



*Quiet
vibration-free
performance from
today's high-revving
diesels*



SILENCING AND EXHAUST SYSTEMS

Components to build exceptionally quiet exhaust systems

HMI SILENCING AND EXHAUST SYSTEMS

Every HMI product in this brochure is designed and manufactured in Britain

WHY USE SILENCERS?

Noise is tiring. Noise creates sea-sickness. For the commercial operator it takes the pleasure out of work. For the private user it turns pleasure into hard work. Our objective is to achieve an exhaust noise reduction of around 40% with our basic silencers, 70% with our specialist dual chamber silencers, or 80% with silencers and our exhaust water separation units.

WHAT IS A MARINE EXHAUST ACHIEVING?

A marine engine exhaust system ejects the cooling water as well as silencing the engine's combustion noise and removing the exhaust gasses. The system must create minimal restriction to the flow of exhaust gasses, known as back pressure, or the engine may be damaged.

There are four main objectives:

- 1 To reduce noise by between 40% and 90%.
- 2 To cool the exhaust, and eject the engine cooling water through the exhaust without excessive back pressure.
- 3 To minimise the risk of water running back up the exhaust and into the engine cylinders, causing serious engine damage.
- 4 To site the outlets at the stern of the boat to minimise exhaust fumes on board.



INDEPENDENT TESTS

These tests studied the reduction in exhaust noise using our exhaust silencers. Halyard also offers products to reduce airborne noise, and vibration or structure borne noise.

In-line silencers

Mike Wake, a technical journalist and former editor of the Royal Institute of Naval Architects Smallcraft Journal, tested a smaller non turbo engine with no silencer, then with a rubber silencer, and finally with an HMI silencer. Noise doubles every three decibels, so a 3dB(a) reduction halves the noise.

Dual chamber silencers

Motor Boat and Yachting's test used two identical 13m (45') power boats with twin diesels of around 450hp. One had no silencers. The other had HMI dual chamber silencers. Noise doubles every three decibels, so the 6 dB(a) reduction at 3000rpm means the exhaust noise had reduced by 75%.

Water separators and silencers

Benson Cruisers tested a 50hp diesel with a straight through exhaust, then adding an HMI silencer, then an HMI separator as well. The results are shown at tickover and at 2,000rpm. At 2,000rpm the complete system reduced exhaust noise from 85dB(a) to 62dB(a) – or 99%. Figures were measured 1m from the exhaust outlet.

WHAT'S NEW IN EXHAUST SYSTEMS?

Dual chamber silencers.

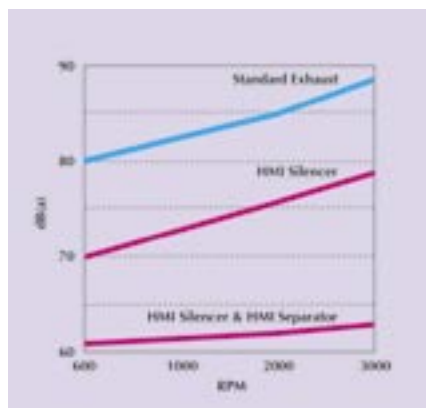
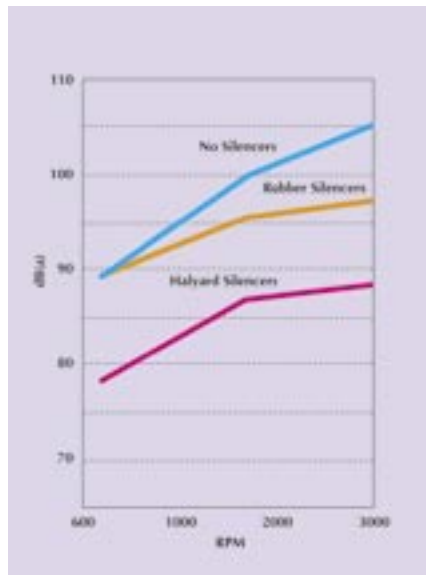
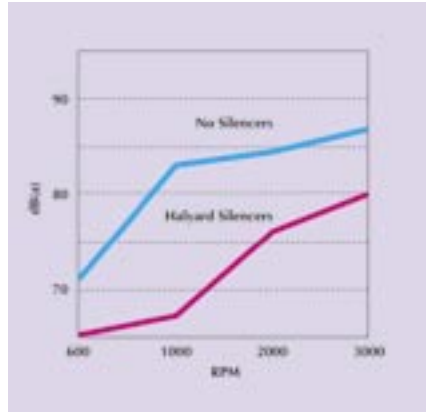
Halyard's dual chamber silencers now set incredible standards in reducing exhaust noise. Finally the customer has a real choice between achieving a reduction of up to 50% with standard HMI silencers at realistic costs, or spending more on a dual chamber silencer which will cut noise by as much as 75%.



