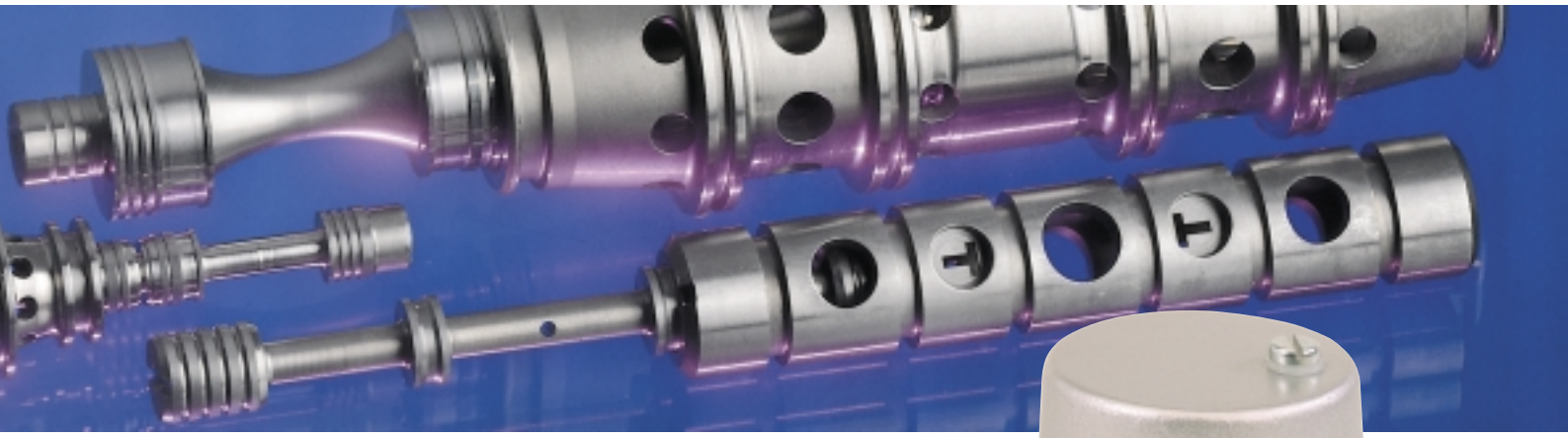
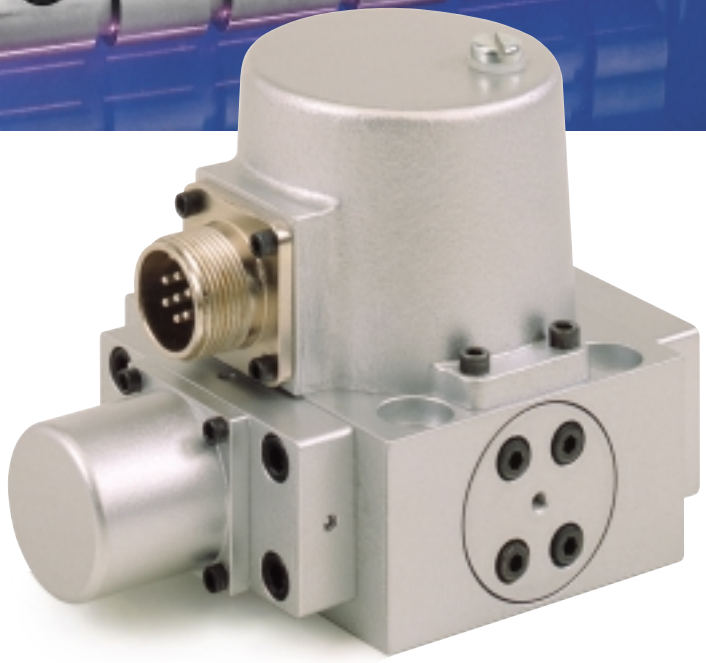
MOOG

Servovalves
with integrated Electronics
D765 Series
ISO 10372 Size 04





D765 Series
Two stage Servovalves

The D765 Series flow control servovalves are throttle valves for 3- and preferably 4-way applications.
The design of these valves is based on the wellknown D761 Series. The mechanical feedback has been replaced by an electric feedback with a position transducer. An integrated electronics closes the position loop for the spool.
These valves are suitable for electrohydraulic position, velocity, pressure or force control systems with extremely high dynamic response requirements.

Principle of operation
An electric command signal (flow rate set point) is applied to the integrated position controller which drives the pilot stage. The thereby deflected nozzle flapper system produces a pressure difference across the drive areas of the spool and effects its movement.
The position transducer (LVDT) which is excited via an oscillator measures the position of the spool (actual value, position voltage). This signal is then demodulated and fed back to the controller where it is compared with the command signal. The controller drives the pilot stage until the error between command signal and feedback signal will be zero. Thus the position of the spool is proportional to the electric command signal.

CE The D765 Series valve described in this catalogue has successfully passed EMC tests required by EC Directive. Please take notice of the respective references in the electronics section.

