HALE HAMILTON

Excellence in Pressure & Flow Control

A CIRCOR International, Inc. Company

High Performance
Fluid Control Equipment

DEFENCE

www.halehamilton.com

Manufactured in the United Kingdom

THE COMPANY

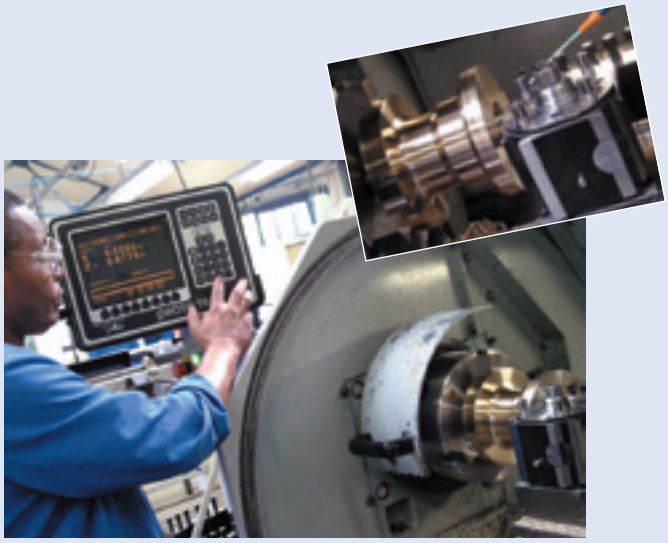
The Company, Strategy and Direction

Hale Hamilton is a leader in the design, manufacture, supply and support of high performance fluid control equipment, designed to perform under critical conditions of pressure and cleanliness, to satisfy demanding technical requirements worldwide.

1,200m² machine shop - 3-axis CNC lathe (foreground)

In support of our customers, as a design authority, our principal asset is the knowledge, experience and commitment of our people. Through this expertise we provide a comprehensive package of products and associated product support services, competitively priced, to the required quality, on time and with a full spares and service backup.

To meet the expectations of our customers and to ensure a satisfactory return for our shareholders, progress will be achieved through innovation in design and development. Growth in our chosen markets will be driven by the introduction of new fluid control products and the continuous improvement of existing products, employee core skills and manufacturing processes.



Semi-CNC lathe (inset machining submarine blow valve)

Facilities and Resources

SAP ERP System, supporting:

• Sales, Engineering, Production, Quality Assurance, Customer Service, Finance & Administration

SolidWorks® 3D Computer Aided Design (CAD) System, linked to:

•DBWorks® PDM (Product Data Management) System, supported with:
• Hewlett Packard ME10 2D CAD System
• Licom Alpha Computer Aided Manufacturing (CAM) System, allowing the transfer of design details to the CNC machines

Comprehensive manufacturing facility, including:

• 1,200m² machine shop, equipped with modern CNC, semi-CNC and manual machines

• Matsuura H405 horizontal machining centre
• 800m² Assembly and Testing facility, containing automated cleaning plant, hydrostatic pressure test rigs, dedicated pressure test rigs for hydraulic equipment and for air, oxygen and other gaseous fluid applications.
• Class 100 Clean Rooms incorporating Class 10 Assembly areas, with Mass Spectrometry (Edwards 5000) gas analysis facility

Manufacturing Cell, equipped with:

•Abrasive flow machining (AFM), Electro-polishing (EPOL), Electro-chemical de-burring, automated part marking, automated cleaning plant and co-ordinate measuring machine (CMM) inspection

Development Test Facilities, with:

• Functional gas testing to 600 barg (8,700psi), 110nm /min and a temperature range of -65ºC to +120ºC
• Hydraulic testing to 1,000 barg (14,500psi)

Matsuura H405 Machining Centre

Horizontal boring machine

CNC Machining of NiAlBr Manifold Block

DESIGN CAPABILITY / INNOVATION

Design Capability - A product to meet your exact requirements

A core competence of Hale Hamilton is the ability to develop products to meet the exact requirements of our customers. A proven track record in providing creative solutions has provided our customers with reliable, durable and cost effective fluid control equipment with cost of ownership minimised by design.

