

CORE SYSTEMS

AMTG-007 | VERSION 1.0 | JULY 2026

# Understanding Hydraulic Systems

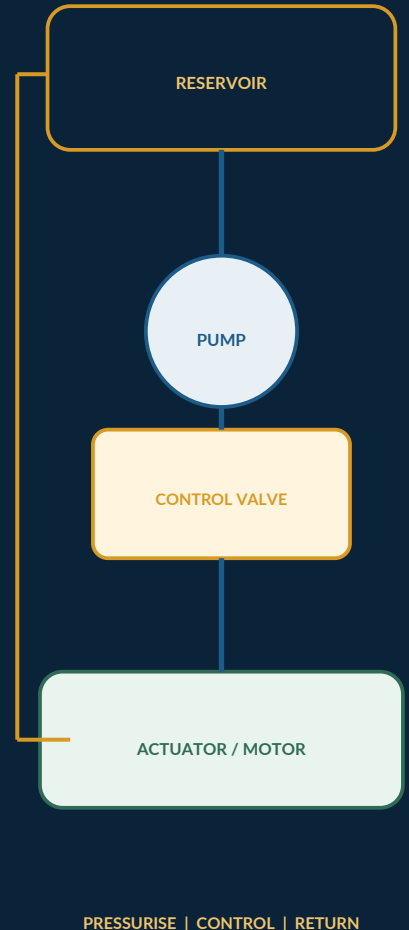
An owner's guide to pressurised fluid, shared machinery and stored-energy risk

Hydraulics create powerful, compact movement.

Reliability depends on clean fluid, controlled pressure and safe isolation.

**Absolute Marine**

Commercial thinking for private cruising.



## GUIDE OVERVIEW

# What a hydraulic system is designed to do

Hydraulic systems transmit power through pressurised fluid to steering, stabilisers, thrusters, cranes, passerelles, platforms and other machinery. They deliver high force from compact equipment, but can also create serious stored-energy, leakage and contamination hazards.

**SCOPE**

This guide provides a whole-system overview. Actual yachts may use several independent power packs, engine-driven pumps, shared central systems, accumulators and electronically controlled proportional valves.

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

- Explain how flow, pressure and resistance interact in a hydraulic circuit.
- Identify reservoirs, pumps, filters, valves, accumulators, coolers, hoses and actuators.
- Recognise leakage, aeration, cavitation, contamination and overheating warning signs.
- Understand why a shared hydraulic fault can affect several yacht functions at once.
- Ask better questions during purchase, survey, maintenance and offshore preparation.

**CORE PRINCIPLE**

Hydraulic pressure can remain trapped after pumps stop. Before opening a connection or approaching a moving load, the system must be secured, isolated and depressurised using the approved procedure.

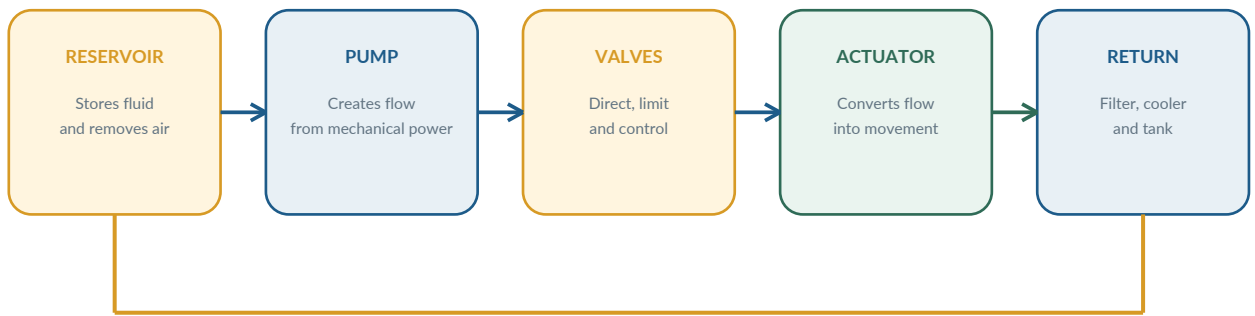
**Safety**

High-pressure fluid can penetrate skin without leaving an obvious wound, and a hose or component may move violently when pressure is released. Never search for a leak with your hand. Suspected injection injury requires urgent specialist medical assessment.

