

Company profile

Stork Gears & Services is a specialised repair company with a huge amount of expertise in gearboxes and gear technology. Stork Gears & Services is fully geared to manufacture, repair and modify gearboxes, gears and related components for all makes and types of gearboxes. We have customers in the following market segments:

Petrochemical industry / offshore:

- Extruder drives
- Stirrer drives
- Mixers
- Blowers
- Steam turbines*
- Compressors*

* Together with
Stork Turbo Services



FPSO:

- Forward propulsion turbines
- Generator propulsion turbines
- Boiler feed water pump turbines
- Ballast and loading pump turbines
- High speed gearboxes

Shipping:

- Forward propulsion gearboxes
- Generator drives
- Sand pump drives
- Winches
- Bow propellers
- Deck cranes
- Ballast and loading pump drives



Steel industry:

- Roller work drives
- Hoisting winch drives
- Loading crane drives
- Tipping chair drives
- Edge and crest roller gearboxes



Energy companies:

- Wind turbines
- Coal mills
- Hydro electric stations
- Total power stations
- Exhaust gas cleaning installations
- Boiler feed water pump drives



Storage and transhipment companies:

- Hoisting and closing work gearboxes
- Track works
- Crane track works
- Swivel works
- Conveyor belt drives

Stork Gears & Services is part of the Technical Services division of Stork N.V.

Gearbox repair

The Service Department of Stork Gears & Services has had decades of experience in the overhaul of gearboxes. As a make-independent repair company in mechanical drives, we overhaul all sorts and types of gearboxes and related drives. We are active in various branches, where most of our orders have an extremely short completion time.

Approach

The specialisation determines our repair approach. The procedure below is followed when the service request concerning gearboxes arrives. This can be done both on site and in our workshop:

- Determination of the condition of the gearbox. This determines bearing settings, gear clearance and gearing size.
- Careful dismantling of the gearbox, compilation of an inspection report and performance of a damage analysis in order to pass on improvement proposals better in consultation with engineering and the client.
- Overhaul proposal and quotation to inform the client about the scope and cost of the project.



Once the above procedure has been executed, assembly follows delivery of the purchase and manufacturing parts in which:

- The gearbox with new parts is installed.
- Bearing and gear clearance are adjusted and contact patterns are recorded. Stork Gears & Services can grind the gears in our gear-cutting department if due to circumstances the gear clearance or contact patterns are not in accordance with the specifications, after which the gearbox will be within the specifications.
- Once the gearbox has been assembled correctly, it will be tested for 4 hours on our trial bench.
- All results will be recorded in our report, which will be handed to the client complete with all documents (and possibly certificates) after overhaul.

Facilities

The service department has a wide range of special tools in order to carry out specialised work. These tools consist for example of a 250 ton vertical hydraulic press, hydraulic pulley pullers, a Hytorc force multiplier, induction heater, nitrogen bath, mobile workshop, etc. With all these facilities we are able to do give good field-service. It is also possible to do a complete gearbox overhaul on location.

We also have 6 alignment computers with which we rapidly and adequately perform shaft alignments on site of all possible sorts of equipment. This service as well as the repairs, inspections and start-ups of gearboxes are carried out by Stork Gears & Services throughout the world.

Our 24-hour service '*all over the world*' offers our clients a total accessibility and a service-orientated deployment in which reliability, quality and speed are our most important driving forces. Stork Gears & Services always has service engineers ready to assist you anywhere in the world.

Testing plant

An important last step in the overhaul process is the trial run of an overhauled idling gearbox on our testing plant. This testing plant is an area of 60 m² where our trial run procedure can be run through with 5 gearboxes simultaneously.

It is possible to test up to a power of 187 kW and a rpm of approx. 20,000. These high rpms are attained using a 'speed-up' gearbox. The gearbox is operated for 4 hours during this procedure, in which the following parameters can be analysed:

- Temperature
- Vibrations
- Noise
- Oil viscosity

All testing data is recorded in a test report, which will be sent to the client and filed by us.