Applications Engineering

A team of fluid control design engineers work together with our sales resource, our customers world-wide and with our production management in the provision of engineering support services.

New Product Development

The Company's growth in its chosen markets has been and continues to be driven by the introduction of new fluid control products and systems. Significant resource is dedicated to this activity in the form of experienced design engineers, dedicated development workshops and the necessary project management expertise.

Innovation

Today Hale Hamilton's Defence market customers may benefit from the progress made in the design of innovative fluid control systems and system components for the Company's Industrial market customers. Applications in areas such as industrial gas filling, gas turbine control and sub-sea valve actuation are providing developments in defence applications featuring automated component control and PLC system control, such as Automated Cylinder Filling (ACF) Systems for charging ship's fire-fighting breathing air bottles.

Value Engineering

In recognising that our Defence customers' today place great emphasis on product and project costs, everyone at Hale Hamilton is focused on delivering equipment that meets our customers' Statement of Requirements (SOR) without undue cost, complication or delay.
Cost Of Ownership (COO) is a key design driver, with the consideration of a product's though-life cost often bearing greater significance than that of its initial purchase price.

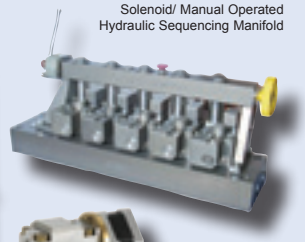
Critical Design Review (CDR) meeting

Prototype of new pressure regulator

3D CAD Work Station

Solenoid/ Manual Operated Hydraulic Sequencing Manifold

Automated Cylinder Filling (ACF)



Electric Motor Operated Hydraulic DCV

Solenoid Operated Hydraulic Directional Control Valve (DCV)

Hydraulic Test Rig to 1000 barg (14,500 psi)

Systems Engineering

Turnkey solutions to fluid control systems' requirements are an established capability and for defence customers this means we are able to offer a larger and more integrated scope of supply; on a warship we will provide the complete systems engineering and supply for the high pressure down to the low pressure systems. Some general examples are:

PLC Driven Air Distribution Panel

– designed to control the supply of air from two compressors on to a high pressure ring main. This system was designed, manufactured, installed and commissioned by Hale Hamilton personnel.

Ultra High Purity (UHP) Gas Control Cabinet

– designed for direct 'hook-up' to our customers semi-conductor fabrication tool.

MARKETS / TRACK RECORD

Sea

Hale Hamilton valves, reducing stations/ pressure reducing manifolds and control panels are to be found in extensive use by Navies worldwide.

Surface Ships

Typical applications include: main engine starting air, auxiliary engine starting air, diesel generator starting air, low pressure air supply from high pressure system, torpedo launching air, air reservoir charging, breathing air bottle charging and aviation services air supply equipment.

Submarines

Typical applications include: pneumatic and hydraulic valves used in weapons' handling, weapons' discharge and submerged signal ejection (SSE) systems, specialist hydraulic systems' valves, through-hull valves, ballast tank blow valves, emergency built-in breathing system (BIBS), submarine emergency escape (SEIE) system, Hood Inflation System (HIS) Pressure Controller and Stole Charging Valve (SCV).

Air Distribution Manifold – with Series 30 valve inserts

HMS Vanguard – photo courtesy of BAE SYSTEMS

Air

Hale Hamilton air, oxygen and nitrogen charging equipment is in use today with air forces, civilian operators and ground support units around the world.

Support Systems

The Company's Ground Support Equipment (GSE) includes single, twin and multi-cylinder charging trolleys/ trailers. Hale Hamilton is a preferred supplier of Portable GSE to the UK Royal Air Force (RAF) Air Support (AS) IPT, and offer a very compact, light-weight, robust portable charging unit for air, oxygen or nitrogen charging. (see picture opposite)

Pure Air Generation

Hale Hamilton is a supplier of dedicated design miniature solenoid and relief valves that are used in systems generating high pressure pure air. Reliability and durability are key operational requirements.