SYSTEM OVERVIEW

# How hydraulic power moves through the yacht

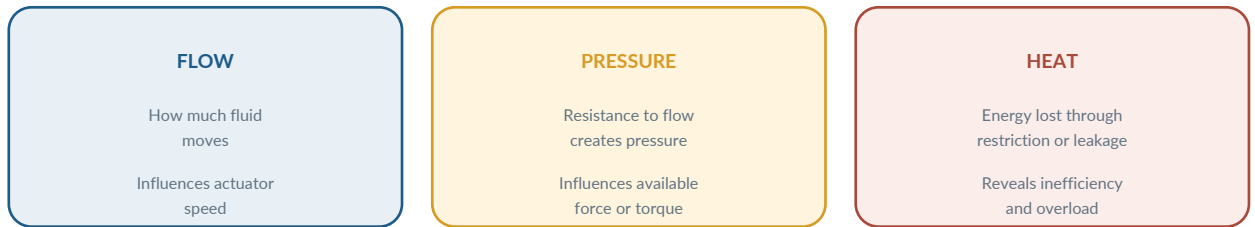
A pump creates flow. Pressure develops when that flow meets resistance. Valves control direction and limit pressure, while an actuator converts hydraulic energy into movement or torque.



Pressure develops when flow meets resistance. Return flow completes the circuit and carries heat and contamination back for control.

## The basic circuit

- Reservoir: Stores fluid, allows heat and entrained air to dissipate, and provides a supply to the pump.
- Pump: Draws fluid from the reservoir and creates flow.
- Pressure control: Relief and reducing valves protect equipment and set operating limits.
- Directional and proportional control: Routes flow to the required actuator and controls movement.
- Actuator: A cylinder produces linear movement; a motor produces rotation.
- Return circuit: Carries fluid through filtration or cooling before returning it to the reservoir.



A high pressure reading does not by itself prove adequate flow, and a moving actuator does not prove the system is healthy.

|               |                                                                                                                                                                                             |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OWNER INSIGHT | A slow actuator may result from low flow, internal leakage, a restriction or a weak pump. Increasing pressure settings without diagnosis can damage the system and create a serious hazard. |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## MAIN COMPONENTS

# What owners should be able to identify

Hydraulic reliability depends on the complete circuit, not only the pump or actuator. Good access, labels and accurate drawings are especially important when several consumers share one system.

| Component                 | What it does                                                                            | Owner focus                                                                                    |
|---------------------------|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Reservoir and breather    | Stores fluid, accommodates volume change and allows air and heat to separate.           | Level, temperature, cleanliness, vent condition, internal corrosion and correct fluid.         |
| Pump and drive            | Creates flow using an engine, electric motor, gearbox take-off or dedicated power pack. | Noise, leakage, mounting, coupling, belt or drive condition and operating history.             |
| Filters and indicators    | Remove contamination from pressure, return or suction circuits.                         | Correct element, restriction indication, bypass condition and clean replacement practice.      |
| Relief and control valves | Limit pressure and direct or regulate flow.                                             | Seals, solenoids, labels, manual overrides and evidence of unauthorised adjustment.            |
| Accumulator               | Stores pressurised fluid for damping, emergency use or peak demand.                     | Pre-charge, service status, isolation and residual stored-energy hazard.                       |
| Hoses and rigid pipework  | Carry fluid between components.                                                         | Chafe, support, bend radius, corrosion, heat exposure, age, leaks and correct pressure rating. |
| Cylinder or motor         | Converts fluid power into movement or torque.                                           | Rod condition, seals, mounting pins, abnormal drift, heat and mechanical guarding.             |
| Cooler and sensors        | Controls temperature and reports pressure, level, temperature or filter condition.      | Cooling-water or airflow, alarm history and whether indications match local gauges.            |

|               |                                                                                                                                                                                                                                            |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DOCUMENTATION | Useful drawings identify normal valve positions, relief settings, shared consumers, priority valves, emergency pumps, accumulators and safe depressurisation points. A generic diagram that no longer matches the yacht has limited value. |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

FLUID CONDITION

# Contamination, air, water and heat

Hydraulic components operate with close internal clearances. Particles, water, incorrect fluid and air can reduce efficiency, damage surfaces and make control unpredictable.