Water separators.

In 1992 Halyard launched the first production water separator for marine generators.

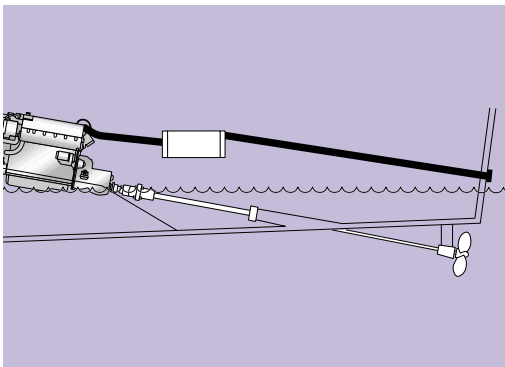
- There are two benefits: -
- The irritating noise of water "splashing" out of the exhaust is removed completely, reducing exhaust noise from generators running in quiet anchorages by up to 90%.
 - Back pressure is minimised.



HMI EXHAUST SILENCERS - DESIGNING AN EXHAUST?

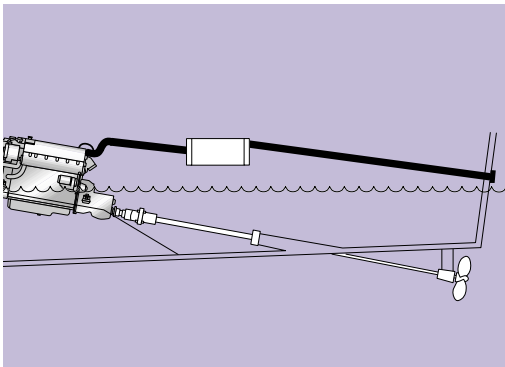
WHERE'S THE WATERLINE?

That's the vital question. The engine's cooling water is usually added to the exhaust right behind the engine. Will water run naturally out of the exhaust? Will it drain when you stop the engine? Might it collect in the exhaust and run back into the engine if the boat pitches? Is the exhaust system diameter large enough to allow free flow without creating high back pressure? Let's look at the basics of good exhaust design.



Engine well above waterline?

This engine is sited well above the waterline, with a gradient steeper than 1 in 8 to the back of the boat. The water will run naturally down the exhaust to the stern. To reduce noise by up to 50% a straightforward in-line silencer should be used. To reduce noise by around 70% a dual chamber unit could also be used.

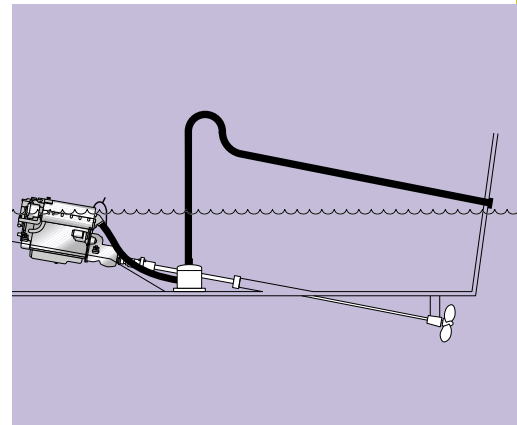


Engine only just above waterline?

A problem! The hose from the engine to the transom is nearly flat. Water could run back into the engine if the vessel pitches on its mooring – or a wave could do the same. A "high riser" is needed on the engine. This is an extension to the exhaust outlet on the engine taking it well above water-line to create a 1 in 8 gradient from the water injection on the engine down to the stern. An In-Line silencer can then be used with a noise reduction of around 50%. Alternatively you might get the necessary height by using a Dual Chamber silencer, with a noise reduction of around 75%. We make high risers to order and some engine manufacturers also keep them as an option.

Engine below waterline?

Sailing yachts and many displacement craft have engines where the exhaust water injection point is actually below waterline. In this situation a lift silencer has to be put in the system to collect water when the engine is stopped. A syphon-breaker should be fitted into the cooling water feed. The exhaust must rise to a U bend (or "gooseneck") well above the waterline, and then run down to the transom. In this way the lift silencer collects water when the engine is stopped, and the gooseneck prevents a stern wave flooding the system. A standard Lift Silencer will reduce noise by up to 50%. Better still, replace the gooseneck with a water separator and reduce noise by up to 80% - this will have the added advantage of reducing back pressure.



