, must not be exceeded (even in the case of cylinder misfiring).

Fig. 3



Type U, fully reversible

$$Y = \frac{T_{el}}{T_{KN}} = \frac{perm.el.vibratory\,torque}{nominal\ \ torque}$$

$$X = \frac{T}{T_{KN}} = \frac{mean\ \ torque}{nominal\ \ torque}$$

$0 \le X \le 1$ $\qquad Y = 0.6 - 0.3 * X$

$1 < X < 1.3$ $\qquad Y = 1.3 - X$

Service Life

Gesilco shaftlines are designed for a service life of 20 years in standard ship applications.

Permissible Shock Torque

Gesilco shafts are designed to take shock or peak torque loads as required by the Classification Societies.

Torsional Vibration Calculation

The undimensioned damping factor is defined as the ratio of the amplitudes of the damping torque T_d to the amplitude of the elastic torque T_e.

$$\kappa = \frac{T_d}{T_e}$$

κ undimensioned damping factor
T_d damping torque
T_e elastic torque

Damping factors have the following values:

Undimensioned damping factor κ for carbon fiber Gesilco shafts (Table 1): $\kappa = 0.01$

Technical Data

Table 1: Technical Data of Carbon Fiber Gesilco Shafts

Designation	Nominal diameter	Nominal torque	Mass per linear meter	Torsional stiffness per linear meter	Imax	Integrated flanges	Max. bearing distance as a function of speed n [rpm]
	mm	kNm	kg	MNm/rad	mm		mm
IS 8/1.2/1C	80	1.2	1.7	0.06	3331	Yes	78240 / √n
IS 8/0.9/2C	80	0.9	1.7	0.037	4418	Yes	111107 / √n
IS 12/4.2/1C	120	4.2	3.8	0.30	4646	Yes	95825 / √n
IS 12/3.1/2C	120	3.1	3.8	0.19	6363	Yes	136078 / √n
IS 21/22.4/1C	210	22	12	2.84	8211	Yes	126764 / √n
IS 21/16.8/2C	210	17	12	1.77	10889	Yes	180014 / √n
IS 29/58.9/1C	290	59	22	10.3	11374	Yes	148965 / √n
IS 29/44.2/2C	290	44	22	6.4	12000	Yes	211541 / √n
IS 33/86.8/1C	330	87	29	17.3	12000	Yes	158907 / √n
IS 33/65.1/2C	330	65	29	10.8	12000	Yes	225659 / √n
IS 36/112.7/1C	360	113	34	24.5	12000	Yes	165973 / √n
IS 36/84.6/2C	360	85	34	15.3	12000	Yes	235693 / √n
IS 40/154.7/1C	400	155	42	37.3	12000	Yes	174951 / √n
IS 40/116/2C	400	116	42	23.3	12000	Yes	248443 / √n
IS 48/267.3/1C	480	267	61	77.4	12000	No	191649 / √n
IS 48/200.4/2C	480	200	61	48.4	12000	No	272155 / √n
IS 60/522/1C	600	522	95	189.0	12000	No	214270 / √n
IS 60/391.5/2C	600	392	95	118.1	12000	No	304279 / √n
IS 80/1237.3/1C	800	1237	169	597.2	12000	No	247418 / √n
IS 80/928/2C	800	928	169	373.3	12000	No	351351 / √n
IS 100/2416.6/1C	1000	2417	264	1458.0	12000	No	276622 / √n

All technical data are without warranty. Modifications of dimensions and design reserved.

Examples for the Selection of Gesilco Shafts

Example 1

Engine MCR:	6000 kW
Shaft speed (between gearbox and water jet):	570 rpm
Calculated mean torque T:	100.53 kNm
Total length of the shaftline:	16 m
Selected length for Gesilco shaft:	2 x 8 m
Selected Gesilco shaft (Carbon fiber) from Table 1	IS 36/112.7/1C
Nominal torque (> 100.53 kNm)	113 kNm
Mass per linear meter:	34 kg/m
Max. permissible shaft length at 570 rpm:	max. 7 m < 8 m
requested	
	(not possible)

This result makes it necessary to select a shaft with the next larger nominal torque from Table 1 (the value "max. length as a function of the speed" also must be larger than in the selection before).