Thrust Vector Control

The Company is a supplier on to the Sea Wolf missile programme, with a dedicated design miniature solenoid valve used in the directional control of the weapon on launch. Here reliability is a critical operational requirement.

Harrier – photo courtesy of BAE SYSTEMS

MV124 Miniature Solenoid valve – pure air generation

Nitrogen PCU

MV116 Miniature Solenoid valve – Sea Wolf missile

MV160 Solenoid valve – variable ride height suspension

Land

The Company is an established supplier, with equipment in-service on the Challenger 2 main battle tank, for example.

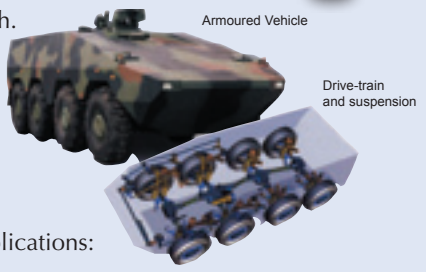
Military Vehicles

Hale Hamilton supplies both pneumatic and hydraulic equipment for the following applications:

- Variable height suspension systems – reference to air-transportability
- Adaptive damping systems – reference to human factors for personnel transport
- 'Locked' suspension systems – reference to stabilisation of engineer tanks.
- Over pressure systems – reference to NBC Collective Protection (Colpro).

Towed Field Artillery

Hale Hamilton is a supplier on the BAE SYSTEMS Ultra Light-weight Field Howitzer (UFH) gun. The specialist hydraulic valves are used to lower and raise the gun to and from its ground firing position to its towing position.



Armoured Vehicle

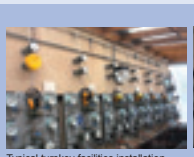
Drive-train and suspension

UFH Gun - photo courtesy of BAE SYSTEMS

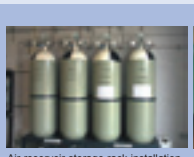
QA26 Quick Acting Hydraulic valve

Facilities

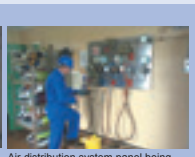
The Company undertakes turnkey design, supply and installation projects for defence contractors and naval dockyards world-wide.



Typical turnkey facilities installation project



Air reservoir storage rack installation



Air distribution system panel being installed

Infrastructure Projects

Typical infrastructure projects include the design, installation and support of: emergency breathing air systems for military installations, the installation of dock or shore-based gaseous valve & pipe-work systems, and the provision of the complete compressed air system, including breathing air compressors for navy diver training facilities such as that shown above:

PRODUCTS / APPLICATIONS

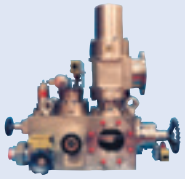
Reducing Stations / Manifolds / Panels

A Reducing Station (RDS) is a minor system of control valves, usually embodied in a single forged Nickel Aluminium Bronze (or Stainless Steel) block, that fulfils the function of the safe control and reduction of high pressure stored/ generated air down to a lower pressure to suit the specified application. The containment of the control valves within the forged block offers their protection from shock, vibration and mechanical damage, whilst providing a compact space envelope.

Type 45 Destroyer
photo courtesy of BAE SYSTEMS

Gas Turbine Start

This application requires a high flow rate of air at typically 30-40 barg with a limit on the maximum permissible outlet pressure, to avoid damaging the air starting unit.



RDS134 MILSPEC High Flow
Engine Start Manifold

Diesel Engine & Diesel Generator Start

NGRS 4000
Reducing Station

In the mid-1990's, the Company developed a range of 'New Generation Reducing Stations' (NGRS) – each reducing station feature's valve inserts from the Company's Series 30 cartridge valve range. The benefit from using valve inserts is that a faulty valve insert can be quickly replaced by a spare insert and the manifold can be re-pressurised with minimal system outage/ down-time.

