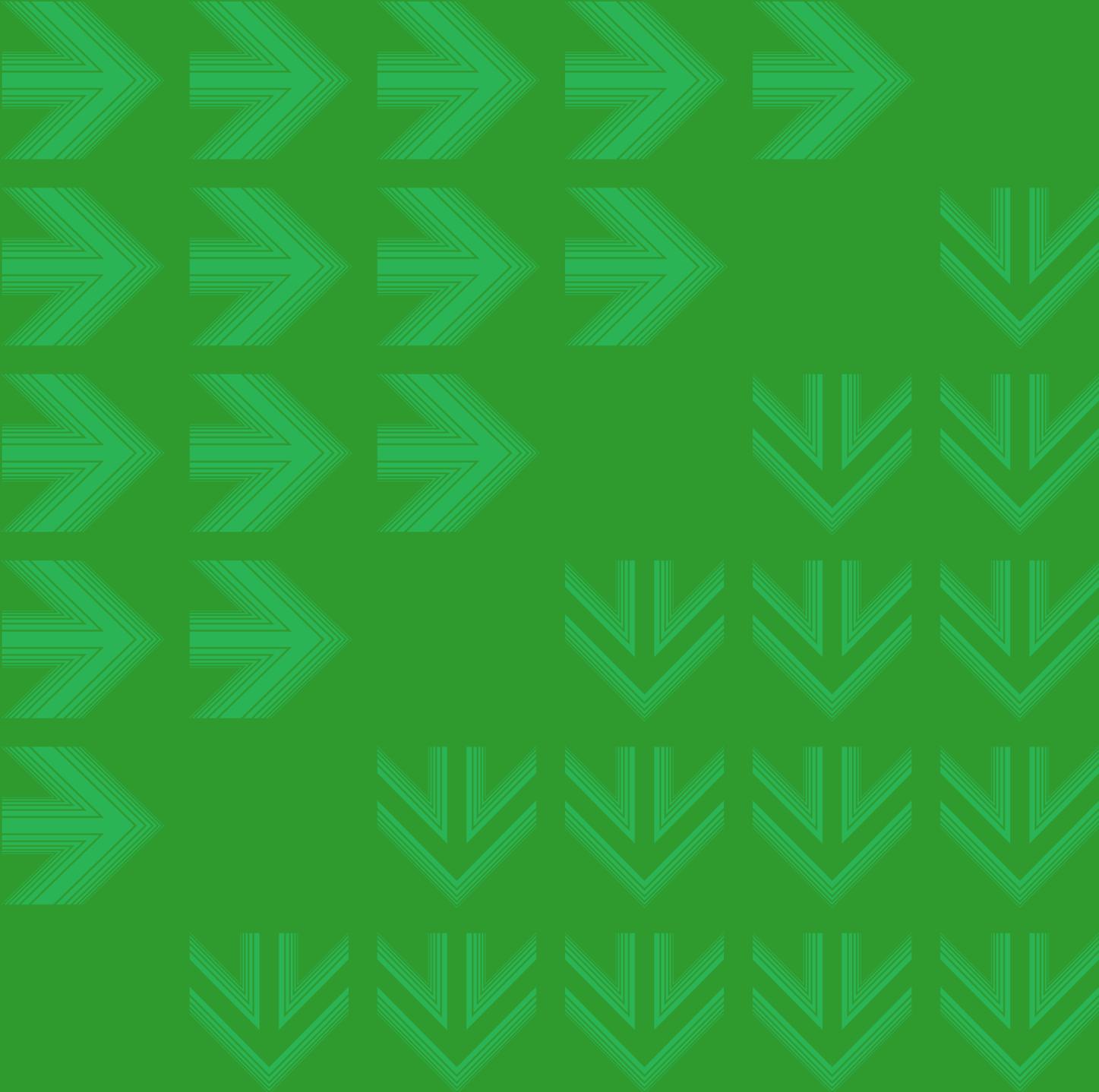


choke valves



Mokveld choke valves, a concept that works

Chokes are critical for the safe and economic production of the world's oil and gas reserves. In the past simple needle-and-seat chokes were adequate as pressure cuts were low and the applications of adjustable chokes were less demanding.

Also, in that era, adjustable chokes employing the rotating disc principle provided satisfactory performance.

A number of factors have changed the demands on chokes.