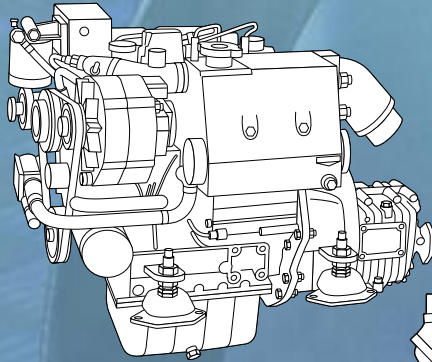
Dimensions on Lift Silencing systems vary widely, but a 12m yacht normally needs a drop of 300mm (12") from the water injection point on the engine exhaust outlet to the top of the lift silencer. The gooseneck should then be 450mm (18") above waterline – or more if the exhaust is to one side. The lift silencer should not fill with water by more than 30% when the engine is stopped, and it must be large enough for this. These are very general guidelines and will change with angles of heel, size of vessel, engine choice etc. Individual installations must be checked with qualified designers or marine engineers.

HOW DO I DECIDE THE EXHAUST DIAMETER?

The diameter of the exhaust system is crucial to avoiding back pressure problems. Don't simply use the diameter of the exhaust outlet on the engine. Longer systems create more back pressure. Sharp bends create more back pressure. Large cooling water flows cause more back pressure. But the larger the diameter of the exhaust system, the less back pressure. All the tips given below assume that the outlet on the hull is above waterline by at least its own diameter, and remains above water under way.

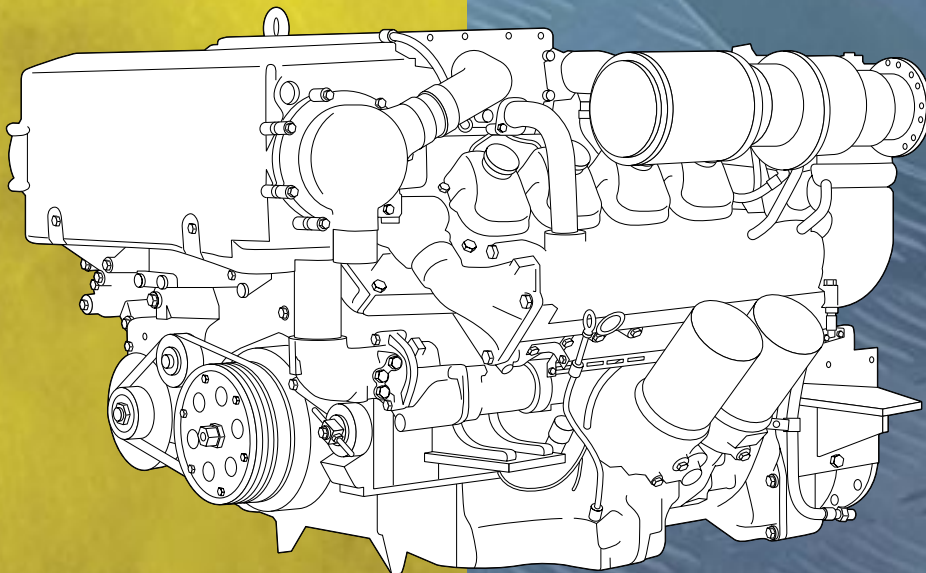
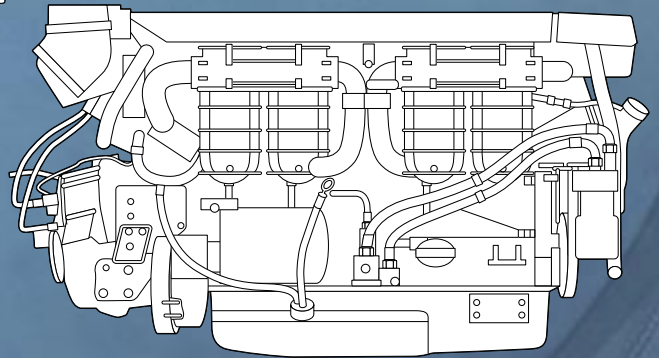
Engines up to 30kW (40hp)

On a small diesel without a turbo the hose diameter can often be the same as the engine manufacturer's outlet, as long as the system is below 3m in length with no more bends than the Lift Silencer system illustrated above. We can give informal help on the phone, but it is wise to check with the engine manufacturer.



Engines up to 100kW (140hp)

Give us a ring to check. We can say quickly whether the choice is simple or complicated. The diameters chosen by the engine manufacturers vary widely. Some assume the exhaust will be short. Others assume it will be complex. Each manufacturer has different back pressure requirements. You are often safe just adding 25mm (1") to the diameter of the exhaust outlet. We are delighted to help, but our telephone advice can only be binding if we are sent full drawings of the vessel and produce a professional written recommendation.



