

CORE SYSTEMS

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Understanding Stabiliser Systems

An owner's guide to roll reduction,
operating limits and degraded operation

Stabilisers reduce motion; they do not remove it.

Readiness depends on correct operation,
realistic limits and a safe failure state.

Absolute Marine

Commercial thinking for private cruising.

ACTIVE FINS



GYRO STABILISER



SENSE | COUNTER | CONTROL

GUIDE OVERVIEW

What a stabiliser system is designed to do

A stabiliser system reduces roll motion to improve comfort, crew endurance and the ability to operate the yacht safely. It does not make the yacht immune to weather, remove every form of motion or replace sound passage decisions.

SCOPE

This guide compares the main principles used on cruising yachts, including active fins, zero-speed fins, gyroscopic systems and passive arrangements. Individual systems have manufacturer-specific operating and emergency procedures.

By the end of this guide, you should be able to:

- Explain how stabilisers produce a counteracting roll moment.
- Distinguish underway fin, zero-speed fin, gyroscopic and passive arrangements.
- Identify the main power, control, cooling, hydraulic and structural components.
- Recognise operating limits, common warning signs and damage concerns.
- Ask better questions during purchase, survey, maintenance and offshore preparation.

CORE PRINCIPLE

A stabiliser should reduce motion without creating an unsafe dependence. The owner should know the safe state after loss of power, control, cooling or hydraulic pressure.

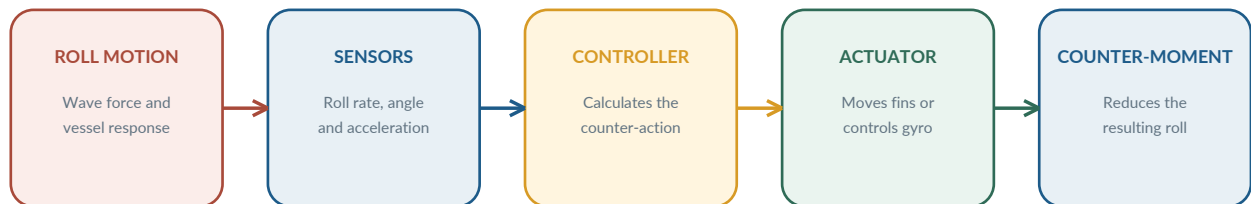
Safety

Fins, shafts, actuators and gyroscopic machinery can move with high force and retain stored energy. Keep clear of moving equipment, use the approved shutdown procedure and do not work beneath or beside an unsecured mechanism.

SYSTEM OVERVIEW

How roll reduction works

The vessel rolls because waves and its own mass, hull form and loading create a repeating motion. The stabiliser senses that motion and generates a counteracting force or torque.



The system reacts to motion; it does not remove the sea state or every form of vessel movement.

What stabilisers can improve

- Crew endurance, sleep quality and the ability to keep an effective watch.
- Movement around the vessel, cooking, maintenance and machinery-space inspection.
- Comfort at anchor or underway, where the installed system is designed for that mode.
- Reduced loose-equipment movement and lower likelihood of minor injuries.
- Operational confidence when the system remains within its designed envelope.

What stabilisers do not remove

- Pitch, heave, slam, yaw and acceleration caused by the wider sea state.
- The need to secure furniture, tenders, stores and machinery.
- The consequences of excessive speed, poor loading or unsuitable weather routing.
- The possibility of seasickness or injury in severe conditions.
- The need for a safe reduced-motion plan if the system becomes unavailable.

HUMAN FACTOR

A highly effective system can encourage the crew to accept weather or speed that would otherwise feel uncomfortable. The yacht's structural, machinery and crew limits still apply even when roll is reduced.

SYSTEM TYPES

Different ways to reduce roll

The best arrangement depends on yacht size, hull form, speed, available space, electrical or hydraulic capacity, noise tolerance, anchoring plans and maintenance support.

UNDERWAY FINS

Hydrodynamic lift
requires water flow

ZERO-SPEED FINS

Large fin motion
creates lift at rest

GYROSCOPIC

Flywheel momentum
creates counter-torque

PASSIVE / TANK

Drag or moving mass
reduces roll energy

Each arrangement has different speed, power, noise, maintenance and damage considerations.