Hydraulic contamination is often a cycle: wear creates particles, particles create more wear.

| Observation                  | Possible explanation                                                                | Why it matters                                                                                  |
|------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| Dark or burnt-smelling fluid | Overheating, oxidation or extended service.                                         | Viscosity and additive performance may have deteriorated; seals and components may be affected. |
| Milky or cloudy fluid        | Water contamination or fine entrained air.                                          | Can promote corrosion, poor lubrication, foaming and erratic operation.                         |
| Foam in reservoir            | Air leak on suction side, low level, poor return design or unsuitable fluid.        | Aerated fluid compresses and may cause noise, heat and poor response.                           |
| Metallic or gritty debris    | Component wear, contaminated filling or failed filtration.                          | Indicates active damage and can spread through the whole circuit.                               |
| Repeated filter restriction  | Heavy contamination, failing component, wrong element or cold/high-viscosity fluid. | A bypassing or blocked filter can remove protection or starve the pump.                         |
| Rising operating temperature | Internal leakage, restriction, cooling failure, overload or low reservoir level.    | Heat accelerates fluid, hose, seal and component deterioration.                                 |

|                  |                                                                                                                                                                                                                                 |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CLEANLINESS RULE | Opening a clean system carelessly can introduce more contamination than the failed part that prompted the repair. Use clean containers, capped hoses, correct filtration and the fluid specified by the equipment manufacturer. |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## HOSES AND STORED ENERGY

# Leakage, accumulators and safe isolation

Hydraulic leaks can cause loss of function, fire risk, pollution and injection injury. Accumulators and supported loads may retain dangerous energy after the pump is stopped.

| Finding                              | Meaning or concern                                                                                   |
|--------------------------------------|------------------------------------------------------------------------------------------------------|
| Wet fitting or hose                  | The leak may be minor now, but pressure pulses, movement and heat can accelerate failure.            |
| Cracked, blistered or abraded cover  | Reinforcement may be exposed or damaged. External appearance does not reveal internal deterioration. |
| Kink, tight bend or twist            | Restricts flow and stresses the reinforcement and end fittings.                                      |
| Corroded fitting or unsupported pipe | Vibration and wall loss can cause leakage or sudden rupture.                                         |
| Cylinder drift                       | May indicate internal leakage, valve leakage or mechanical movement of the load.                     |
| Movement after shutdown              | Stored pressure, gravity or a loaded accumulator remains active.                                     |

## Safe isolation principles

- Stop and isolate the hydraulic power source using the approved procedure.
- Secure cranes, passerelles, platforms, fins, steering linkages or other moving loads mechanically where required.
- Close the correct isolation valves without trapping an unsafe condition elsewhere.
- Discharge accumulator pressure through the designed method and confirm pressure at an appropriate gauge.
- Do not loosen a fitting to 'bleed off' unknown pressure.
- Keep people clear of pinch points and the potential path of a moving actuator.

### INJECTION INJURY

A pinhole leak may be nearly invisible. Use cardboard or another approved method to locate suspected leakage - never fingers or bare skin. Any suspected fluid injection is a medical emergency.

## SHARED SYSTEMS

# Consumers, priority valves and common failures

One central hydraulic system may supply several functions. A fault, low reservoir level or overheating problem can therefore affect steering, stabilisers, thrusters and deck machinery together.

| Consumer                      | Typical duty                                            | Failure consequence to consider                                                                    |
|-------------------------------|---------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Steering                      | Continuous or intermittent control of rudder actuators. | Loss or degradation can immediately affect directional control and may require emergency steering. |
| Fin stabilisers               | Rapid, continuously varying actuator movement underway. | Loss may increase roll; a hydraulic leak or uncentred fin can create additional risk.              |
| Thrusters                     | Short-duration, high-flow manoeuvring demand.           | May consume most available capacity and overheat or deprive other consumers if poorly prioritised. |
| Cranes and davits             | High-force lifting and slewing, often at low speed.     | A fault can leave a suspended load, unsecured tender or trapped energy.                            |
| Windlass, capstan or platform | Intermittent deck or access operation.                  | Failure can affect anchoring, boarding or watertight closure of a moving platform.                 |
| Passerelle or hatch           | Controlled extension, lifting or locking.               | May obstruct escape, damage structure or remain unsecured if pressure is lost.                     |

## Priority and load sharing

- Priority valves may protect steering or another essential function when flow is limited.
- Simultaneous operation of several consumers can cause slow movement, pressure fluctuations or overheating.
- A standby pump may share the same reservoir, cooler, valves or contaminated fluid as the primary pump.
- Control systems may inhibit one consumer while another is operating.
- Owners should know which equipment can safely be used together and which function receives priority.