Engines between 100kW (140hp) and 1000kW (1400hp)

Please give us a ring. We can run through the system and say very quickly whether it is likely to be complex. We can respond informally to faxed or Emailed sketches, or we can send a qualified designer to produce formal design proposals.

HMI EXHAUST SILENCERS - HOW ARE THEY MADE?

Halyard produces GRP silencers using specialist resins, allowing our HMI silencers to survive remarkably high temperatures if the cooling water supply blocks for short periods. Silencers are usually made from filament wound GRP tube, manufactured in our own plant, which is hand-laminated with flat sheet bases. Every single silencer produced is pressure tested individually to guard against leaks. Every silencer is gel-coated after completion and the production number on the label links into a Quality Assurance system which allows us to trace each operator involved in its production.

GRP is used as the base material to avoid the corrosion and acoustic problems of welded stainless units, and to avoid the low melting points of plastic silencers. Although normal marine exhausts run at between 40°C and 60°C, HMI silencers will remain operational after exposure to 300°C or more, while a plastic unit will melt at around 150°C. More costly resins allow us to offer silencers for even higher temperatures for specific applications.

Halyard GRP silencers will be replaced free of charge if they prove faulty within five years. Lloyds and many Classification Societies will readily accept HMI silencers and formal Lloyds Approval can be arranged on specific installations. Customers should check for up-to-date information. Most major engine manufacturers recommend HMI silencers and several list them as options.



HMI Lift silencers are designed for use with engines positioned on, or below waterline. Thousands are sold each year and major users include most quality British production boatyards where excellent acoustics and good temperature resistance are paramount. HMI Lift Silencers are as popular with generators as they are with propulsion engines. Details of the full range of sizes are in our price list.

HMI Side in, top out, lift silencers

The side in, top out lift silencer is the best selling small lift silencer in the HMI range. Smaller silencers have smart, resin transfer moulded lids. Every unit is pressure tested and gel-coated for a durable and smart appearance.

HMI Top in, top out, lift silencers

In many applications a top inlet unit will be easier to use. The noise result and cost are the same as the side inlet units, and the same rigorous quality tests apply.

HMI Dual Chamber silencers is the best wet-exhaust silencer on the market today. Exhaust noise reductions of up to 80% can be achieved and the back pressure created by the unit is minimal. Most units are hand-built with inlet and outlet positioned to suit the particular craft. Each has a production number, and the quality standards applied are designed to give a life in excess of ten years on a privately owned craft. Dual Chamber Lift Silencers are used by most major names in powerboats today, as well as by commercial operators looking for comfort on board.

HMI LIFT SILENCERS - UP TO 50% NOISE REDUCTION



HMI Horizontal Lift Silencers

These low lying units can be very useful in sailing yachts, where the silencer needs to be secured alongside the propeller shaft. The moulded ends are used on smaller units.

HMI DUAL CHAMBER SILENCERS - UP TO 80% NOISE REDUCTION



HMI Twin Inlet Dual Chamber Lift Silencer

Some dual chamber silencers have two inlets to accept the exhaust hose from a V engine. Each inlet has been specifically angled to suit the particular craft and the outlet points straight to the positioned provided on the hull.

HMI IN-LINE SILENCERS UP TO 50% NOISE REDUCTION

HMI In-Line silencers are used where the engine is well above the water-line, or where a high-riser has been fitted to achieve a 1 in 8 gradient from the engine to the transom outlet. They are simple to specify and fit, and ideally need to be 500m to 1m behind the engine. The internal design requires the exhaust gasses and water to bubble through a layer of water on the bottom of the silencer to reduce noise. They offer excellent noise reduction and are widely used on both pleasure and commercial engines.



HMI Round In-Line Silencers

These silencers are made from enormously strong filament wound tube, giving the maximum possible protection if the exhaust back-fires. Every unit is pressure tested before being gel-coated. They must be installed within 5 degrees of horizontal.

Oval In-Line Silencers

Our oval silencers are hand-moulded for use where the round body unit cannot be accommodated. They give the same excellent results and every single unit is pressure tested and gel-coated. HMI Twin Inlet In-Line Silencers are built on an individual basis for V engines. The inlets can be angled to ease the connection to the engine, and positioned on the end or the side.



HMI High Risers combine two features: They raise the engine exhaust outlet to increase the gradient on the exhaust system, and they have a carefully calibrated range of water spray holes sized to make water jet into the exhaust gasses at full power to maximise the cooling effect. Each is fabricated from 316 stainless to the highest standards. Many of the surfaces are polished, and each is equipped with heat protecting jackets tailored for the particular unit.