Selected Gesilco shaft (Carbon fiber) from Table 1	IS 40/116/2C
Nominal torque (> 100.53 kNm)	116 kNm
Mass per linear meter:	42 kg/m
Max. permissible shaft length at 570 rpm:	max. 10.4 m > 8 m (possible)

Example 2

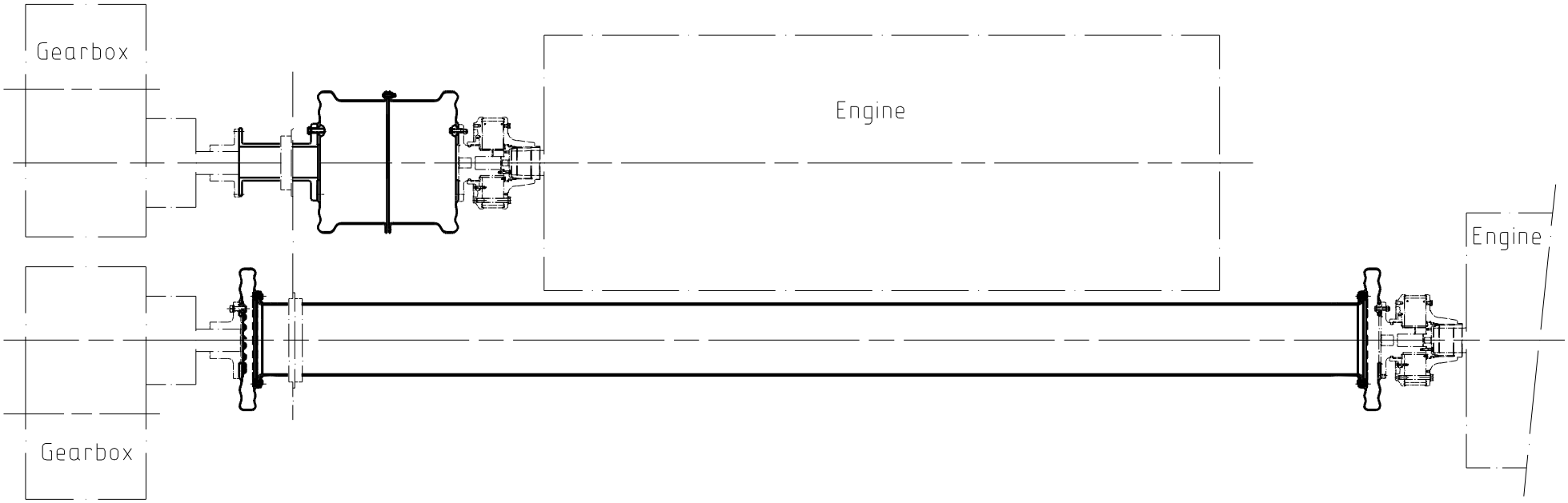
Engine MCR:	1970 kW
Shaft speed (between engine and gearbox):	1900 rpm
Calculated mean torque T:	9.9 kNm
Total length of the shaftline:	4.5 m
Selected length for Gesilco shaft:	4.5 m
Selected Gesilco shaft (Carbon fiber) from Table 1	IS 21/16.8/2C
Nominal torque (> 9.9 kNm)	17 kNm
Mass per linear meter:	12 kg/m
Max. permissible shaft length at 1900 rpm requested	max. 4.1 m < 4.5 m (not possible)

This result makes it necessary to select a shaft with the next larger nominal torque from Table 1 (the value "max. length as a function of the speed" also must be larger than in the selection before).