### FALSE REDUNDANCY

Two pumps connected to one contaminated reservoir and one failed suction line do not provide complete redundancy. The shared fluid, pipework and control path must also be considered.

## FAILURE AWARENESS

# Common weaknesses and warning signs

Hydraulic failures often give warning through changing sound, heat, speed, pressure, fluid level or control response before complete loss of function.

| Symptom                      | Possible cause                                                                            | Why it matters                                                     |
|------------------------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| Pump whine or rattling       | Low fluid, suction restriction, aeration or cavitation.                                   | Pump damage and loss of flow may follow quickly.                   |
| Actuator slow or jerky       | Low flow, air, contamination, sticking valve, internal leakage or overload.               | Control becomes unpredictable and may affect safe operation.       |
| Pressure low under load      | Weak pump, relief valve passing, major leakage or drive problem.                          | The system may move unloaded but fail when force is required.      |
| Pressure unusually high      | Blocked line, seized actuator, incorrect valve position or altered relief setting.        | Hoses, seals and components may be exposed to damaging loads.      |
| Reservoir level falls        | External leak, cylinder-volume change or incorrect previous level.                        | Continued loss can starve the pump and remove several consumers.   |
| Fluid temperature rises      | Internal leakage, cooler failure, restriction, overload or insufficient reservoir volume. | Heat accelerates degradation and may precede loss of performance.  |
| Load drifts or will not hold | Cylinder seal leakage, valve leakage, hose failure or mechanical lock problem.            | A crane, platform, fin or steering actuator may move unexpectedly. |

**DO NOT NORMALISE IT**

A hydraulic system that is always topped up, regularly overheats or moves with a familiar jerk is showing a defect. Repeated operation can spread contamination or turn a small leak into a sudden failure.

## Fire and environmental risk

A fine hydraulic spray can ignite on a hot exhaust or turbocharger. Spilt fluid can also contaminate bilges and the sea. Stop the source, protect ignition hazards and contain leakage using the vessel's emergency plan.

OWNER CHECKS

# Routine inspection and maintenance thinking

Owner checks should reveal change without disturbing a clean, pressurised system. Internal adjustments, pressure testing and component overhaul belong with competent hydraulic specialists.

| When                  | Useful checks                                                                                                                                         |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Before departure      | Check reservoir level and temperature, visible leaks, hose condition, filter indicators, cooler supply and normal valve or control status.            |
| During operation      | Monitor pressure, temperature, noise and speed; inspect shared consumers for unusual interaction; keep people clear of moving equipment.              |
| After heavy use       | Check for heat, new leakage, loose supports, fluid loss and loads that do not remain secured.                                                         |
| Routine service       | Use the specified fluid and filters; maintain cleanliness; inspect breathers, accumulators, coolers, flexible hoses, seals and drive equipment.       |
| After repair or refit | Confirm correct flushing, filling, bleeding, relief settings, hose routing, valve positions, alarms and independent operation of essential consumers. |

## Useful spares and information

- The correct hydraulic fluid in clean, sealed containers.
- Specified filter elements, breathers and seals where owner replacement is appropriate.
- Hose and fitting details, but not improvised repairs beyond the rated system requirements.
- Absorbent materials, drip trays, plugs or caps and suitable spill-containment equipment.
- Current circuit drawings, pressure settings, fluid specification and specialist contact details.

|                |                                                                                                                                                                                                                          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FLUID SAMPLING | Trend-based fluid analysis can identify water, particles, viscosity change and wear metals. Samples are useful only when taken cleanly from a representative point and interpreted against the correct fluid and system. |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Work to refer

Pressure adjustment, accumulator charging, hose manufacture, internal valve or pump overhaul, contamination flushing, pressure testing and diagnosis of persistent steering or lifting faults should be referred to competent specialists.

## OFFSHORE READINESS

# Responding to leakage or loss of hydraulic power

The immediate response depends on what the hydraulic system is controlling. A leak affecting a crane alongside is different from one affecting steering or stabilisers offshore.