HMI HIGH RISE SPRAY HEADS



Spray heads

Many engine manufacturers make a standard spray head for use when a high riser is not needed. If not Halyard can help. We can also produce spray heads with particular spray patterns for installations where cooling is critical.

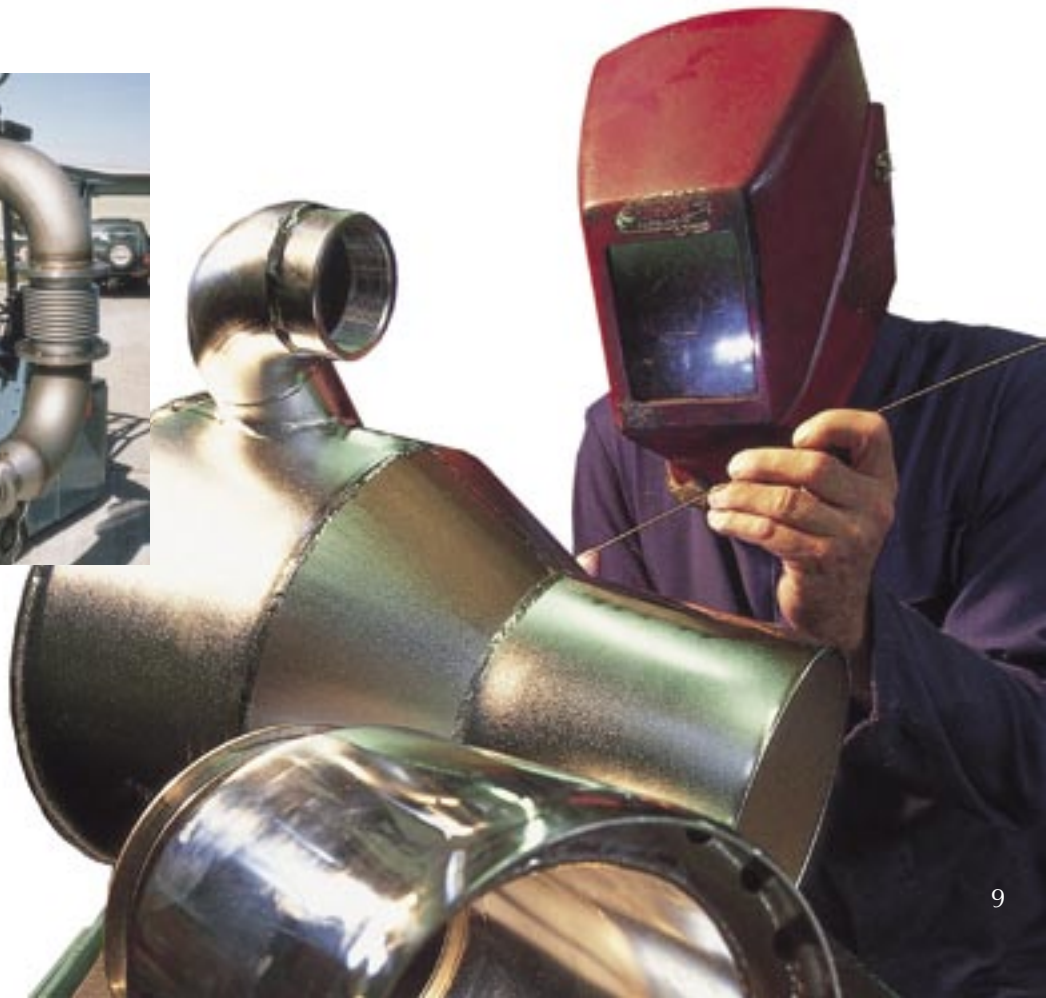
Modular spray head and high riser

This modular spray head rotates at three points along its length, so that the riser can be incorporated in the exhaust in the easiest possible way. Once positioned, special clamps on each joint are tightened to fix the position permanently, and the heat resisting jackets are fitted.



Bespoke Stainless exhausts

This specially manufactured dry exhaust section resulted from one of our designers flying to a new vessel in a Turkish yard, measuring the exhaust, and then flying home to complete the design on CAD.



HMI EXHAUST WATER SEPARATORS

HMI Mid-Gen Separator

This larger separator is designed for use where the generators cooling water flow rate exceeds 40 litres per minute, and the generator exhaust is up to 90mm (3.5") diameter. Individual applications must be checked for correct sizing. It may also be used with propulsion engines.