High/Low Pressure Cross Connection

Anodised Aluminium
Alloy Manifold

Typically the lower pressure requirements on a ship are serviced by taking a reduced pressure air supply from the ship's high pressure local supply or ring-main.

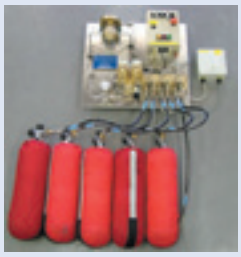
NGRS Pressure Controller
Insert – spares' item

Torpedo Charging / Weapon System Supply

This is a relatively low flow application, with a relatively high outlet pressure, which allows a spring-loaded controller to be used rather than a dome-loaded pressure controller, with a physically smaller reducing station as a direct result. The NGRS range offers a typically smaller space envelope and light weight, when compared to other such equipment for comparable applications.

Automated Cylinder Filling - ACF

The picture opposite shows a typical layout for an Automated Cylinder Filling (ACF) Panel, where the Company's vast experience in the design of Industrial Cylinder Filling Plant has been developed to provide military users with a product offering safe, rapid and consistent bottle charging. The hazards from over-pressurising and over-heating are removed.

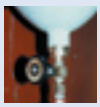


Automated Cylinder Filling (ACF)

Bottle Head Assemblies

The air from the main high pressure air reservoirs on a surface ship is typically distributed from the reservoir through a Hale Hamilton bottle head assembly, direct mounted or bulkhead mounted, such as shown below;

Multi-port bottle head
assembly c/w relief



Bottle drain assembly

DG Start Reducing
Station

SURFACE SHIPS

UK
Invincible Class CVS
Type 42 Destroyers
Type 45 Destroyers
Type 23 Frigates
Type 22 Frigates
Sandown Class SRMH
Hunt Class MH
LPD/ LPH/ AOR/ RFA

AUSTRALIA
Anzac Frigates
Huon Class MH

BRAZIL
Inhauma Class Frigates
Niterói Class Frigates

BRUNEI
Corvette

CANADA
Halifax Class Frigates

DENMARK
Nils Juel Class Corvettes

GERMANY
F124
Brandenburg Class (123) Frigates
Bremen Class (122) Frigates

GREECE
MEKO 200 Mk3 Class Frigates
Super Vita Class Attack Craft

INDIA
Delhi Class Destroyers
Godavari Class Frigates
Khurkri Class Corvettes

ITALY
Lupo Class Frigates
Meastrale Class Frigates
Minerva Class Corvettes

NORWAY
Oslo Class Frigates

NETHERLANDS
Air Defence & Command Frigates
Karel Doorman Class Frigates
Kortenaer Class Frigates
Alkmaar Class MH

OMAN
Vigilance Class Corvettes
Province Class Patrol Boats

PORTUGAL
MEKO 200 Class Frigates

QATAR
Vitar Class Patrol Boats

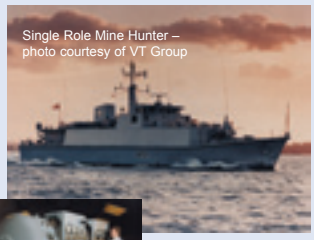
KSA
Al Jawf Class SRMH

SPAIN
Alvarode Bazan Class Frigates
Segura Class MH

USA
AOE(V) Class FCS Ship

Panels / Breathing Air Systems

Hale Hamilton has a long track record in the supply of panels used with weapon systems, for cooling & maintaining dry environs and for breathing air and diving air applications.


Single Role Mine Hunter – photo courtesy of VT Group

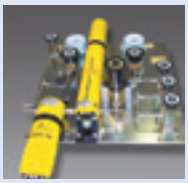
Breathing Air (BA) Cylinder Charging

A typical application on a naval vessel is the provision of a controlled supply of breathing quality air required to charge portable breathing air cylinders used in emergency situations, such as fire fighting or damage control. Automated Cylinder Filling systems are now available for both BA and DA charging.