Type	Where it works best	Main limitations
Underway active fins	Cruising with reliable water flow over the fins.	Reduced effect at very low speed; drag, shaft/seal maintenance and external damage exposure.
Zero-speed fins	At anchor and at low speed, as well as underway where designed.	Large fin movement, power demand, noise, nearby swimmers/objects and shallow-water restrictions.
Gyroscopic stabiliser	At anchor and underway without external appendages.	Weight, heat, electrical demand, spin-up/down time, noise, bearing and structural-foundation requirements.
Passive fins / bilge keels	Continuous low-maintenance roll damping underway.	Cannot actively adapt and may add drag; little or no effect at rest.
Paravanes / flopper stoppers	Low-speed cruising or anchoring on suitable vessels.	Deck gear, rigging, handling risk, restricted manoeuvring and snagging exposure.
Anti-roll tanks	Selected larger yachts where tank motion is tuned to vessel roll.	Space, weight, loading sensitivity and specialist design; poor tuning can reduce benefit.

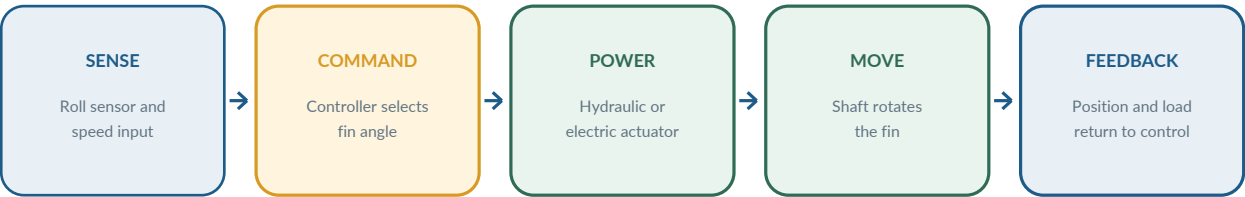
NO UNIVERSAL WINNER

A system that performs exceptionally at anchor may carry more weight, power demand or machinery complexity than an owner who mainly cruises underway requires.

FIN STABILISERS

Actuators, shafts, seals and hydrodynamic load

Fin systems rotate external foils to create lift. Underway performance depends on water flow; zero-speed systems use larger or faster movements to create alternating lift while the yacht is nearly stationary.



Fin effectiveness and loads change with speed, sea state, fin area and control strategy.

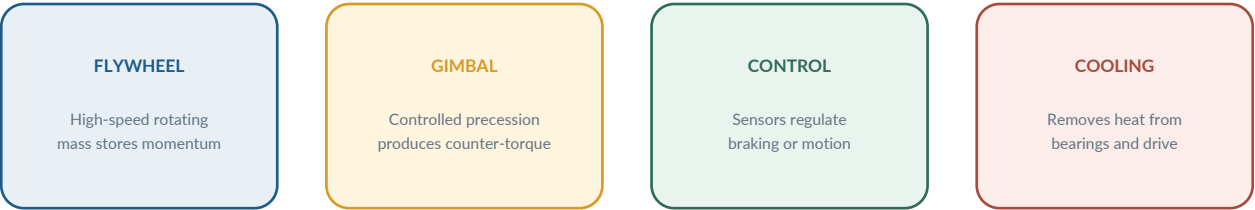
Component	Purpose	Owner focus
Fin and shaft	Creates lift and transfers hydrodynamic load into the yacht.	Impact damage, corrosion, fouling, shaft condition, anodes and fairing around the hull penetration.
Shaft seal and bearing	Supports the shaft and maintains watertight integrity.	Leakage, service history, bearing play, seal replacement interval and access inside the hull.
Actuator and linkage	Rotates the fin through the commanded angle.	Hydraulic leaks, pins, fasteners, mechanical stops, full travel and ability to centre or lock.
Hydraulic or electric drive	Provides the power required for fin movement.	Pressure, fluid, filters, motor current, cooling, standby power and shared dependencies.
Position feedback	Confirms fin angle to the controller.	Calibration, secure linkage, agreement between commanded and actual position.
Retraction or centring	Places the fin in a lower-risk position after shutdown or failure.	Whether the process works without normal power and how the crew confirms the final position.