Operating pressures have increased. Safety and reliability are becoming increasingly important. And finally, the economics of the equipment, seen over the life of the field, are vital for the profitable development of the field. Mokveld manufactures chokes that meet the demands of today.

The new challenge was met by Mokveld with a proven expertise in control valves. Mokveld pioneered in the use of cages in production chokes. A cage-type choke has a multiple-orifice cylinder – the cage – and a piston which is connected to the stem. The movement of the piston modulates the area of the fluid passage. As a result of the impingement effect generated in the cage-type design, the erosive action of the fluid is fully under control. Also, noise is reduced to safe levels.

When the pressure cuts in chokes are high, only a cage-type choke can dissipate the energy without erosion. This greatly enhances the reliability and the safety of the choke. The Mokveld choke concept provides safe, rugged, and low maintenance equipment for the most demanding designer and user.

Many oil and gas companies rely on Mokveld chokes for the safe and profitable production of their oil and gas reserves. Mokveld chokes are used by all the major oil and gas companies world-wide.

gas re-injection choke in the Middle East



gas production choke used for 'zero flow' concept in the North Sea



the choke valve that offers more

reliability through controlled erosion

Mokveld chokes are equipped with a cage provided with holes uniformly distributed over the full circumference. This design ensures that the fluid is symmetrically distributed. The multitude of flow jets are diametrically opposed. Consequently, the energy is dissipated in the center of the valve. This is in the fluid itself and not near the surface of any choke component. Also, preferential flow – the major cause of hazardous body erosion – is fully avoided.

low noise through low pressure recovery

The pressure recovery factor of Mokveld chokes is low as a result of the cage concept. This causes noise levels in gas applications to be low. Additionally, in oil production applications flashing and flowing velocities in the downstream piping are reduced.

complete piston guidance

The piston is guided over the complete length of the stroke. All sealing areas and guiding surfaces are away from the throttling area. To provide the ultimate degree of erosion resistance, cages must be made of hard materials. Such materials demand that the cage is firmly secured in the valve body. In the Mokveld design the cage is held in position at both ends: the seat and the piston guide. Consequently, the most resistant materials can be used for the cage without the risk of fracturing the cage due to vibration.

pressure balancing

The downstream pressure which acts on the piston surface is also applied to the top of the piston. This results in low operating torques. Therefore, manually operated chokes do not require intermediate gear boxes which improves the control sensitivity. For automatic operation, the required actuators are small and light.

high rangeability

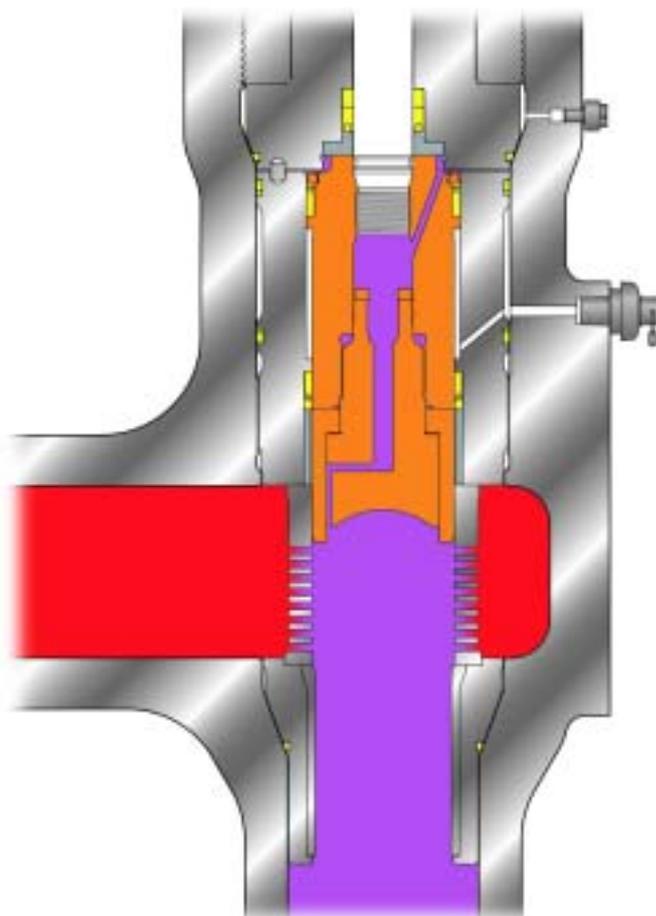
Another benefit of the cage concept is its very high rangeability. Well start-up can be performed at low flow rates. Also, a wide range of well conditions can be controlled without the need to exchange the choke trim in future years.