Custom-built

Flexibility, own production facilities and knowledge of gear technology are distinctive to Stork Gears & Services, who has acquired its knowledge by the development and the takeover of OEMs. The engineers of our Engineering Department supervise the repairs, design modifications and develop complete 'custom-built' gearboxes.

We strive to keep our knowledge as an OEM at the highest level by the development of new gearboxes, made with the newest technologies. We lead in the gear technology branch through innovative designs and applications.

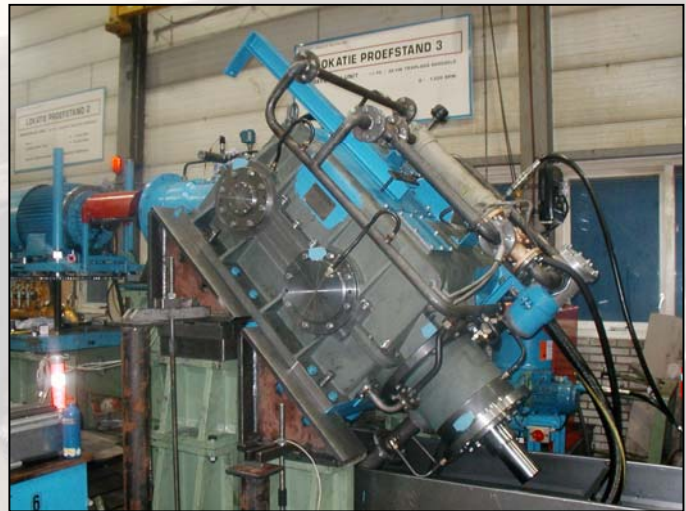
The client usually only needs to pass on the desired reduction, shaft centre-to-centre distances and the power for a new gearbox to be built. Our engineers then discuss a design with accompanying calculations with the client in a short time. After receiving the order, the production drawings are made, after which the parts of the gearbox are made. This service-minded attitude enables Stork Gears & Services to design, make and supply a high quality, complete gearbox to the client within three months.

Drawing packages

The takeovers we have made in the past have given us complete drawing packages of the following makes of gearboxes:

- Kuypers
- Brevo
- Rademakers
- Conrad

This enables us to supply the spare parts of the above makes in accordance with the original measurements and types of material.



Reverse engineering

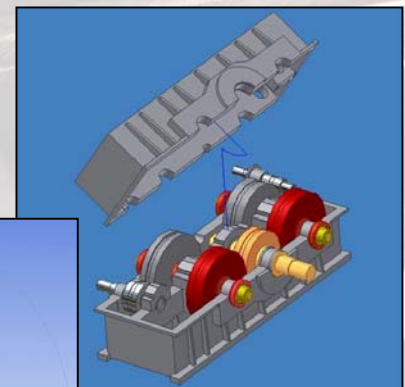
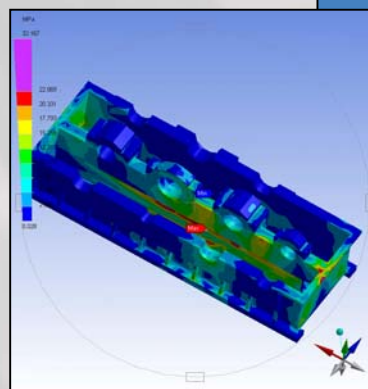
If in some cases the client does not have the technical data of the gearbox to be overhauled, we use reverse engineering to "copy" the existing parts to be replaced, so that these new parts at least comply with the specifications of the original parts. A delivery time of a couple of days is guaranteed for a simple gear, and three weeks for carbonised or nitrated internal works.