## Immediate priorities

- Protect people: Stop movement and keep clear of hoses, suspended loads, pinch points and hot sprayed fluid.
- Secure the equipment: Use mechanical locks, supports or approved emergency stowage where available.
- Stop the source: Shut down the pump or drive and isolate the affected branch using the correct procedure.
- Preserve essential functions: Confirm steering, propulsion support and other shared consumers remain available.
- Contain the leak: Protect hot surfaces, bilges and the environment without exposing crew to pressure.
- Reassess the voyage: Reduced steering, an uncentred fin or loss of tender recovery may justify diversion or assistance.

**DO NOT IMPROVISE  
UNDER LOAD**

A temporary hose or fitting must be compatible with fluid, pressure, temperature, movement and fire risk. An unsuitable repair can fail violently and make the casualty worse.

## Questions before going offshore

- Which essential and non-essential consumers share each reservoir and pump?
- What hydraulic function remains after loss of the primary drive or electrical power pack?
- Can steering operate independently from stabilisers, thrusters or deck machinery?
- How are fins, cranes, platforms and passerelles secured if pressure is lost?
- Which isolation valves and emergency controls can be reached safely?
- Does more than one person understand the emergency and depressurisation procedures?
- What defect would contaminate or disable both primary and standby arrangements?

## PURCHASE AND READINESS

# Buyer, survey and owner-familiarisation checklist

A clean reservoir and freshly painted hoses do not prove internal condition. Service history, fluid analysis, realistic load testing and evidence of safe isolation are valuable.

| Area                   | Questions worth asking                                                                                                      |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Architecture           | Which systems share reservoirs, pumps, filters, coolers, valves and controls? Are current circuit drawings available?       |
| Fluid and cleanliness  | What fluid is specified, when was it changed or analysed, and is there evidence of water, particles or mixed products?      |
| Hoses and pipework     | Are routes supported and protected? Is there chafe, corrosion, heat exposure, poor bend radius or undocumented replacement? |
| Pumps and valves       | Are pressure, temperature and response stable under realistic demand? Have relief settings or controls been altered?        |
| Accumulators           | What is their purpose, service status and safe isolation procedure? Is stored pressure clearly identified?                  |
| Essential functions    | What remains after one pump, drive, reservoir, cooler or control failure? Is steering genuinely protected?                  |
| Emergency arrangements | Can loads be secured, branches isolated and the system depressurised without entering a dangerous area?                     |

## Quick readiness check

|  | Readiness statement                                                                     |
|--|-----------------------------------------------------------------------------------------|
|  | Reservoirs, pumps, filters, valves, accumulators, coolers and consumers are identified. |
|  | Normal fluid level, pressure, temperature, sound and response are known.                |
|  | There are no unexplained leaks, repeated top-ups, overheating or abnormal movement.     |
|  | Correct fluid, filters and maintenance records are available.                           |
|  | Hoses, fittings, supports and pipework are accessible and in credible condition.        |
|  | Stored-energy and load-securing procedures are understood.                              |
|  | Essential consumers have realistic backup or reduced-mode arrangements.                 |
|  | More than one crew member knows the immediate response to a hydraulic failure.          |

## KEY TAKEAWAY

A dependable hydraulic system combines clean correct fluid, controlled pressure and temperature, sound hoses and components, safe stored-energy management and a clear plan for preserving essential functions after a failure.

## Standards and guidance to consult

Where applicable, consult the current editions of ISO 4413 Hydraulic fluid power - General rules and safety requirements for systems and their components, ISO 1219 for fluid-power symbols and circuit diagrams, ISO 4406 for fluid cleanliness coding, the equipment manufacturers' instructions, and relevant flag-state, coding, class and insurance requirements.

# Understanding Yacht Systems

Practical guides for owners, buyers  
and offshore cruising crews.

## AMTG-007

### Understanding Hydraulic Systems

#### RELATED GUIDES

AMTG-008 Understanding Steering Systems

AMTG-009 Understanding Stabiliser Systems

AMTG-046 Understanding Bow and Stern Thrusters

AMTG-048 Understanding Fin Stabilisers

AMTG-052 Understanding Tender-Lifting and Crane Systems

**ABOUT ABSOLUTE MARINE**

Independent technical advice for explorer yacht owners,  
buyers and offshore cruising yacht owners.

Survey Report Reviews | Offshore Readiness Reviews  
Reliability | Risk | Readiness

**[absolute-marine.co.uk](https://absolute-marine.co.uk)**

[info@absolute-marine.co.uk](mailto:info@absolute-marine.co.uk)