Twin Man Compression Chamber (TMCC) – photo courtesy of MSI Defence Systems

Diving Air (DA) Cylinder Charging

Diver's bottles may be charged on board ship from a dedicated Hale Hamilton Charging Panel, often supplied complete with two stage filtration. See panel opposite:


Breathing Air/ Diving Air Filtration & Supply Panel

Aviation Services

Hale Hamilton supplies the standard NATO Air Panel, deployed on naval vessels world-wide, and used for charging fixed wing & rotary aircraft air systems. Panels controlling the Supply of Oxygen and Nitrogen are also supplied, which can be trolley mounted. Portable Charging Units (PCU) are also available:


Boosted Charging Trolley


Oxygen PCU


Nitrogen PCU

Breathing Air Systems

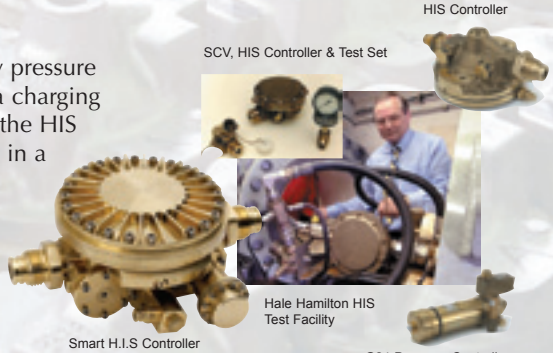
Hale Hamilton is considered a Design Authority by many of its customers. A number of our design and development personnel have specific expertise in our customer's systems, such as submarine escape and the supply of emergency breathing air:

Built-in Breathing System

The BIBS system (panel or manifold) comprises all the valves necessary to control the dedicated clean air supply used during a planned escape from a submarine. The complete system senses the escape compartment pressure, maintaining a constant positive supply of breathing air to the submariners preparing to escape.

Hood Inflation System (H.I.S)

The HIS system valves comprise a primary pressure regulator, a main pressure controller and a charging connection. At the 'heart' of the system is the HIS Pressure Controller. This valve is mounted in a submarine's escape tower and tracks the rising pressure as flooding takes place. It must respond to the changing tower pressure, meeting the demand of the submarine escape immersion suit and maintaining a positive air supply to the escaping submariner.


HIS Controller

SCV, HIS Controller & Test Set

Hale Hamilton HIS Test Facility

Smart H.I.S Controller

G24 Pressure Controller – primary regulator

SUBMARINES

UK
Astute Class
Vanguard Class
Trafalgar Class
Swiftsure Class

AUSTRALIA
Collins Class

BRAZIL
Type 209/ 1400

CANADA
Victoria Class (T2400)

FRANCE
Triomphant Class
Daphné Class

GERMANY
U212 Class

GREECE
Type 209/ 1200
Type 209/ 1100

INDIA
Type 209/ 1500

ITALY
Sauro Class

NETHERLANDS
Walrus Class
Zwaardvis Class

NORWAY
Type 207/ Type 210

SPAIN
Scorpene (S90) program

SWEDEN
Gotland Class
Västergötland Class
Näcken Class

TAIWAN
Zwaardvis Class

TURKEY
Type 209/ 1400
Type 209/ 1200

USA
Ohio Class
Seawolf Class
Los Angeles Class


Sauro Class – photo courtesy of Italian Navy

Standard Product Range / In-Line Valves

Hale Hamilton offer a very large number of different fluid control products and a sample of the standard range is shown below; a more comprehensive product overview may be found from our website or by requesting a copy of our Product Catalogue.

Regulators / Controllers

Two basic types of Pressure Controller are offered; dome loaded controllers and spring loaded regulators. Both types are used to reduce pressure.


RH2RS HP Dome Controller


RL3 LP Dome Controller


Series 28/15 Manual Regulator


Series 28/20 Manual Regulator


Series 28/35 Type Regulator

Manual Stop Valves

A wide variety of stop valves, suitable for working pressures from zero up to 414 bag (6,000psi) are available. Most Hale Hamilton stop valves are fully pressure balanced and thus require a very small operating torque, even at the highest pressures. Many valves in the range are suitable for both pneumatic and hydraulic applications.
These valves are approved by the UK Ministry of Defence.