safety and weight reduction through a one piece body

The bodies of Mokveld chokes are made of one piece castings or forgings. This eliminates the potential leakage path of split-body designs, and saves weight and space.

complete range of sizes and ratings

Mokveld chokes are available in nominal body sizes from 1 inch thru 8 inch with pressure ratings of ANSI 900 thru ANSI 2,500 and API 3,000 thru API 10,000. Inlet and outlet connections, by means of flanges, clamp connectors or butt weld ends can be supplied in all possible options for choke sizes up to and including 16 inch in the ANSI ratings and 16^{3/4} inch in the API ratings.



design details

Various design details of the Mokveld choke are unique and make it the most reliable choke available in the industry.

The throttling zone in the choke is contained by the cage (1), the sliding piston (2) and the seat (3). The seat is extended into the outlet section of the choke for erosion protection of the valve body. The cage and the seat are retained by the piston guide (4). The piston guide is threaded into the valve body and pre-loads the cage and the seat.

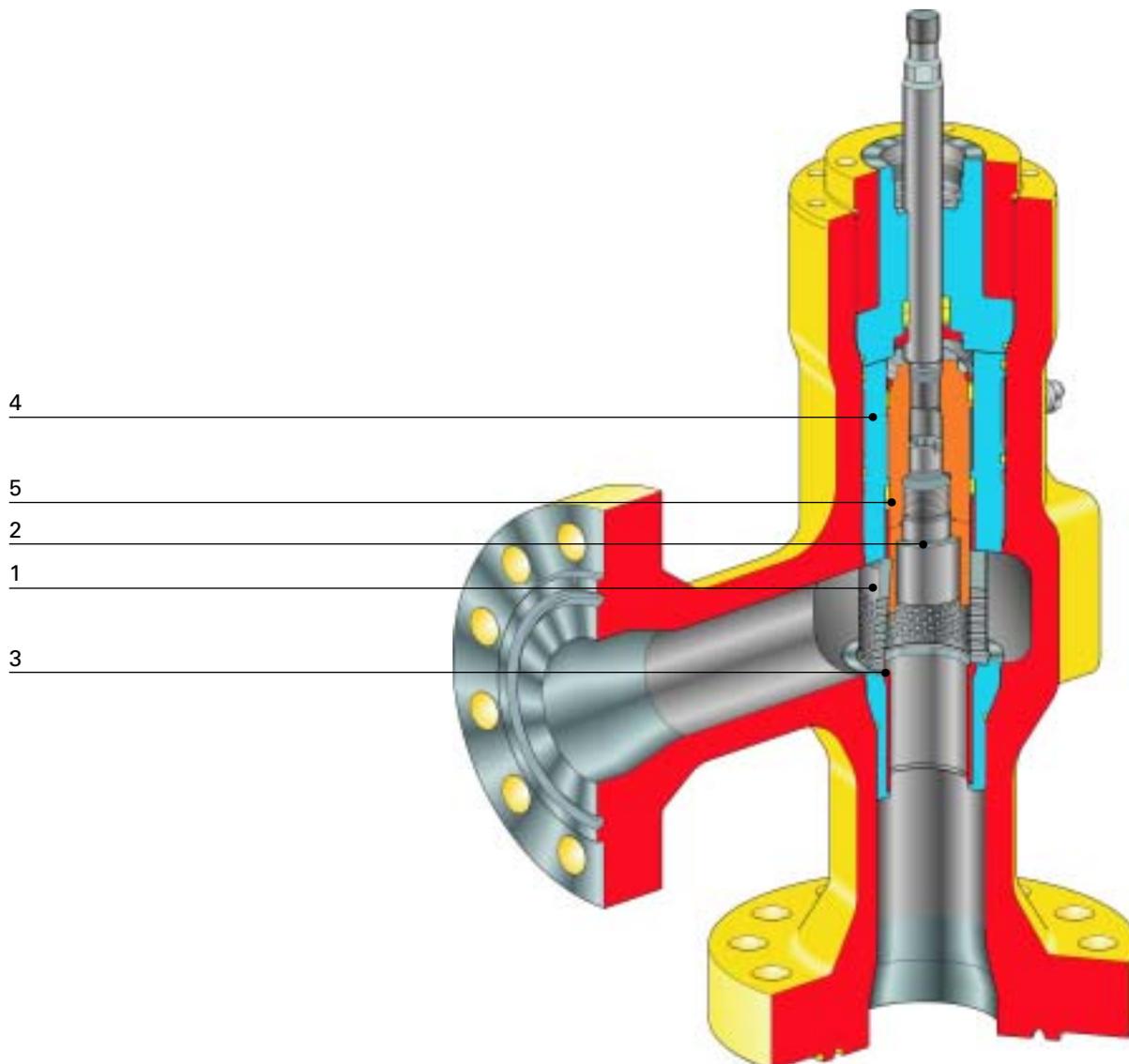
The cage is supported and clamped at both ends: top and bottom. This is critical to prevent damage to the cage from fluid forces induced by vibration.