Selected Gesilco shaft (Carbon fiber) from Table 1	IS 29/44.2/2C
Nominal torque (> 9.9 kNm)	44 kNm
Mass per linear meter:	22 kg/m
Max. permissible shaft length at 1900 rpm:	max. 4.9 m > 4.5 m (possible)

Examples

- **Gesilco BF and CS Coupling and Geislinger Couplings**



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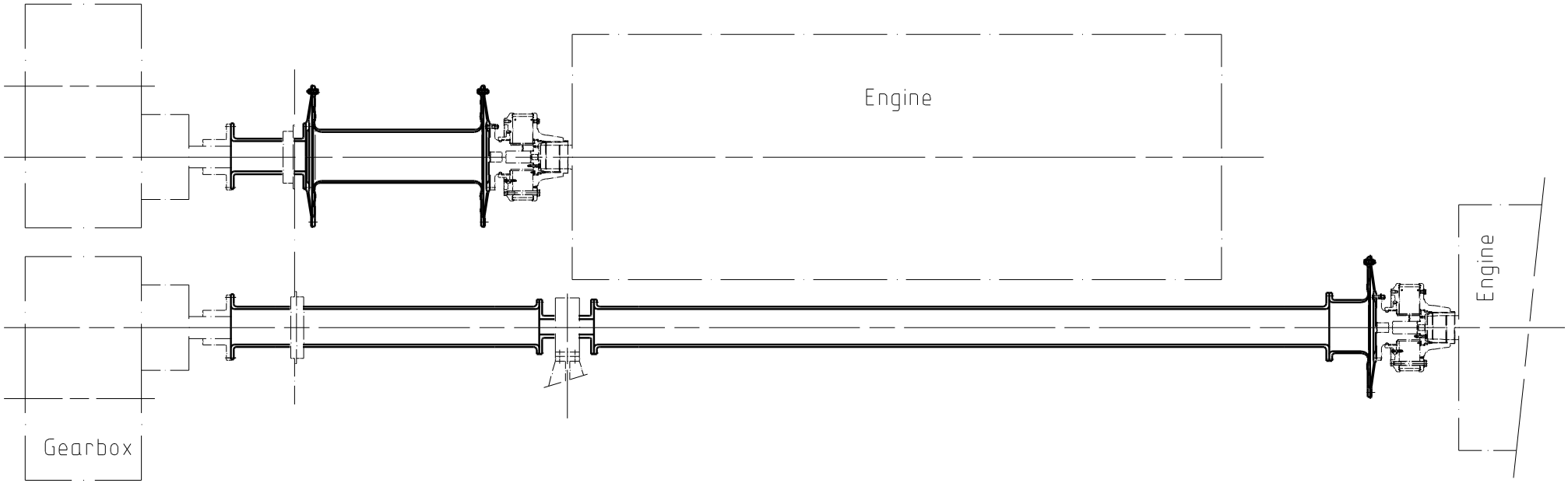
Gesilco Shaftlines, Gesilco CI Couplings and Geislinger Couplings



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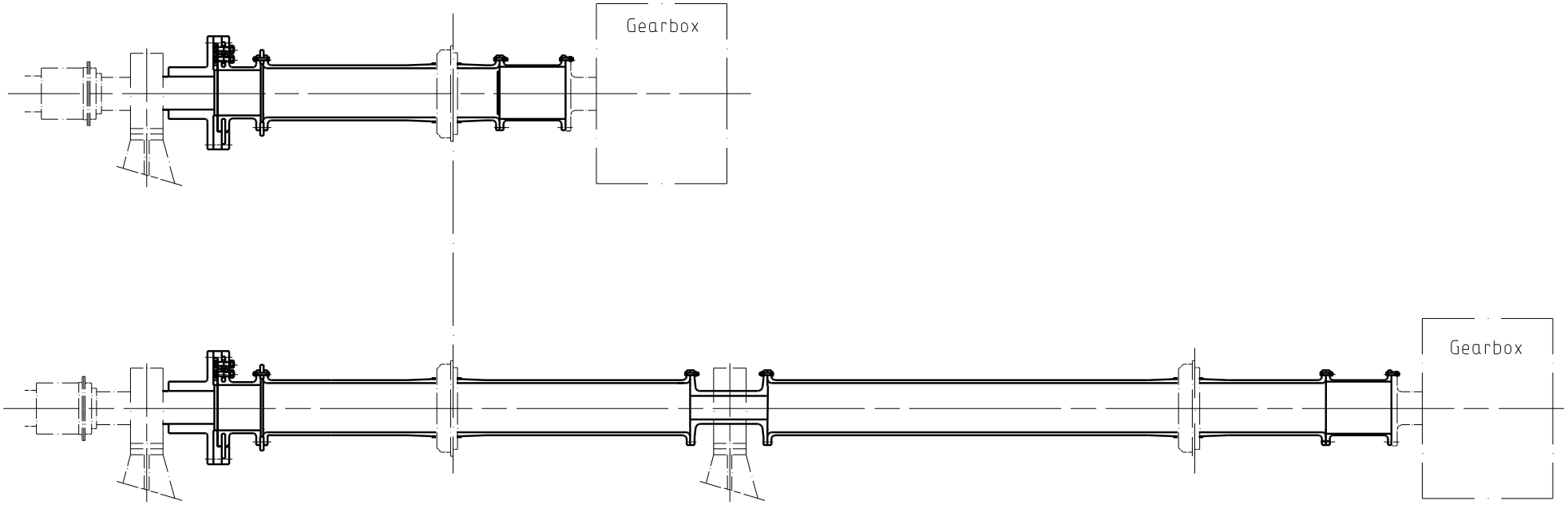
Gesilco Shaftlines with Geislinger Flexlinks