SV47 balanced stop valve


N6 balanced stop valve


N8 balanced stop valve


WSV3 Series 30 stop valve

Solenoid Valves

Hale Hamilton design & manufacture specialist solenoid valves for defence applications. The range includes 2-Way and 3-Way direct, pilot operated and pilot operated balanced solenoid valves. Where products have been offered with BASEEFA approval, today ATEX approval can now be offered if required.


MV17 3-Way direct operated solenoid valve


MV122 3-Way direct operated solenoid valve


MV160 type solenoid valve

Relief Valves

Pressures from as low as 0.03 barg (0.45psi) up to pressures in excess of 550 barg (8,000psi) are accommodated by our range of relief valves, available in a choice of different materials to suit the operating medium.


RS11 differential relief valve


RVA10 type HP relief valve


RVA14 type relief valve

Non-Return Valves

Our standard NRS range of in-line non-return valves feature a mitre seat with 'o'-ring insert to ensure a leak-tight shut-off with an efficient flow path. The valves are but lightly spring loaded to enable positive operation at any angle of installation.


NRS1 in-line non-return valve


NRS2 in-line non-return valve


NRS4 in-line non-return valve


WNRV type Series 30 non-return valve

Back Pressure Maintaining Valves

A choice of valves with either a spring loaded diaphragm or a spring loaded piston are available, providing accurate control of back-pressure in a gas of hydraulic system.

Filters

Hale Hamilton offer in-line filters of the sintered bronze type or of stainless steel wire wound on a brass former. Pressures up to 414 barg (6,000psi) may be accommodated.


F105 filter (wire wound type)

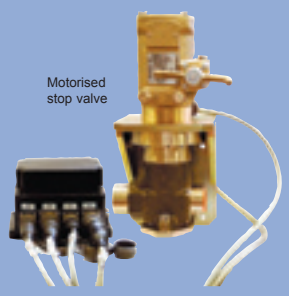
Pipe Couplings and Adapters

To facilitate the installation of our valves, a large range of high integrity couplings and adapters is available in a choice of materials to suit the fluid medium and pipe-work. Pipe couplings and adapters from other approved OEMS's may also be specified.


Non-magnetic bulkhead coupling assembly

Actuated / Motorised Stop Valves


Actuated control valve



The Company manufacture a range of gas actuated stop valves, where a pilot pressure of air or nitrogen is used to open or close the valve. Electric and Hydraulic actuators are also available. The motorised stop valve (above) is specified on the UK RN's Type 45 destroyer.

SUPPORT SERVICES

Services

•Engineering •Technical Support •Testing
•Development • Prototyping •HAZOP
•FMECA •Test Specifications •Cycle Testing
•Operating Manuals •Service Instructions
•Value Engineering •Interface Drawings
•Project Management •Design Services
•Specifications •System Integration
•Field Services •Shock & Vibration Testing
•General Arrangement Drawings •Warranty
•Environmental Stress Screening •NDT

Repairs

The service, repair and refurbishment of valves is a key activity for Hale Hamilton. It is economical to repair most Hale Hamilton equipment, either at the factory or on-site. Valves are returned to the customer complete with a new certificate of conformity.

Product Support

Hale Hamilton product support personnel are available for installation, commissioning, trials, test, maintenance, repair or re-certification. Our personnel are also available to work together with our customer's engineers, where capacity or capability is required.

Integrated Logistics Support(ILS)

Data gathered from existing product in-service, failure rate analysis and RM&T data, all contributes at the design phase to an assessment of an equipment's supportability and total cost of ownership. The principle and application of whole life costing is applied by design.

Reliability, Availability, Maintainability & Testability (RAM&T)

RMA&T requirements, RGT and RCM are first considered at the design stage, together with other issues, such as Human Factors (MMI), risk management and safety case.