The pre-loading of the cage and the seat makes it possible to use primary metal-to-metal seals between the cage, the seat and the body, whereas o-rings are only used for secondary back-up.

The piston seal (5) is located outside the throttling zone to eliminate the possibility of seal wear caused by abrasive erosion. The surface of the piston, over which the piston seal runs, is kept outside the cage at all choke positions. Consequently, wear to piston surface will not result in a failure of the piston seal.

Both the piston and seat surface are designed to provide a tight shut-off. Even after lifting of the piston from the seat, the minimum clearance between cage and piston limits the flow until the piston reaches the first cage holes, thereby eliminating the possibility of sealing face washout.

Mokveld chokes are pressure balanced. The piston area is balanced by bringing the downstream pressure to the top side of the piston. In high pressure applications, even the stem area is pressure balanced. This is accomplished by compensating the effect of the stem area in the guide and the piston.



trim styles and applications

Mokveld type

applications and key characteristics

CHV-P-RCX

Heavy duty adjustable choke for high pressure cuts and severe erosion production applications. Multiple orifice type, with the cage guided at the top and bottom.

average Cv

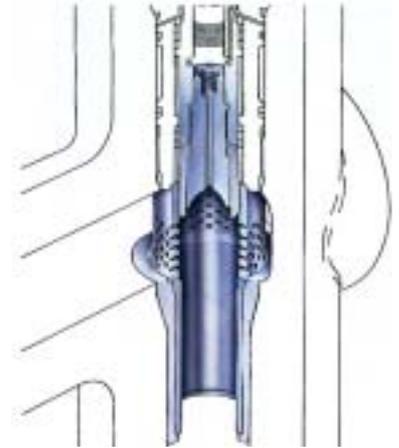
tungsten carbide trim only

low pressure recovery

very high erosion resistance

high noise abatement

high cavitation index



CHV-PM-RCX

General purpose adjustable choke for production and injection applications. Multiple orifice type, with the cage guided at the top and bottom.

high Cv

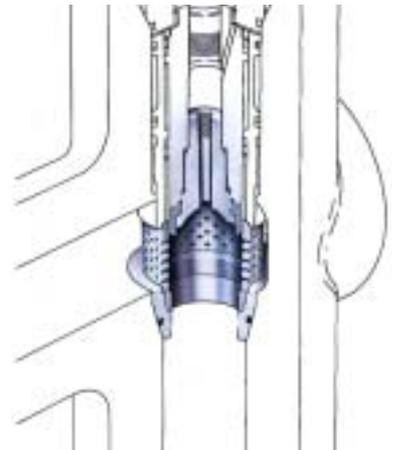
various options of trim materials

low pressure recovery

high erosion resistance

high noise abatement

high cavitation index



CHV-PM-RVX

High capacity adjustable choke for light duty production and injection applications. Multiport type with the cage guided at the top and bottom.

very high Cv

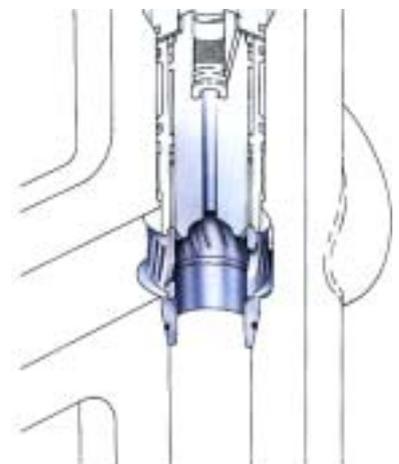
limited options of trim materials

average pressure recovery

average erosion resistance

average noise abatement

average cavitation index



Mokveld type

applications and key characteristics

CHV-PM-RMAX

Adjustable choke for water injection applications with cavitation potential. Multistage type, with the cage guided at the top and bottom.