HULL-INTEGRITY CONCERN	A fin strike or shaft/seal fault can be more than a comfort-system failure. Inspect the fin compartment and bilges for water ingress whenever damage, impact or abnormal shaft movement is suspected.
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GYROSCOPIC AND PASSIVE SYSTEMS

Internal counter-torque without external fins

Gyroscopic stabilisers use a rapidly rotating flywheel and controlled precession to create a counter-roll torque. Passive systems dissipate or redistribute roll energy without a powered control loop.



A gyro can work without vessel speed, but it needs spin-up time, power, cooling and strong structural foundations.

Area	What it does	Owner focus
Flywheel and enclosure	Stores angular momentum at high rotational speed.	Operating hours, vacuum or enclosure condition, vibration, noise and overhaul history.
Gimbal and bearings	Allows controlled precession to generate counter-torque.	Bearing wear, lubrication, end stops, movement, alarms and manufacturer overhaul limits.
Drive and electrical supply	Spins the flywheel and powers controls.	Starting current, running load, generator/inverter compatibility and emergency shutdown.
Cooling system	Removes heat from motor, bearings and electronics.	Seawater or freshwater flow, pumps, strainers, heat exchangers and run-down cooling needs.
Structural foundation	Transfers counter-torque into the hull structure.	Bolts, welds, cracking, corrosion, alignment and evidence of movement or vibration.

Passive arrangements

- Bilge keels and passive fins add damping with little owner input, but also add drag and external damage exposure.
- Paravanes and flopper stoppers require suitable rigging, deck strength, handling procedures and safe recovery.
- Anti-roll tanks depend on correct fill level and tuning; free-surface effects and loading changes require specialist consideration.

RUN-DOWN MATTERS	A gyro can remain at high speed after the main drive is stopped. Cooling, movement restrictions and safe access may still be required during the run-down period.
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OPERATION AND CONTROL

Modes, start-up, speed and safe shutdown

Correct operation depends on selecting the right mode, allowing machinery to stabilise, respecting speed and depth limits and placing the system in a known safe state before close-quarters work or shutdown.



The correct mode and limitations should be clear to every watchkeeper.

Operation	Objective	Owner focus
Pre-start checks	Confirm cooling, hydraulic, power and exclusion conditions.	Inspect leakage, alarms, seawater path and nearby people or objects.
Underway mode	Uses speed and motion data to control fin or ride response.	Respect maximum speed, fin-angle and shallow-water limits.
Zero-speed mode	Uses large fin movement at anchor or low speed.	Maintain exclusion zone and understand power and noise demand.
Gyro spin-up	Brings the flywheel to operating speed and thermal condition.	Allow time, cooling and generator capacity before relying on full effect.
Mode change	Transitions between anchor, manoeuvring and passage operation.	Confirm fins or gyro reach the commanded state and alarms clear.
Shutdown or run-down	Centres or retracts fins and manages gyro stored energy.	Cooling may need to continue after stabilising effect stops.

SAFE STATE IS SYSTEM-SPECIFIC	Some fins centre, some retract or lock, and gyros require controlled run-down. The crew should know the exact installed procedure.
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SUPPORTING SYSTEMS

Power, hydraulics, cooling and control

A stabiliser may depend on propulsion, electrical generation, hydraulic power, cooling water, speed data and a control network. Loss of a shared service can remove more than roll reduction.

Dependency	Why it matters	Questions to resolve
Electrical power	Controls, pumps, motors and gyros may require substantial continuous or starting power.	Which generator, inverter, bus and breaker supply the system? What remains after one source fails?
Hydraulic power	Fin systems may share pumps, reservoir, filters or coolers with steering, thrusters or deck machinery.	Are essential consumers protected by priority valves or separate circuits?
Cooling	Heat limits hydraulic efficiency, electronics and gyro bearings.	What pumps, strainers, seawater intakes or fans are required, and what alarm appears first?
Sensors and data	Roll, speed, heading, acceleration and fin-position information control the response.	Can a failed sensor be isolated? Does the system fail safe or continue with false information?
Control network	Integrated systems may use common displays, networks and software.	Is local control available if the bridge display or vessel network fails?
Propulsion state	Some hydraulic pumps or underway-fin modes depend on an engine or shaft turning.	What stabilisation remains with one engine stopped, at low speed or under sail/tow?