Product support team on the road

Part marking on Assembly

Assembly of submarine ballast tank blow valves

Repair valves on Assembly

Refurbishment of a dome controller

Pressure testing a reducing station

Spares

Hale Hamilton support defence customers world-wide with the supply of individual component parts, part kits, valve sub-assemblies, valve inserts, fasteners and rubber items. Complete valve assemblies can be supplied as system spares.

Kitting an order for Assembly

NGRS Controller insert spare

Contractor Logistics Support(CLS)

In specific customer contracts, we are able to offer an appropriate level of logistic support, such as Scheduled Maintenance activities, Vendor Managed Inventory (VMI), all the elements of Through Life Support (TLS), specific product/ system Configuration Management, Documentation Management and Risk Assessment for example.

Training

Courses tailored to meet the needs of our customers are run throughout the year.

QUALITY ASSURANCE / APPROVALS

IS09001:2000

Hale Hamilton are accredited by LRQA to ISO9001: 2000 (August 2003).

ATEX/ PED/ TPED

Other statutory and regulatory requirements met by Hale Hamilton include the ATEX Directive (94/9/EC), European Pressure Equipment Directive (PED) and Transportable Pressure Equipment Directive (TPED).

Fully Traceability

All products and systems will be supplied complete with a QA Certificate of Conformity.
Where a customer requires equipment to be fully traceable, in terms of raw material supply, process records and assembly and test data, this service is available.

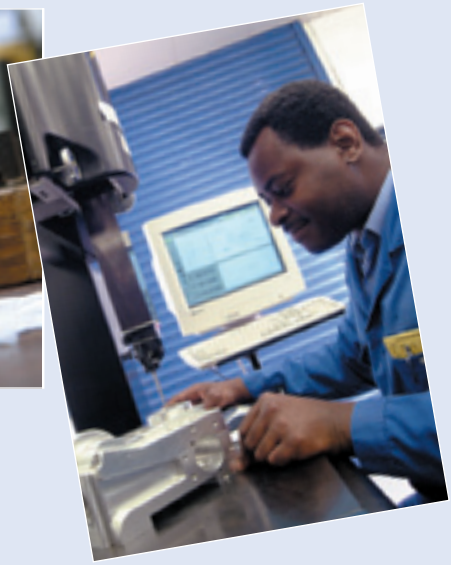
ISO9001:2000 QA Accreditation Certificate

Classification Society Approval

The Company regularly undertake project work under the auspices of Lloyds Register of Shipping (LR), Germanisher Lloyd (GL), DNV and other such regulatory bodies.

Raw material store

Vibro-etching of Part Number/ Batch Number



CMM – Coordinate Measuring Machine

Quality Plans

A project specific Quality Plan is available to support individual customer requirements.

Customer Approvals

Approval and inspection by our customers' quality assurance representatives is standard. The Company is an Approved Supplier to the UK MOD, US DOD, Naval Dockyards and Defence Ministries worldwide, and to BAE SYSTEMS, Rolls Royce, Weir Strachan & Henshaw and many other global Defence Contractors.

Customer Service

Our aim is to provide our customers with the most consistent and reliable products and service, designed and manufactured to meet their requirements and delivered on time.
Our quality control system has been developed to meet this aim first time, every time. We are committed to achieving these product and service standards, and to achieving total customer satisfaction.

HALE HAMILTON

Excellence in Pressure & Flow Control

A CIRCOR International, Inc. Company

DEFENCE

www.halehamilton.com

HEAD OFFICE

Hale Hamilton Limited
Cowley Road
Uxbridge
Middlesex
UB8 2AF
England
T +44 (0) 1895 457551/ 542/ 566
F +44 (0) 1895 457951/ 942/ 958
E defsales@halehamilton.com
www.halehamilton.com/defence