low Cv

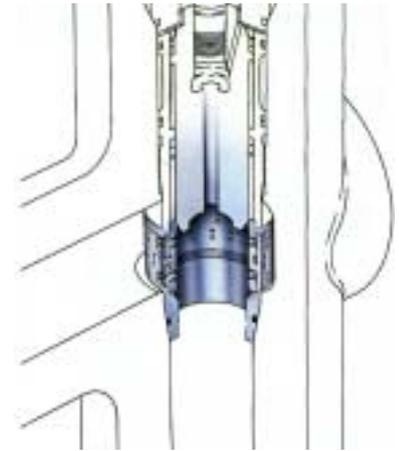
limited options of trim materials

very low pressure recovery

average erosion resistance

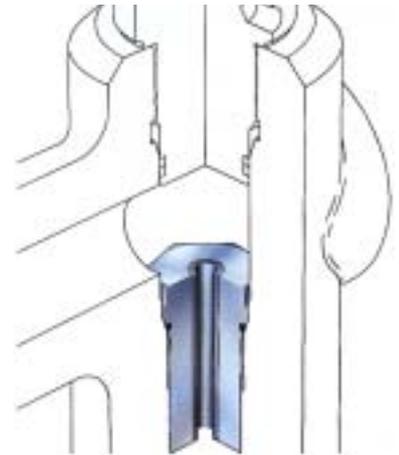
very high noise abatement

very high cavitation index



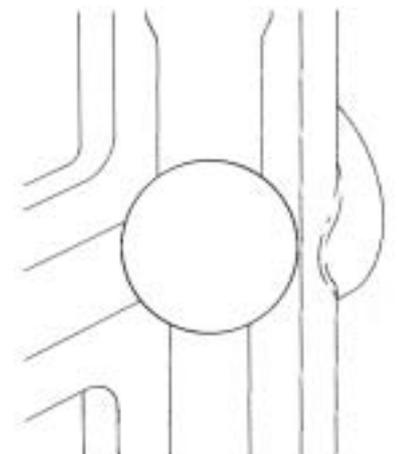
CHV-PC

Fixed position choke for general purpose.



CHV-P-???

The custom-made choke to meet your special needs.