Control modes

- Underway, zero-speed, anchor, rough-weather, manual and automatic modes may use different limits.
- Gain or sensitivity settings affect fin or gyro response and should follow manufacturer guidance.
- Automatic systems should still provide clear indication of mode, load, temperature and alarm condition.
- The crew should know how to centre, retract, lock or stop the system without relying on the main display.

COMMON-MODE FAILURE	Two fins are not independent if one shared hydraulic power unit, controller, speed sensor or cooling system can disable both. The same applies to multiple gyros on one electrical or cooling supply.
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OPERATING LIMITS

Speed, depth, sea state and crew expectations

Stabiliser performance changes with operating condition. The owner's responsibility is to understand the permitted envelope and the consequences of leaving it.

Condition	Why it changes the system	Owner action
Low or zero speed	Underway fins lose hydrodynamic effectiveness; zero-speed fins may use larger movement.	Select the correct mode and confirm nearby people, tenders and objects are clear.
High speed	Fin and shaft loads increase significantly with water speed.	Respect fin-angle and speed limits; investigate load or over-torque alarms.
Shallow water or debris	External fins are exposed to grounding, lines, nets, ice and floating objects.	Retract or centre where the system allows and maintain a suitable safety margin.
Reverse operation	Flow direction and hydrodynamic loads change.	Follow manufacturer restrictions before manoeuvring astern with fins active.
Heavy or breaking seas	Roll reduction may increase other accelerations or encourage excessive speed.	Use seamanship, speed and heading changes rather than relying on stabilisation alone.
At anchor	Fin movement, gyro noise and electrical demand affect swimmers, tenders and overnight operation.	Brief crew and guests, monitor power/cooling and secure the exclusion area.

Comfort is not the same as safety

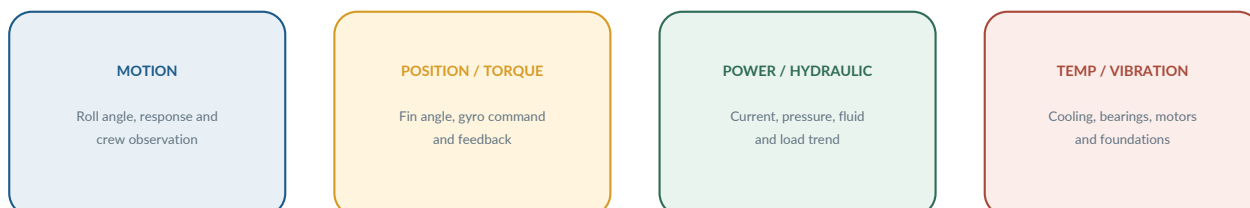
- Reduced roll can make a sea state feel less demanding than it is.
- Loose objects, tenders and deck gear still experience acceleration and impact.
- A sudden stabiliser trip can produce an immediate increase in roll.
- Crew should be prepared before entering a known limitation, not after the system alarms.
- The passage plan should remain acceptable with stabilisation unavailable.

PRACTICAL TEST	The crew should know how the yacht behaves with the stabilisers off at a safe speed and sea state. That experience makes an offshore failure less surprising.
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MONITORING AND NORMAL VALUES

Recognising effective control and developing machinery stress

Useful evidence includes roll response, commanded and actual fin position, hydraulic pressure, motor current, temperatures, gyro speed, vibration, noise and cooling flow.



Normal readings should be recorded for underway and at-anchor modes where fitted.

Observation	What it may indicate	Owner response
Fin position differs from command	Feedback, actuator, hydraulic or control fault.	Reduce speed and use approved centre or safe-state procedure.
Hydraulic level falls	Hose, shaft seal, actuator, fitting or cooler leak.	Inspect bilges and isolate before losing shared fluid.
High temperature or cooling alarm	Blocked strainer, failed pump, fouled cooler or overload.	Reduce demand and restore cooling before damage.
Abnormal vibration or noise	Bearing wear, loose foundation, cavitation, imbalance or impact.	Stop or derate according to manufacturer guidance.
Unexpected hunting or movement	Sensor error, control instability, air or contaminated fluid.	Protect people and avoid operation near swimmers or structures.
Roll reduction declines	Fouling, fin limitation, gyro speed, sensor or sea-state mismatch.	Compare with speed, mode and normal baseline.