Calculations

The Engineering Department has to calculate the parts concerned for new construction, modifications or overhaul in order to assess if the selected quality is correct. A list is given below of which calculations and accompanying software are used:

- *Gear calculations:* according to DIN, Neratrans, AGMA and self-written applications; gear control calculations according to classification agencies such as Germanische Lloyd, DNV and ABS.
- *Shaft calculations:* according to Hexagon and in-house developed applications.
- *Bearing calculations:* according to SKF, FAG, Timken and in-house developed applications for reversing and sliding bearings.

2D and 3D drawing software is also used to design and draw the parts. Calculations of for example stresses, displacements and own frequencies in complex strain situations are carried out according to the finite elements method using Ansys Design Space.



Laser cladding

Stork Gears and Services is expanding by the introduction of laser cladding, the innovative technology for the application of metallic coatings. An additional material is 'cladded' to the work item using a powerful diode laser. This coating technique sets new standards for e.g. adhesion, layer thicknesses and fields of application.

Stork Gears & Services has linked up with the trendsetting Fraunhofer Institut Lasertechnik for the implementation of laser cladding technology. A system has therefore been developed in close co-operation with this institute for the quick and purposeful processing of axles, gear drillings and other work pieces.

The application options of laser cladding are countless. Overhaul work pieces can be locally provided with a new layer of metal, for example by worn sealing rings. New work pieces can also be upgraded with a coating for which other specific requirements are set. The possibility of applying diverse materials provides a wide field of application for laser cladding, such as:

- Repair of damaged shafts
- Application of hard-wearing coatings
- Applications of corrosive-resistant coatings

As Stork Gears & Services carries out the laser cladding in-house, it can react quickly and accurately to the wishes of its clients. Great technical advantages are also gained compared with conventional methods:

- 100% metallic adhesion; no chance of coating coming loose
- Both simple and special, high-quality coatings are possible
- Very local application possible
- Small total heat contribution; no deformation
- Contact-free; no forces are exerted on the work piece
- Process depth is well defined
- Environmentally friendly process
- Superior properties:
 - No porosity
 - Homogeneous distribution of the elements
 - Excellent control of the layer thickness
 - Controlled minimum mixing
- Finishing work after cladding brings each workpiece back to the original measurement or tolerance
- Dimensions of up to a diameter of 500 x 2000 mm (sack diameter 1100 mm)



Machine department

Stork Gears & Services has a large machine park for mechanical manipulations. We can give work pieces for gearboxes the following treatment here: (CNC) turning, (CNC) milling, (CNC) boring, rounding-off, smoothing of drillings and pulling and slotting of keyways. Broken-off bolts, taps and bores can also be removed by arcing. A list of the machine capacities is given below:



- Turning up to diameter 920 mm, length 3.000 mm.
- Carrousel up to diameter 2,130 mm, length 1.050 mm.
- CNC turning/milling up to diameter 1,220 mm, length 6,000 mm, weight 13,500 kg.
- (CNC-) boring up to 2,000 x 1,800 x 1,400 mm, max. table weight 8,000 kg.
- Milling up to 1,150 x 330 x 440 mm.
- Smoothing of drillings up to diameter 1,100 mm, length 475 mm.
- Rounding-off up to diameter 500 mm, length 2,000 mm.
- Slotting/pulling keyway up to stroke length 450 mm, keyway width up to 50 mm.

Gear cutting department

Gear grinding machines

Stork Gears & Services has a technologically high quality gear-grinding bank to provide the quality required by the market. This grinding bank provides good quality, high-standing gearing. The technical specifications are given below:

- Maximum grinding diameter 1,600 mm
- Maximum modulus 25
- Maximum gearing width (with straight gearing) 800 mm
- Table load 6,000 kg

Profile corrections such as tip and foot relief, high barrelling, end bevelling and flank line barrelling are programmed and done by a CNC-control. A grinding quality of the gearing is guaranteed to class 4 according to DIN standard 3962. It is also possible to measure the total gearing quality such as profile, flank line and normal pitch deviation with this machine with a print-out of the corresponding measurement graphs.