HMI Mid-Engine separator

The mid-engine separator is an easy solution for most engines with exhausts from 60mm (2.5") upwards. Units are produced in batches using the same proven technology as HMI silencers. The internal pipe work and body are both from Halyard's tough filament wound tube, and every unit is pressure tested. The unit comes with differing body sizes to match the varying exhaust inlets. Two outlets are provided on most units so that yachts can have an outlet for both angles of heel.

HMI Silencer:Separator

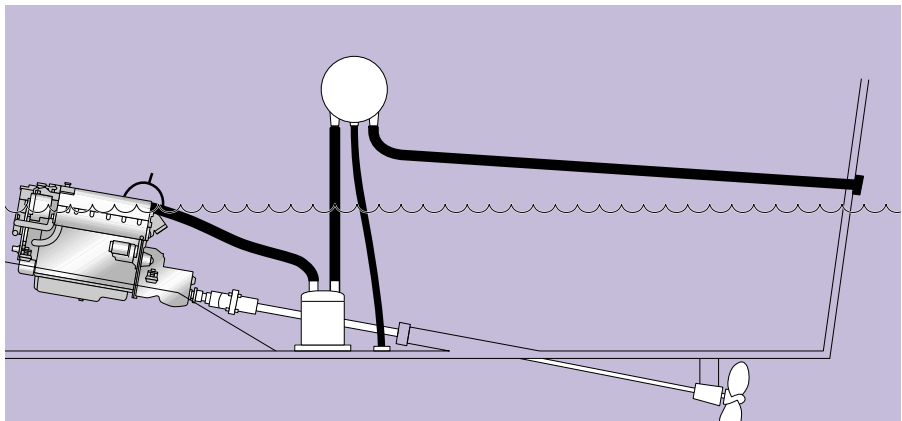
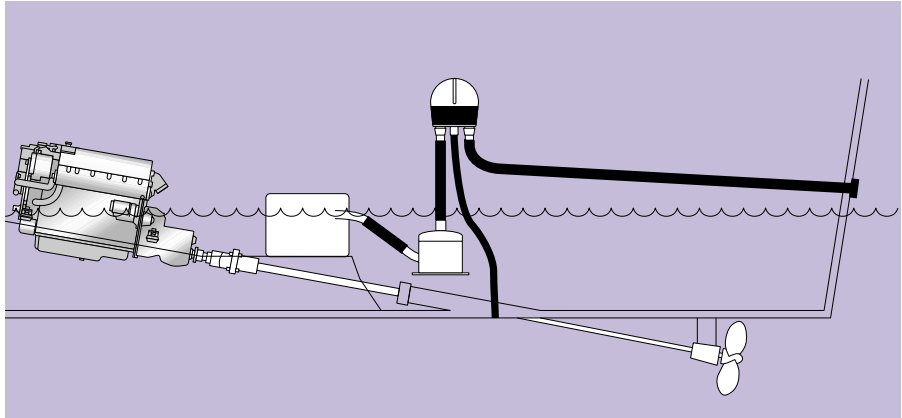
An example of a bespoke silencer: separator designed and built specifically for a Mediterranean super-yacht. This unit is part of a system which extracts all water from the exhaust, and allows the gas from a 200kVA generator to be piped up the main engine funnel. The fumes from the generator will then disperse silently, and well above the heads of those on deck below.



HMI EXHAUST WATER SEPARATORS

NOISE REDUCTIONS UP TO 90%

Halyard developed the concept of water separation and now designs and produces systems for engines ranging from small diesel generators through to mighty power providers on super-yachts and commercial craft. Fitting a water separator into the exhaust to replace the gooseneck removes water once it has done its cooling job, draining this quietly away below waterline. Back pressure is reduced dramatically. The separator removes the principal cause of back pressure and stops the splashing noise which accompanies every marine engine ticking over in a harbour – or on a generator splashing away in a quiet haven somewhere, to the fury of nearby boats.



HMI Production Separator.

In 1993 sales of small HMI separators reach a point where more economic production had to be found. The MS series of separators represented a huge investment in injection mould tooling, which reduced the unit price to very modest levels by using a special high temperature polypropylene. Today the MS series covers a huge range of exhaust diameters, for generators and propulsion engines with cooling water flow rates of up to 40 litres per minute. The MS unit will remove all but a tiny trickle of water.

The HMI Separator won the RYA British Nautical Award for Technical Innovation.



HMI EXHAUST TRANSOM FITTINGS

When the HMI exhaust Thru Hull fitting was designed, we set out to achieve a make a product which was infinitely stronger than the plastic and GRP units on the market – and tougher than most stainless units.