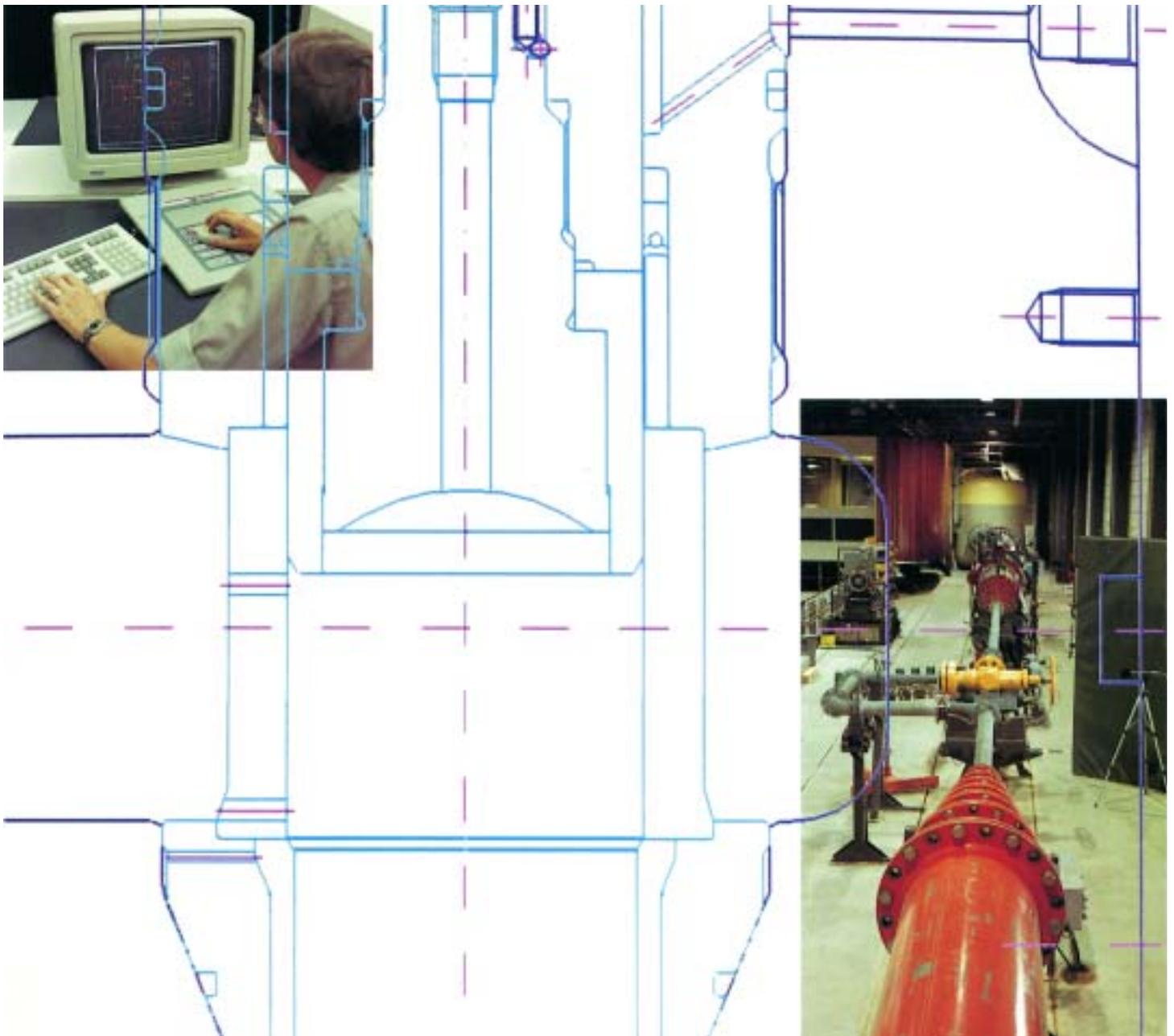
sizing and custom design

Chokes are often the most critical component for the safe and economic operation of a well. The correct sizing and selection of the choke is therefore of great importance. Over the years Mokveld has developed the expertise for the optimum selection of choke sizes and trims. This expertise will result in unsurpassed MTBF and safety records. Users find that the inspection frequency required for Mokveld chokes is considerable lower than required for conventional chokes.

Depending on the well characteristics and the depletion curves, tailor-made trim packages may be selected. Often, trim change outages in future years can be avoided when this option is used.

In the continuing effort of Mokveld to serve the industry with safer and more economical products, an ongoing research and development program is in place. The program includes laboratory activities as well as extensive field research.

Comprehensive guides for sizing and noise prediction are provided in the Mokveld catalogue. Clients may take advantage of company's computerized valve sizing programme that conform to ISA standards.



a variety of options

materials

Mokveld has wide experience in the development of choke material selections for fluids like raw gas, oil, produced water, seawater and multiphase fluids. The parameters included in the selection process are fluid composition, potential abrasive erosion, flow velocity, operating and design temperatures and pressures.

Commonly used choke body materials are:

- carbon steel
- alloy steel
- austenitic stainless steel
- carbon and low-alloy steel for low temperature service
- duplex alloys
- 13% chromium steel
- Incoloy 825
- SMO 254

temperature ranges

Mokveld chokes can be supplied to operate within a temperature range of -50°C to $+205^{\circ}\text{C}$ (-58°F to $+400^{\circ}\text{F}$).

actuators and control systems

Mokveld chokes can be equipped with the following types of actuators:

- pneumatic linear
- hydraulic linear
- electric
- electro-hydraulic
- pneumatic stepping
- hydraulic stepping
- handwheel
- handwheel with calibrated fixed positions

Control systems are available to suit all requirements, including fail safe action, positioning, power packs etc.



gas production choke on the North Sea



multiphase oil production chokes offshore Norway

quality control and quality assurance

It is Mokveld's policy that all valves are manufactured within strict quality standards. All valves are subjected to body and seat tests prior to shipment.