Stork Gears & Services also has 3 other grinding banks:

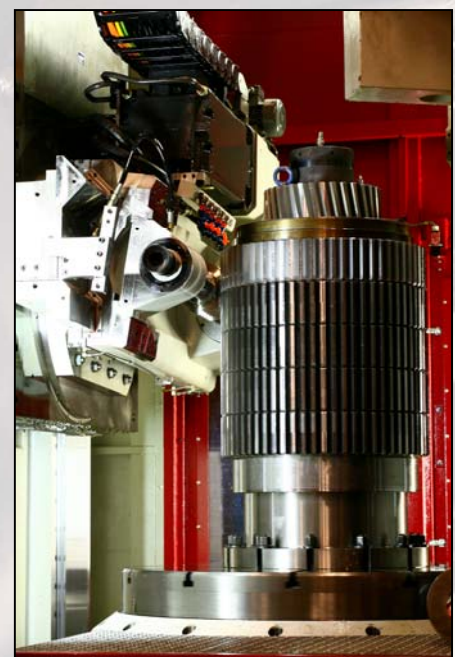
- Niles 1500 Maximum grinding diameter 1,500 mm, Modulus 24
- Niles 630 Maximum grinding diameter 630 mm, modulus 12
- Hofler 1000 Maximum grinding diameter 1,000 mm, modulus 16

Gear milling machines

Stork Gears & Services has a technologically high-quality gear-milling machine to guarantee high quality and a quick working time. The technical specifications of this gear-milling machine are as follows:

- Maximum gear hobbing diameter 1,600 mm
- maximum modulus gear hobbing 22/28
- Gear hobbing quality DIN 3962 class 6
- Maximum gearing width 1,000 mm
- Table load 6,000 kg
- Distance between centres 700-1,700 mm

Stork Gears & Services also has 3 milling machines with which gears can be made with the following dimensions:



- Lorenz E16 maximum diameter 2,000 mm, modulus 16
- TOS of 16 maximum diameter 1,500 mm, modulus 24
- Lorenz F400 maximum diameter 400 mm, modulus 4

Stork Gears & Services also has a large number of mills for to spline gears, chain wheels, Klingelberg (or bevel gear) wheels and worm gears.

Slotting machines

Stork Gears & Services has the following machines to gear cut by slotting:

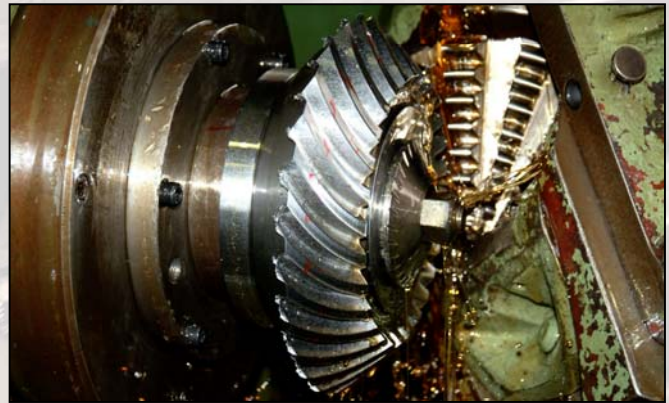
- Lorenz LS 1000 Maximum diameter internal 1,200 mm, modulus 10
Maximum diameter external 1,050 mm, modulus 10
- Lorenz SJ 7000 Maximum diameter in/external 1,000 mm, modulus 10
- Lorenz SNJ 5 Maximum diameter in/external 400 mm, modulus 4

Klingelberg gearing



Klingelberg Cyclo Palloid Hypoid

- Maximum outside diameter 800 mm
- Maximum normal module 13 mm
- Maximum transverse modulus 23 mm
- Maximum offset 100 mm



Klingelberg Cyclo Palloid

- Maximum outside diameter 540 mm
- Maximum normal module 8 mm
- Maximum transverse module 12 mm

The gearing sorts that Stork Gears & Services makes are given below:

Cylindrical straight, in- and external
Cylindrical slanted, in- and external
Arrow gearing
Conical wheels straight and slanted gearing
Conical wheels Klingelberg gearing

Spline gearing in- and external
Worm axles and worm gears
Screw wheels
Chain wheels
Multi-wedge shapes

The correct gearing interlocking can be created by means of head and foot corrections and end retraction for a better finish, which improves the operational certainty of the gearboxes.