The HMI Thru-Hull uses 3mm thick 316 stainless to ensure that the risks of damage when manoeuvring a craft are reduced to the absolute minimum. All units are designed so that the flap, at rest, is shrouded by the stainless rim to prevent damage if the vessel nudges a harbour wall.

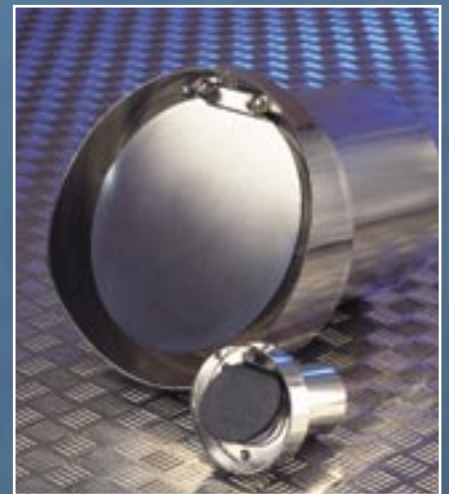


HMI Thru Hull Fittings – Neoprene Flap

Units to accept exhaust hose up to and including 100mm (4") hose have neoprene flaps. Each has a really generous tail allowing "T" bar exhaust hose clamps to be used to secure the hose. Smaller sizes have 3 countersunk fixing holes. The 90mm and 100mm (3.5" and 4") units have 4 bolt holes and a bolting flange which fits right around the unit inside the hull.

HMI Thru Hull Fittings – Stainless Flap.

Units from 125mm (5") upwards all have stainless flaps lined with neoprene. All have tails with plenty of space to use proper "T" bar clamps to secure the hose. Between 4 and 8 bolt holes are provided and all units have bolting flanges to fit around the unit inside the hull. Sizes to suit up to 300mm (12") hose are currently manufactured, and they are a normal stock item up to 254mm (10").



HMI EXHAUST ACCESSORIES



HMI Siphon Breakers

The siphon breaker plays a crucial role in a marine exhaust system, preventing the cooling water backing up into the engine when this is low in the hull. The HMI unit is cast from bronze, and incorporates a tapping point for some cooling water to be drawn off to feed the stern tube bearings. Size details are given in our price list.



HMI GRP Exhaust Tube

Halyard manufactures its own filament wound GRP tube for use in its silencers. Diameters from 50mm (2") upwards are made, ranging right through to a massive 600mm (24"). All tubes are made in 3m (10') lengths. High temperature resins are used allowing normal operating temperatures of up to 80C, and brief exposure to temperatures as high as 300C will not cause a problem.



Peel-ply

Customers fabricating their own structures from filament wound tube will welcome the peel-ply cloth applied to the outside of HMI GRP exhaust tube. This is peeled away immediately before use, minimising the need to grind the surface when laminating joints.



Fabricated sections

We fabricate tubular sections for exhaust and water on craft, and for many other applications both inside and outside the marine industry.

Exhaust Hose

Our exhaust hose is stocked in sizes from 40mm (1.5") right through to 300mm (12") and is generally Lloyds approved. Almost all our hose passes Lloyds stringent tests on temperature and on ozone deterioration, and will give many years service.

Our hose offers very tight corners, but the wall thickness remains heavy enough to give security. The specific bend radius available for each diameter, together with the sizes available and their weights, is shown in our price list. Only real T Bar exhaust clamps should be used when fitting this hose.