GROUP COMPANIES

CAMBRIDGE FLUID SYSTEMS

Cambridge Fluid Systems Limited
12 Trafalgar Way
Bar Hill
Cambridge
CB3 8SQ
England
T +44 (0) 1954 782631
F +44 (0) 1954 782164
E uhp@cam.cambridge-fluid.com
www.cambridge-fluid.com

ASIA

Hale Hamilton Asia Ltd
CFS Technology Pte Ltd
608-B, Geylang Road
Singapore 389547
T +65 749 4728
F +65 747 5728
E cfstech@singnet.com.sg
www.cfstechnology.com.sg

Other Literature available from Hale Hamilton

Industrial Products
May 2007

REPRESENTATIVES

AUSTRALIA

HI FRASER PTY LIMITED
incorporating Philcor
27A Stockdale Road
O'Connor WA 6163
Australia
T + 61 2 9970 7322
F + 61 2 9913 7207
E jeff@hifraser.com
www.hifraser.com

HI FRASER PTY LIMITED
6/5 Vuko Place
PO Box 885
Mona Vale
NSW 1660
Australia
T +61 2 9970 7322
F +61 2 9913 7207

BELGIUM

TRANSMARK N.V
Boomgaarddreef 9
B-2900 Schoten
Antwerp
Belgium
T +32 3 633 01 01
F +32 3 633 06 56
www.transmark-group.com

BRAZIL

BG GROUP & ASSOCIATES
Rua Coronel Joao Brandao, 31
Sao Francisco - Niteroi - Rj
24365-060
Brazil
T + 55 21 2714 4457
F + 55 21 2722 7966
E bguard@terra.com.br

CANADA

MOBILE VALVE,
A SOURCE ATLANTIC COMPANY
P.O Box 90
140-142 Hwy #1
MT.Uniacke, N.S. B0N 1Z0
Canada
T +1 902 886 0719
F +1 902 866 1091
E doucette.chris@sourceatlantic.ca
www.mobilevalve.com

GERMANY

Hale Hamilton (Valves) Limited
Konrad Adenauer Strasse 10
D-35305 Grunberg/ Hessen
Germany
T +49 6401 228477
F +49 6401 228478
E tschnick@halehamilton.com

Also represented in:

Denmark
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Japan
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Malaysia
Avanzamento Engineering Sdn Bhd

New Zealand
Delta Controls

Taiwan
Golden Orient Limited

INDIA

ARCUM ENGINEERING (P) LIMITED
Premlata # 602
39, Shakespeare Sarani
Calcutta - 700 017
India
T +91 33 2283 4382/83/84
F +91 33 2283 4385/86
E calcutta@arcumonline.com
www.arcumonline.com

ARCUM ENGINEERING (P) LIMITED
Udyog Bhavan
Unit - 76, Sonawala Road
Goregaon - E
Mumbai – 400 063
India
T +91 22 2686 4427/28
F +91 22 2686 4229
E mumbai@arcumonline.com
www.arcumonline.com

ITALY

TEKNOMEC SRL
35 Via Terenzio
00193 Roma
ITALY
T +39 06 6889991
F +39 06 8899923
abuccianti@rig.it

SWEDEN

GAVECO AB
Box 2103
SE-135 02 Tyreso
Sweden
T +46 8 742 00 00
F +46 8 798 88 81
E info@gaveco.se
www.gaveco.se

TURKEY

DORMAK Import-Export,
Representation & Consulting
Trade Ltd Co.
Kiz Kulesi Sokak
No: 10 G.O.P. 06700
Ankara
Turkey
T +90 312 446 95 80
F +90 312 446 95 51
E info@dormak.com.tr
www.dormak.com.tr

U.S.A

NUNAMANN & ASSOCIATES, INC
73 Phillips Road
Branchville
NJ 07826
USA
T +1 973 948 3711
F +1 973 948 3069
E bob-n@nunamann.com
www.nunamann.com

AERO INTERNATIONAL, INC
22977 Eagleswood Court
Suite 150, Sterling
VA 20166 - 9549
USA
T +1 571 203 8360
F +1 571 203 8361
E bill.hack@aerointl.com
www.aerointl.com