Measurement

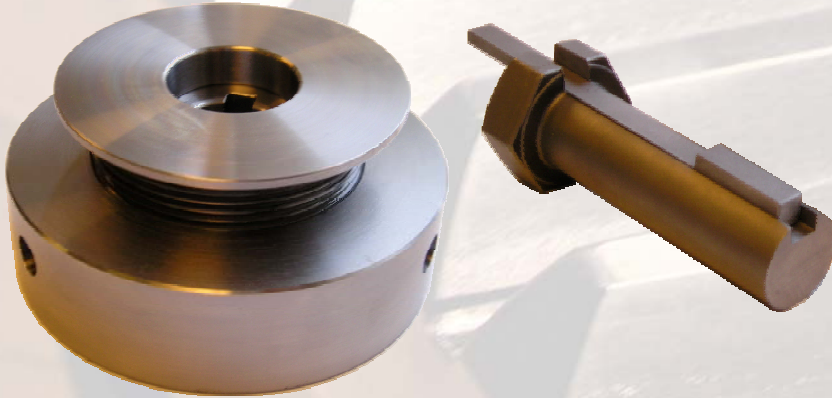
An independent measurement of the gearing quality is done on two measuring machines. These are installed in a conditioned room. This is possible up to a diameter of 1200 mm and a weight of 1000 kg. This enables measurements to be made according to DIN 3962 class 3 to 12.

The manufacture and adaptation of many sorts of gearing is done in a high tempo, in which the quality of the product is central so that the client can use his gearbox with new and/or adapted gearing in a short time with as little production loss as possible.

VARIOCHOCK®

Machine adjustment base

New!!!



CHARACTERISTICS:

- Height adjustment without hydraulic screw jacks
- No special tool needed
- Low incorporation height
- Competitive price
- No "soft foot"
- Use on steel or concrete floor
- Delivery from stock

The Variochock® elements can be used as simple adjustment bases between the machine and the foundation. Variochock® makes it possible to adjust your machine without using hydraulic lifting tools. The height can be adjusted using a normal hexagonal key. You can even use Variochock® if there is limited room between the foundation and the machine. The element is designed for gearboxes and engines, particularly for maritime use. Variochock® has been tested in various projects and a worldwide patent has been applied for.

VARIOCHOCK®		VCM12	VCM16	VCM20	VCM24	VCM30	VCM36	VCM42	VCM48	VCM56	VCM64
Foundation bolt class 8.8	metric	M12	M16	M20	M24	M30	M36	M42	M48	M56	M64
Tightening moment	Nm	90	222	433	749	1480	2586	4131	6195	9926	14915
Load with critical pre-tension force	kN	42	50	126	178	197	271	357	528	454	450
Maximum element load	kN	90	142	270	386	529	757	1026	1410	1675	2065
diameter saucer, D1	mm	55	70	85	110	125	140	150	180	200	210
diameter bolt hole, D2	mm	14	18	22	26	32	38	44	50	58	66
diameter outer ring, D3	mm	65	90	110	130	150	170	200	230	240	260
minimum height, Hmin	mm	25	30	30	36	40	45	50	55	56	60
maximum height, Hmax	mm	38	47	43	52	56	63	73	78	76	81
Adjustment height	mm	13	17	13	16	16	18	23	23	20	21
Maximum angle, A1	Degrees	2.89	2.89	2.31	3.37	3.72	3.99	3.97	3.95	2.14	2.78

*The information in this table is only applicable to standard elements. Special models will be made on request.