HMI EXHAUST ACCESSORIES

High Temperature Exhaust Hose

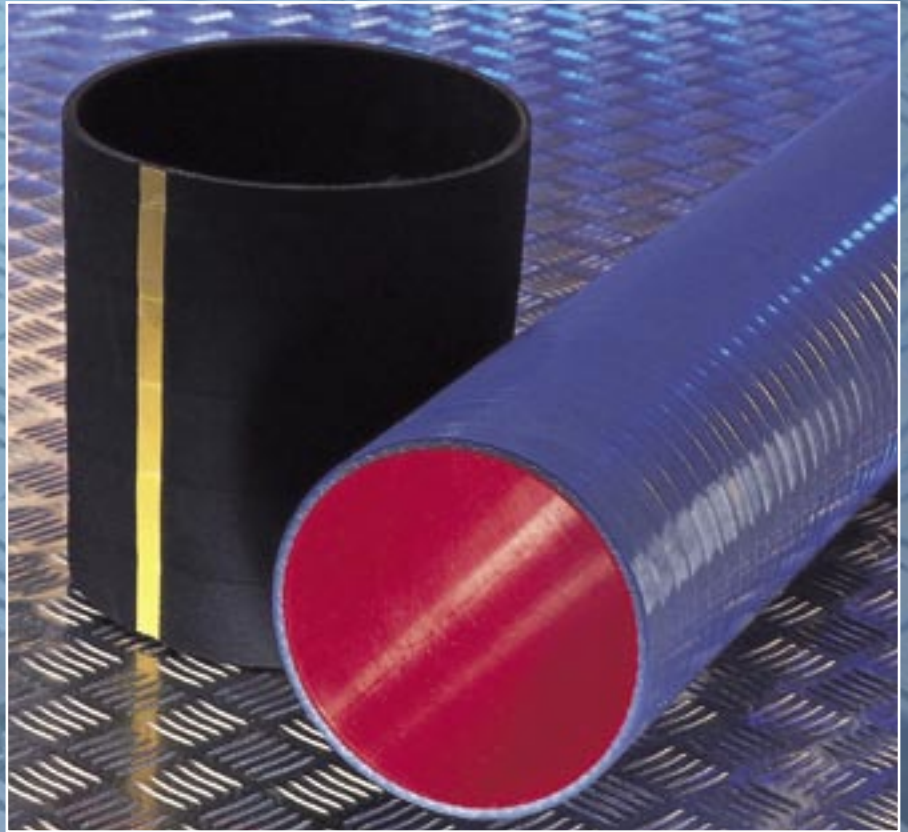
Our hose is also available with a high temperature liner, allowing the hose to handle temperatures reaching 160°C.

Silicon Exhaust Hose

For really high temperatures Halyard can provide silicon exhaust hose, in two grades, handling temperatures of 170°C and 270°C.

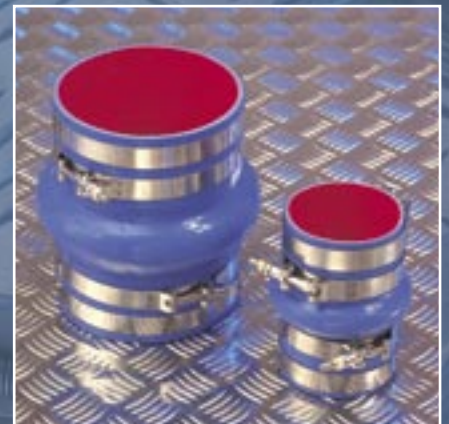
Exhaust hose clamps

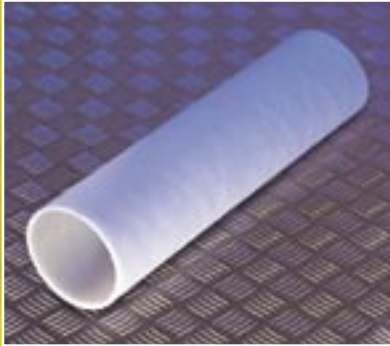
Exhaust hose should be fitted using tough "T" Bar clamps like these, doubled wherever possible. Halyard stocks clamps to suit hose up to 300mm (12"), both in stainless steel and in zinc passivated steel



Silicon Bellows

Flexible exhaust bellows are important to isolate engine vibration from the exhaust system, particularly where a silencer or rigid section is close to the engine. Our bellows cover a wide range of sizes up to 300mm (12") exhaust systems, and they will take temperatures up to 170C





HMI Jumpers

Wherever you connect a bellows, or a rubber elbow, back into an exhaust hose you need a short length of GRP Exhaust tube to couple them up. We make Jumpers up to 300mm (12") in diameter.



HMI GRP Bends and Adaptors

We make a full range of GRP bends and adaptors, all fabricated from our special high temperature GRP tube and designed to get you round 45, 90 and 180 degrees bends, or to couple hoses of differing diameters.

Flexible EPDM Rubber Elbows

Get you round tight corners in the exhaust system, with less back pressure than a GRP fabricated bend. The standard units take up to 120°C, and the blue units up to 160°C.

HMI Hotlag

HMI Hotlag is designed to wrap hot pipes with a thermal insulator which is asbestos free, with a range of special clamps to hold it firmly and permanently in place.



Literature Code HMI 84/01

SILENCING AND EXHAUST SYSTEMS

One of a series of brochures on products from Halyard

We must reserve the right to change specifications without prior notice. Halyard and Aquadrive are trade marks.

Phone and ask us if you'd like more help. We're happy to talk through the details of any installation.



Halyard holds ISO9001 Quality Assurance.



All products in this brochure meet the requirements of the Recreational Craft Directive at 1st January 2000.

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Every HMI product in this brochure is designed and manufactured in Britain