TREND COMPARABLE CONDITIONS	Position, temperature, current and roll reduction are meaningful only when speed, sea state, loading and mode are known.
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FAILURE AWARENESS

Common weaknesses and warning signs

Most stabiliser failures begin with a change in sound, temperature, position, power demand, fluid level or motion response before complete loss of the system.

Symptom	Possible cause	Why it matters
Roll reduction weakens or becomes uneven	Sensor fault, one fin offline, low hydraulic flow, gyro derating or incorrect mode.	The yacht may develop asymmetric motion or lose expected crew protection.
Fin will not centre or retract	Actuator, valve, feedback, mechanical obstruction or control fault.	An exposed or uncontrolled fin can increase drag, yaw or damage risk.
Hydraulic level falls or oil appears in bilge	Hose, shaft seal, actuator, fitting or cooler leak.	May lead to loss of both fins, fire risk or another shared hydraulic function.
High temperature or cooling alarm	Blocked strainer, failed pump, fouled cooler, overload or internal leakage.	Continued use can damage fluid, electronics, bearings or the gyro drive.
Abnormal vibration or noise	Bearing wear, loose foundation, cavitation, imbalance, fouling or impact damage.	Can indicate a developing mechanical failure with high stored energy.
Unexpected movement or hunting	Sensor error, feedback fault, control instability or air/contamination.	May create excessive load and make motion worse rather than better.
System trips when load increases	Weak electrical supply, hydraulic relief, overheating, mechanical resistance or controller limit.	Alongside tests may not reveal the real offshore failure mode.

DO NOT NORMALISE IT

A fin that is always a few degrees out, a gyro that regularly derates or a hydraulic tank that needs topping up is showing a defect. Familiarity does not make it safe.

Impact and water ingress

After a suspected fin strike, grounding or heavy line contact, reduce speed, place the system in its approved safe state and inspect the fin compartment, shaft, seals, bilges and surrounding structure. Normal control indication does not prove the underwater assembly is undamaged.

FAILURE RESPONSE

Placing the system in a safe state and protecting the crew

Loss of stabilisation is often manageable, but sudden motion change, an uncentred fin, hydraulic leakage or gyro machinery fault can create wider operational consequences.



The yacht may remain operable, but crew-endurance and passage margin have changed.

Situation	Immediate thinking	Avoid
Loss of stabilising effect	Reduce speed, secure people and equipment and alter heading if appropriate.	Do not assume the same passage plan remains suitable.
Fin position or control fault	Use approved centre, retract, lock or manual procedure.	Do not force movement against a jam or near structures.
Hydraulic leak	Stop pumps, isolate the branch and protect steering or shared hydraulics.	Do not run until the common reservoir is empty.
Gyro alarm or vibration	Stop command and follow controlled run-down and cooling procedure.	Do not remove cooling or enter the movement zone prematurely.
Suspected fin strike	Reduce speed, centre or stop and inspect compartment, bilges and structure.	Do not rely only on normal display indication.
Generator or cooling loss	Shed demand and use the lowest-risk safe state.	Do not restart repeatedly without resolving the supporting fault.

EXPECT MOTION TO RETURN QUICKLY	Crew and equipment should be secured before a controlled shutdown whenever conditions permit, because roll may increase immediately.
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OWNER CHECKS

Routine inspection and maintenance thinking

Owner checks should reveal changing condition without entering the movement envelope or disturbing pressurised, high-speed or safety-critical equipment.

When	Useful checks
Before departure	Review mode, operating limits and alarms; inspect hydraulic level, visible leaks, cooling, electrical supply, foundations and fin/gyro status.
During operation	Monitor roll response, temperature, power or hydraulic load, fin position, vibration, noise and interaction with steering or generators.
After anchoring	Confirm the correct at-anchor mode, exclusion area, cooling and overnight power plan; inspect for new noise or movement.
After heavy weather or impact	Check alarms, fin-centre position, compartments, bilges, foundations, fasteners, shafts, seals and structural signs of movement.
Routine service	Follow calendar and operating-hour requirements for seals, bearings, fluids, filters, anodes, cooling, software and major overhauls.

Maintenance evidence that matters

- System hours, alarm history and actual operation under load.
- Fin-seal and bearing service records, haul-out photographs and shaft measurements.
- Gyro bearing, vacuum, cooling and manufacturer overhaul records.
- Hydraulic-fluid, filter and cooler history where applicable.
- Software, sensor calibration and control-component replacement history.
- Evidence that emergency centring, stopping or retraction has been tested.