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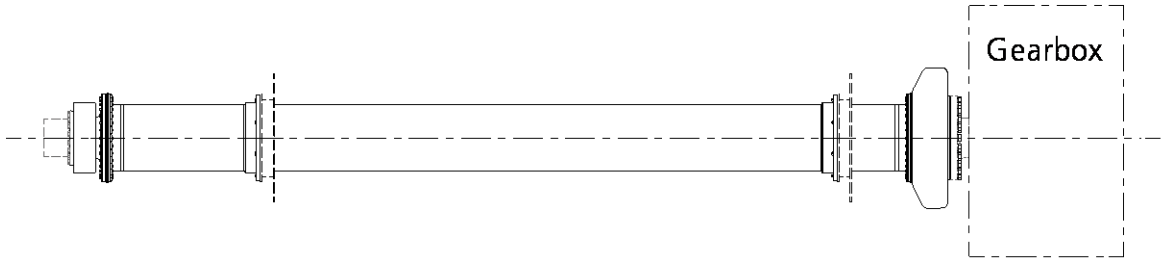
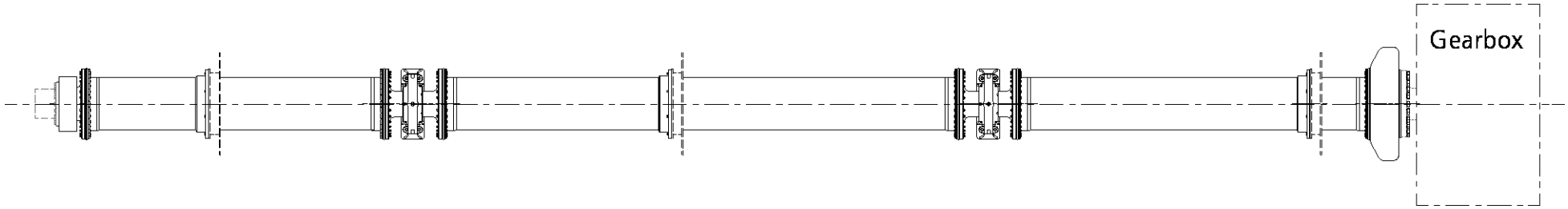
Gesilco Shaftlines and Gesilco MB Coupling





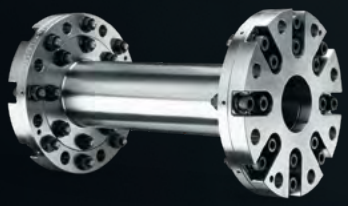
Geislinger Coupling

Geislinger Silenco®

Geislinger Carbotorq®

Geislinger Damper

Geislinger Monitoring



Geislinger Flexlink

Geislinger Vdamp®

Geislinger Gesilco®

Geislinger Gesilco® Shaft

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