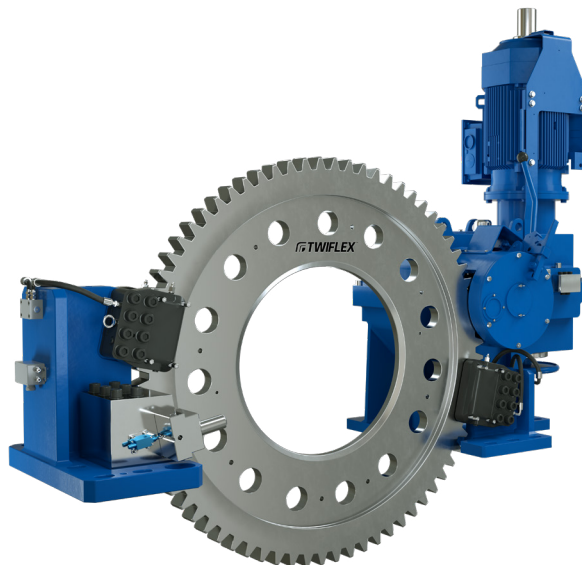




Turning, Locking, & Braking Systems

MARINE PROPULSION APPLICATIONS



TWIFLEX™

TURNING, LOCKING AND BRAKING IN MARINE PROPULSION SYSTEMS



Turning, Locking & Braking Systems
by Twiflex

The Twiflex system comprises a Turning gear, Locking device, and shaft Brake (TLB) together with a power unit (e.g. Hydraulic Powerpack) and a control panel for local operation of the system close to the equipment. The TLB is available as a continuous turning option, as shown, or as an indexing system using a simple hydraulic 'push-pull' arrangement where the brakes and brake disc incrementally inch the propeller shaft for maintenance and accurate alignment. For a more cost effective solution, a simple manual option is also.

TURNING

TURNING: Low power turning while in port

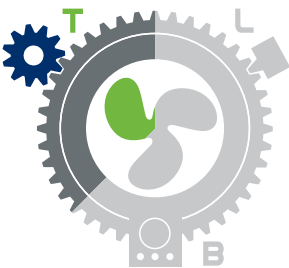
BEARING CONDITIONING: Eliminates bearing damage when vessel is moored in port for extended periods

SHAFT ROTATION: Enables shaft rotation during installation and maintenance

POSITIONING: Optimizes propeller blade positioning while at sea and during maintenance and installation

ROTATION: Provides the ability to rotate the shaft when drive is disengaged

INSTALLATION: Quicker and easier installation and setting of drive components



LOCKING

INCREASED SAFETY: Enables locking of the shaft for maintenance

IMPROVED FUEL EFFICIENCY: Used to lock shaft to prevent a windmilling effect while in operation (twin or multiple screw)

SHAFT LINE Protection: Used to protect redundant or damaged shaft line while at sea



BRAKING

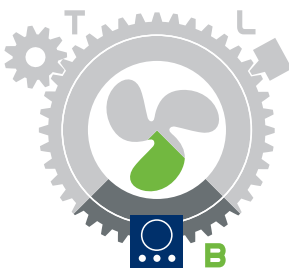
FASTER DIRECTIONAL CHANGES: Used to shorten stopping of rotating shaft or in order to change direction

- Improved maneuverability (twin or multiple screw) allowing better steering for rapid directional change
- Crash astern and crash stop

REDUCE LOAD ON PROPULSION SYSTEMS: used to shorten stopping of rotating shaft when coming into port

- Controlled stopping to protect drive components including gearbox when lubrication system has failed

PREVENT WINDMILLING EFFECT: Shaft holding when unpowered propeller rotates due to the flow stream



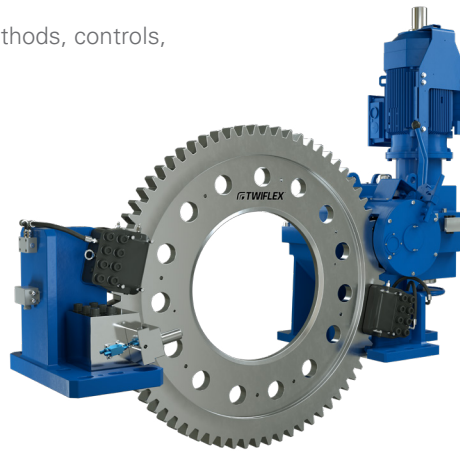
ADVANTAGES OF THE TWIFLEX TURNING, LOCKING AND BRAKING (TLB) SYSTEM

When purchasing a complete turning gear system integrated with locking and braking from Twiflex, customers can consolidate three separate interfaces into one, multi-functional solution: Turning 'T', Locking 'L', and Braking 'B', which enables customers to save dimensional space, decrease installation and maintenance time and reduce costs.