Mokveld Quality Assurance department takes full responsibility to ensure that all applicable customer contractual requirements are fulfilled. For this purpose, the Mokveld Quality Assurance Manual outlines all relevant procedures to ensure that a high quality level is achieved. The procedures include all steps of the sales, engineering, procurement and manufacturing process. A copy of the Quality Assurance Manual is available upon request.

Mokveld quality systems are in full compliance with ISO 9001 and API Q1 and have been audited and approved by all major oil and gas companies, engineering contractors and inspection authorities.

Mokveld chokes are designed and manufactured with the most up-to-date tools and systems. The design work is done on CAD systems and manufacturing takes place on advanced CNC machine tools.

Inventory control, order processing and QA/QC are computerized to provide fast and reliable customer service. The same systems are used for after sales service and spare parts control. So, the users of Mokveld chokes will receive a level of service that every oil and gas operating company needs.

Mokveld manufactures and tests its products in accordance with standards and codes issued by ASME, API, ANSI, BS, CSA, DIN, MSS, NACE, NS, TRB 801; no45, TRbF, TRGL and more.

Mokveld chokes are available in PSL 1 to 4 as defined in the specification API 6A.

In-house valve test facilities are available for hydrostatic and nitrogen body tests, hydrostatic and pneumatic seat tests and procedures meet the requirements outlined in industry like ASME B 16.34, API 6D, API 6A, and other specifications.

Non-destructive testing is performed by certified ASNT-TC-1A level II inspectors. Where applicable, weld procedures are developed, qualified and executed in accordance with ASME Code Section IX.



high pressure test rig

other Mokveld products

Mokveld Valves is manufacturer of:

control valves
shut-off valves
surge relief valves
choke valves
check valves
actuators and control systems

Separate brochures are available upon request.

*anti-surge control valve 12" ANSI 600,
compressor station Russia*

*flowline shut-off valves
gas production plant
N/E Netherlands
(by courtesy of NAM)*



other Mokveld products

*adjustable choke valves 7¹/₁₆"
API 10,000 with inconel cladding,
gas production field UAE*



*adjustable choke valves 8" ANSI 900
lbs with pneumatic actuators,
gas production offshore Malaysia*

*surge control valves 20" and 24"
ANSI 300 lbs,
gas compression facility New Mexico*

other Mokveld products



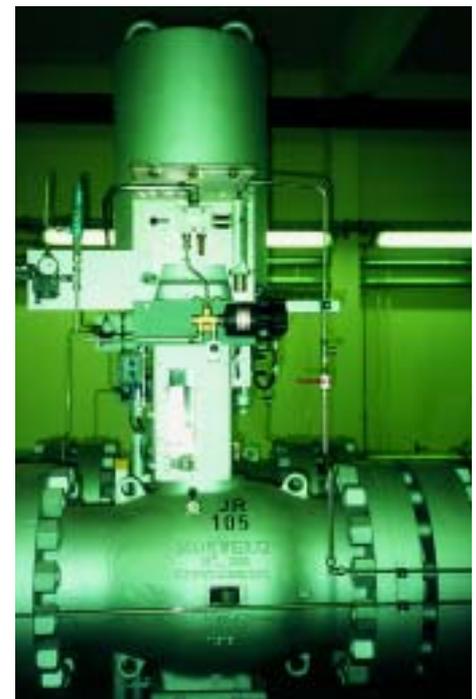
*inline production chokes 10" ANSI 1500,
FPSO Norway*



*pressure control valves 20" ANSI 600 lbs and safety slam shut valves
16" ANSI 600 lbs, M & R station Germany*

*safety shut-off valve 16" ANSI 600,
underground storage field Germany*

flow control valves, underground gas storage field Germany



other Mokveld products



*shut-off valves and non-slam check valves
6" ANSI 900 lbs, water injection manifold
of a crude oil production field, North Africa*



*flow pressure control valves and safety shut-off
valves, M & R station Germany*

Mokveld Valves



Mokveld Valves bv

P.O. Box 227
2800 AE Gouda Holland
Nijverheidsstraat 67
telephone (31) 182 597500
facsimile (31) 182 517977
mokveld@mokveld.com
www.mokveld.com

Mokveld offices in:

Houston, United States of America
Wesel, Germany
Swindon, United Kingdom
Dubai, United Arab Emirates
Sumy, Ukraine
Beijing, the People's Republic of China
Kuala Lumpur, Malaysia
Stavanger, Norway