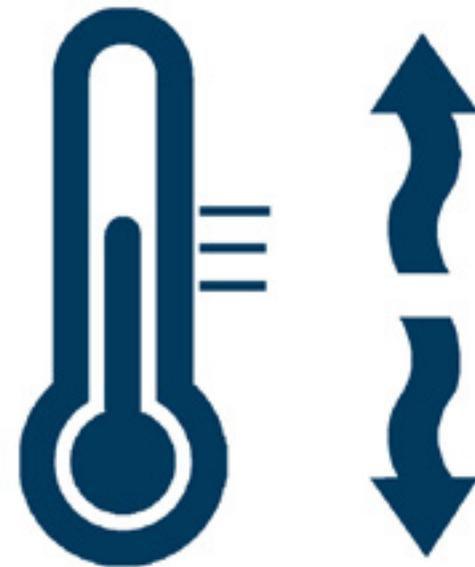




MarQuip B.V.
Nieuwland Parc 10n
2952 DA Alblasterdam
The Netherlands

Tel: +31 (0)78 681 09 75
Fax: +31 (0)78 681 09 76
info@marquip.nl
www.marquip.nl



Exhaust cooling control

The MarQuip logo is displayed in white on a dark blue background. It features the company name in a serif font, with three stylized, wavy lines above the 'Q' in 'Quip'.

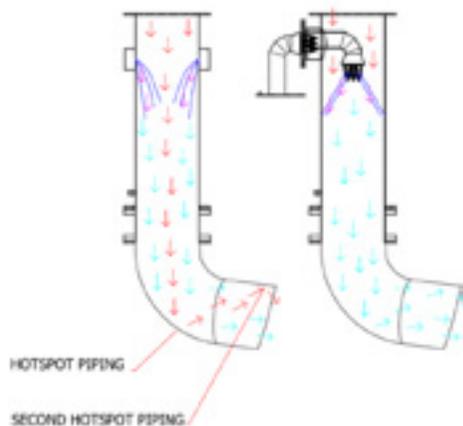
EXCLUSIVE EXHAUSTS, EXPERTLY ENGINEERED



EXHAUST GAS COOLING

In the water injection piece, the hot exhaust gases are cooled through the injection of sea-water: a spray nozzle is used to cool them down from the inside out. This gives us much more control over the size of water droplets, which makes the cooling of exhaust gas more effective by avoiding hot spots in the pipe.

This illustration shows a possible negative side effect of the water ring.



The diagram shows a system in which cooling water is unable to reach the centre of the piping, allowing hot gases to pass without cooling.

To the right we see the same injection pipe with an injection nozzle configuration. This clearly shows how hotspots are prevented by breaking up the exhaust gas stream and cooling from the inside out.

The nozzles used to have a relatively large free passage to prevent clogging. A dual cone spray pattern of small droplets ensure fast and efficient cooling and the best soot washing capacity.

All the nozzles are tested before they are installed inside an injection piece. The tests consist of a visual check of the spray pattern at different pressures to assure no back spray occurs. A nozzle which passes the test is provided with a certificate and stamped for traceability.

Here is an example illustration of a water injection piece and an injection rod which holds the nozzle.

Water injection piece for a main engine, including relatively large bypass pipe.

Typical injection rod with nozzle.



MATERIALS AND CORROSION RESISTANCE

The water injection piece is produced in stainless steel 304 (1.4301), 316 (1.4401 – 1.4436) and high grade stainless steel (HGSS). Due to commercial considerations, we never disclose the exact composition of our HGSS.

Stainless steel 316 is used for both welded flanges and certain piping parts which are not in contact with the injected sea water. Stainless steel 304 is only used in combination with HGSS stub ends, and never comes into contact with exhaust gas or injected water. All parts which might come into contact with seawater are made of HGSS.

HGSS is an austenitic stainless steel designed for maximum resistance to corrosion. As it contains high levels of chromium, molybdenum and nitrogen, HGSS is especially suitable for high-chloride environments such as brackish water and seawater.

The presence of a crevice on a stainless steel surface greatly reduces resistance to chlorides. It is difficult to avoid crevices in construction and operation, although good design and conscientious maintenance can help. As with pitting, high levels of chromium, molybdenum and nitrogen in HGSS retard crevice corrosion. The water injection pieces are welded in conformity with quality standard NEN 5817 Class B.