- Twiflex provides a superior solution with a continuous turning design for the same price as a comparable indexing solution
 - Infinite positioning
 - Fixed speed in both directions (variable as an option)
 - Balanced load profile
 - Quicker & safer stopping
- Fully modular solution providing the customer an option to select each function T,L,B, individually or combined TL, TB or LB in addition to the complete TLB system
- Flexible designs to meet customer requirements with full design and build completely in-house
 - Many configurations available based on five standard brake disc sizes with turning torques up to 454 kNm and turning speeds up to 2.6 rpm depending on configuration.
 - Wide range of well proven locking devices and brakes with torques up to 862 kNm based on the standard range. Custom disc sizes are available.
- Local and Remote operation to suit customer preference
- Manual Turning and Locking available for power failure condition

A superior solution from a single source

- Complete System Provider: brakes, actuation methods, controls, hydraulics, locking devices, etc.
- Strong Design & Technical Competence
- Full Design & Build In-House
- Custom Modular Solutions
- Renowned Testing Facilities
- Balanced Braking
- Superior Continuous Turning Design
- Extensive Marine Application Expertise
- Brand Longevity
- Marine Service Capabilities



Customized solutions to meet individual vessel requirements

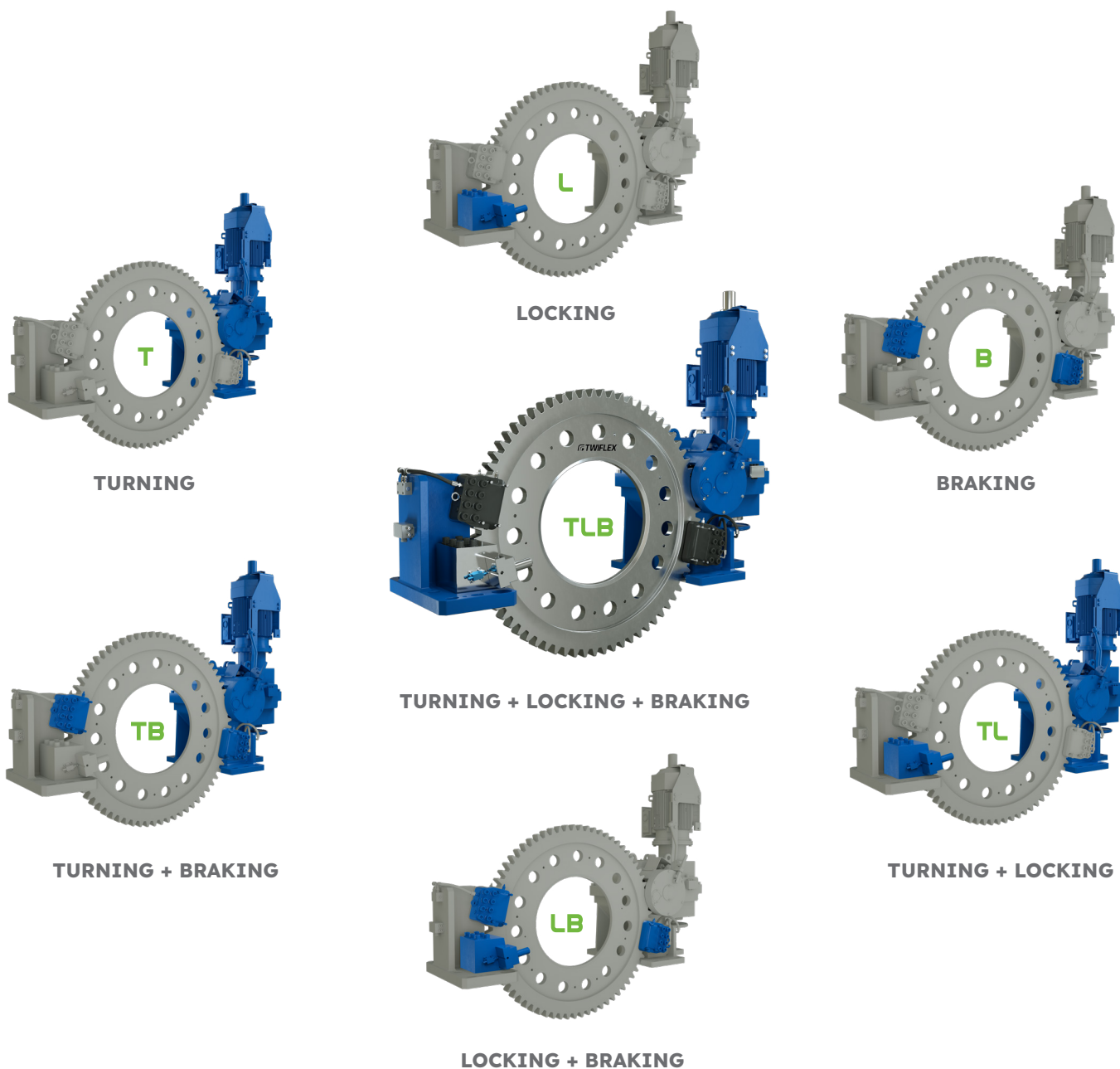


MODULAR TWIFLEX TLB SYSTEM FOR MARINE PROPULSION

The Twiflex TLB system is fully modular and can be supplied as a complete TLB package or variations as listed and shown below:

- **'T'** Turning only
- **'L'** Locking only
- **'B'** Braking only
- **'TB'** Turning and Braking
- **'LB'** Locking and Braking
- **'TL'** Turning and Locking