SPECIALIST SUPPORT	Fin shaft seals, bearings, structural foundations, gyroscopic internals, hydraulic pressure settings, controller calibration and major cooling faults should be handled by competent specialists with the correct system information.
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Spares and information

Useful onboard support may include correct hydraulic fluid and filters, cooling-pump or strainer spares, approved fuses or relays, sensor details, emergency tools and the complete safe-shutdown procedure. Carry only parts the crew can install safely.

RECORDS, SPARES AND SUPPORTABILITY

Keeping the stabiliser system understandable and repairable

Useful records identify exact system type, operating limits, hydraulic or electrical architecture, structural installation, normal readings, safe-state procedure and specialist support.

DRAWINGS

Sensors, drives, shafts, seals and foundations

BASELINE

Mode, speed, load, temp and roll response

SPARES

Fluid, filters, cooling and selected controls

SUPPORT

Manufacturer, haul-out and specialist contacts

Spares should match the exact installed model and the crew capability to fit them safely.

Area	Useful evidence or provision	Why it matters
System and installation drawings	Sensors, controllers, pumps, actuators, shafts, seals, cooling and foundations.	Shows dependencies and maintenance access.
Operating baseline	Mode, speed, current, pressure, temperature, position and roll response.	Makes deterioration visible.
Service and overhaul history	Fin seals, bearings, anodes, fluids, gyro bearings, vacuum and software.	Supports remaining-life and cost assessment.
Impact and structural record	Grounding, line strike, abnormal load, leakage and repair evidence.	Protects hull-integrity decisions.
Selected spares	Correct fluid, filters, pump or cooling parts, fuses, relays or sensors.	Supports common recovery without unsafe substitution.
Support contacts	Manufacturer, hydraulic, haul-out, control and structural specialists.	Reduces delay in regions with limited support.

SUPPORTABILITY CAN DOMINATE OWNERSHIP COST	A healthy older system may still create significant risk if seals, controllers, bearings or proprietary support are no longer available.
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OFFSHORE READINESS

Failure response, buyer questions and readiness checklist

Loss of stabilisation is often manageable, but the sudden motion change, an uncentred fin, hydraulic leakage or gyro machinery fault can create wider operational consequences.



Questions worth resolving

- What is the approved safe state after loss of electrical, hydraulic or control power?
- Can fins be centred, retracted or locked without the normal controller?
- What cooling must continue while a gyro runs down?
- Could a stabiliser fault affect steering, generators or a shared seawater intake?
- How does the yacht handle at passage speed with stabilisation unavailable?

Area	Questions for purchase or survey
System and suitability	Which type, model, age and operating modes are fitted, and does the arrangement suit the intended cruising profile?
Condition and support	Are service records complete, major overhauls current and specialist support still available?
Fin or gyro installation	What is the condition of fins, shafts, seals, foundations, bearings, cooling and structural attachments?
Dependencies	Which generators, hydraulics, coolers, networks and sensors are shared with other equipment?
Degraded operation	Has the safe-state procedure and yacht behaviour without stabilisation been demonstrated?

Quick readiness check

	Readiness statement
	The installed type, modes, limits and normal readings are understood.
	There are no unresolved leaks, alarms, vibration, overheating or position errors.
	The safe centring, retraction, locking, stopping or gyro run-down procedure is available.
	Electrical, hydraulic, cooling, sensor and control dependencies are understood.
	The yacht's behaviour without stabilisation has been considered or tested safely.
	More than one person knows the immediate failure and damage-check response.

KEY TAKEAWAY

A dependable stabiliser system combines effective roll reduction with known limits, maintained machinery, a clear safe-state procedure and a passage plan that remains acceptable when stabilisation is lost.

Guidance to consult

Use the stabiliser manufacturer's operating and service instructions, together with applicable flag, class, coding, insurance and yard requirements.

Understanding Yacht Systems

Practical guides for owners, buyers
and offshore cruising crews.

AMTG-009

Understanding Stabiliser Systems

RELATED GUIDES

AMTG-007 Understanding Hydraulic Systems

AMTG-026 Understanding Monitoring and Alarm Systems

AMTG-047 Understanding Gyroscopic Stabilisers

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