All systems are fully monitored and designed to provide an interface with the customers bridge control.



REGAL REXNORD HAS DECADES OF EXPERIENCE DESIGNING HYDRAULIC, ELECTRO-PNEUMATIC, AND AIR-OVER-OIL CONTROLS FOR BRAKES & CLUTCHES USED IN THE MARINE INDUSTRY.

The TLB system includes a fully monitored control system with a remote panel offering local control. While in normal operation, the system is operated and monitored by the ship's bridge control allowing only the brakes to be applied. In local control, the turning gear and locking device can be operated along with the brakes allowing full TLB control.

For installations where braking and/or locking is required, power units can be customized (air, hydraulic, air-over-oil) along with the control and monitoring operating panel.

Regal Rexnord also offers a full range of direct pneumatic applied spring release scissor and dual spring brakes, as well as air-over-oil systems to meet a variety of configuration needs.



TYPICAL TWIFLEX TLB POWER UNIT AND CONTROL

WHY DO CUSTOMERS SELECT TWIFLEX TLB SYSTEMS?



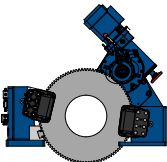
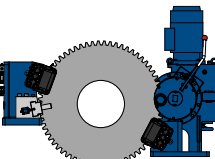
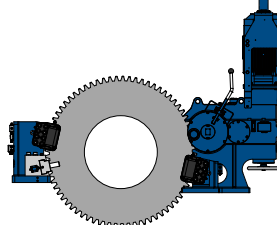
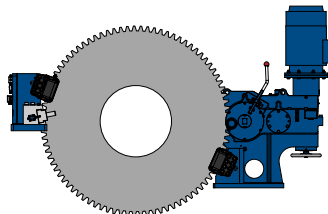
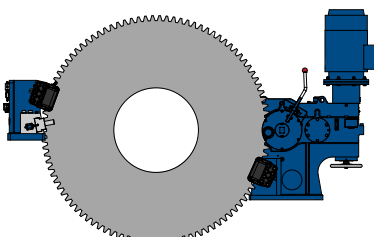
Problem:

During regular maintenance, the shaft on a marine vessel needs to be locked in a fixed position, yet also able to be incrementally rotated in both directions to allow complete access by the ship's engineers. Also, during lengthy stays in port, the shaft is occasionally rotated to keep the propeller free from marine growth. Typically, propulsion OEMs specify separate braking, locking and turning devices to perform all three functions while fitting in a very small footprint. This is a time-consuming challenge that also requires the OEM to ensure that all three components interface properly once installed.

Solution:

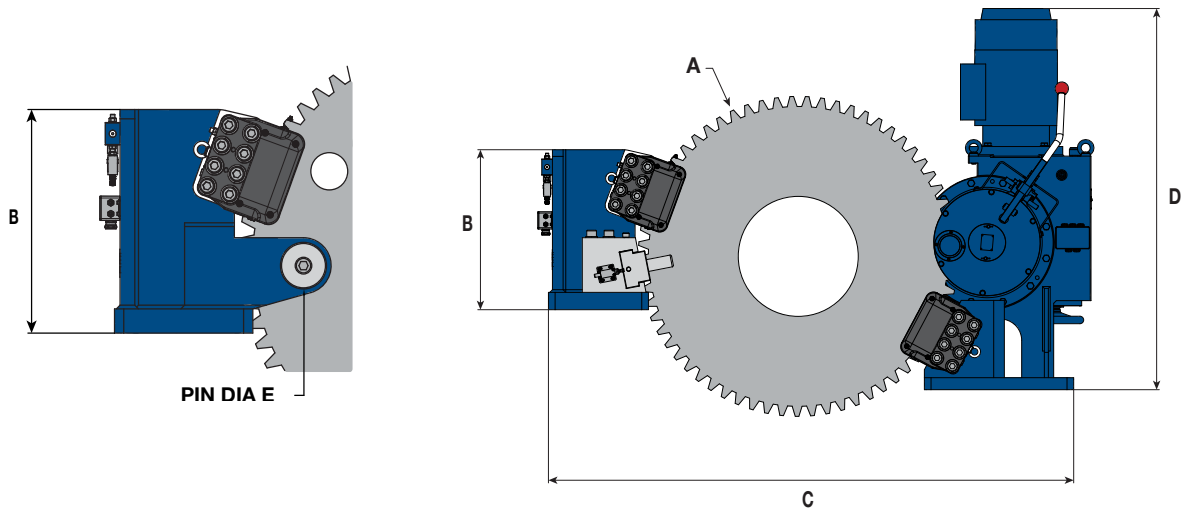
Working closely with a leading global marine propulsion system OEM on a next-generation ice-breaking vessel, Twiflex engineers designed and delivered a complete Turning, Locking & Braking (TLB) System that could be quickly integrated with the rest of the ship's drivetrain. The compact and modular Twiflex TLB system is configured to allow users to select one of the turning, locking and braking functions individually or to choose paired or complete turning, locking and braking functionality, depending on situational requirements.

TLB SYSTEM SPECIFICATIONS

| | Disc Dia. (mm) | Turning Torque (Nm) | | Turning Speed/ (rpm) | | Locking Torque (Nm) | Braking Torque (Nm) | | |
|--|-------------------|------------------------|-------|-------------------------|------|---------------------------|------------------------|--------|--------|
| | | Min | Max | Min | Max | Nom | Min | Max | |
|  | TLB80-C | 800 | 14300 | 158030 | 0.38 | 2.64 | 32000 | 15970 | 31950 |
|  | TLB120-C | 1200 | 21480 | 237040 | 0.25 | 1.76 | 72000 | 36040 | 72070 |
|  | TLB150-C | 1500 | 26850 | 296300 | 0.20 | 1.41 | 190000 | 94720 | 189450 |
|  | TLB200-C | 2000 | 35800 | 395060 | 0.15 | 1.06 | 214000 | 106790 | 213580 |
|  | TLB230-C | 2300 | 41170 | 454320 | 0.13 | 0.92 | 862000 | 430840 | 861670 |

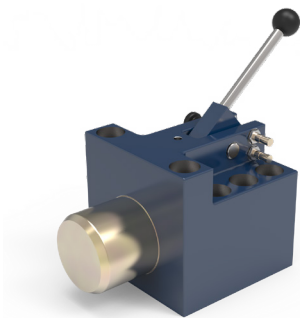
- Braking Torques are calculated using direct applied, spring release hydraulic brakes. Direct applied, spring release pneumatic brakes are also available
- Max operating pressure used in the above calculations is 150 bar
- Coefficient of Friction (μ) has been taken as 0.4
- Max. Braking Torque assumes 2 off brakes (same model and rating) are used on a single brake disc
- Configurations shown are complete TLB systems with continuous turning (-C). Indexing (-I) or manual systems (-M) are available upon request
- All Turning Gear options include the facility for manual turning in addition to normal operation
- The geared brake disc can be supplied as a solid or as a spilt design

TLB SYSTEM DIMENSIONS



| Dimension | TLB80-C | TLB120-C | TLB150-C | TLB200-C | TLB230-C |
|-----------|---------|----------|----------|----------|----------|
| A | 800 | 1200 | 1500 | 2000 | 2300 |
| B | 500 | 600 | 600 | 600 | 600 |
| C | 1350 | 2000 | 2650 | 3450 | 3700 |
| D | 1200 | 1450 | 1950 | 1950 | 1950 |
| E | 75 | 100 | 100 | 100 | 150 |

All dimensions shown in mm



LOCKING DEVICES

Twiflex also offers a range of devices available as either axial locking, using holes in the disc face (or gearwheel as part of the Twiflex Turning, Locking, Braking TLB system), or radially locking using a tapered pawl which is designed to engage in slots machined in the outer disc or coupling periphery.

- Manually operated as standard, hydraulic and mechanical options upon request
- Engineered custom solutions and status monitoring can be provided



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