Operational features

- ❒ 2-stage design with dry torque motor
- ❒ Low friction double nozzle pilot stage
- ❒ High spool control forces
- ❒ Electric feedback with pressure isolated position transducer (LVDT), wear free
- ❒ Integrated electronics with built in false polarity protection
- ❒ High resolution, low hysteresis
- ❒ Completely adjusted at the factory
- ❒ Protection filter easy to replace

The actual flow is dependent upon electric command signal and valve pressure drop. The flow for a given valve pressure drop can be calculated using the square root function for sharp edged orifices:

$$Q = Q_N \cdot \sqrt{\frac{\Delta p}{\Delta p_N}}$$

Q [l/min] = calculated flow
Q_N [l/min] = rated flow
Δp [bar] = actual valve pressure drop
Δp_N [bar] = rated valve pressure drop

If large flow rates with high valve pressure drop are required an appropriate higher pilot pressure has to be chosen to overcome the flow forces. An approximate value can be calculated as follows:

$$p_X \geq 2{,}5 \cdot 10^{-2} \cdot \frac{Q}{A_K} \cdot \sqrt{\Delta p}$$

Q [l/min] = max. flow
Δp [bar] = valve pressure drop with Q
A_K [cm²] = spool drive area
p_X [bar] = pilot pressure

The pilot pressure p_X has to be at least 15 bar above the return pressure of the pilot stage.

Our quality management system is certified in accordance with DIN EN ISO 9001.

This catalogue is for users with technical knowledge. To ensure that all necessary characteristics for function and safety of the system are given, the user has to check the suitability of the products described herein.
In case of doubt please contact MOOG.

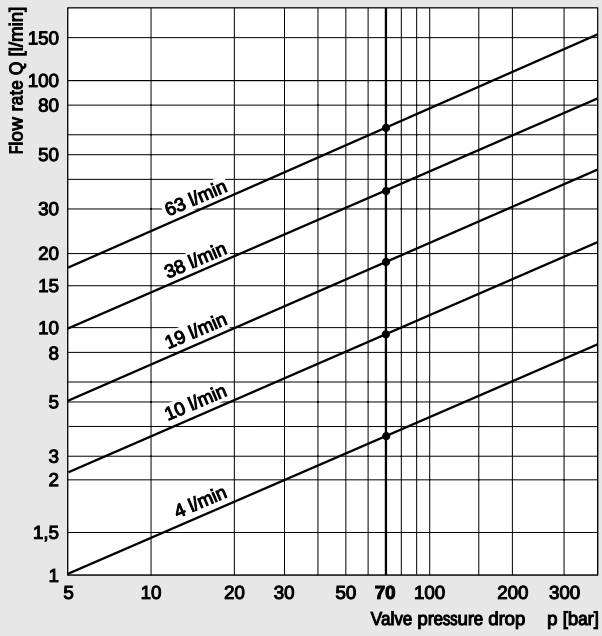
General technical data

Operating pressure		
	Ports P, X, A and B	up to 315 bar
	Port T	up to 210 bar
Temperature range		
	Ambient	-20 to +60 °C
	Fluid	-20 to +80 °C
Seal material		FPM, others on request
Operating fluid		Mineral oil based hydraulic fluid (DIN 51524 part 1 to 3), other fluids on request
	Viscosity recommended	15 to 100 mm²/s

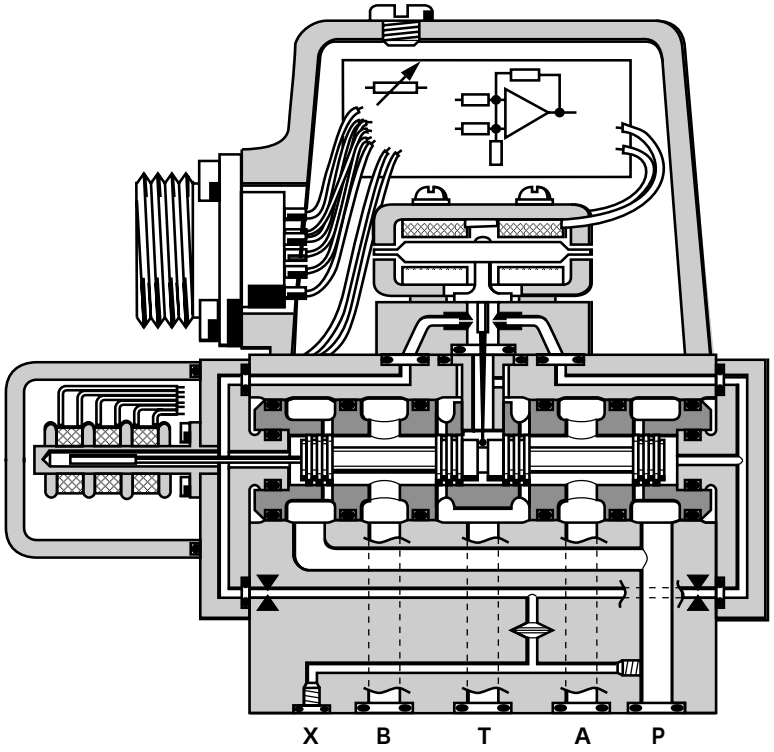
System filtration: High pressure filter (without bypass, but with dirt alarm) mounted in the main flow and if possible directly upstream of the valve.

Class of cleanliness: The cleanliness of the hydraulic fluid particularly effects the performance (spool positioning, high resolution) and wear (metering edges, pressure gain, leakage) of the servovalve.

Recommended cleanliness class	
For normal operation:	ISO 4406 < 14/11
For longer life:	ISO 4406 < 13/10
Filter rating recommended	
For normal operation:	$ß_{10} \geq 75$ (10 µm absolute)
For longer life:	$ß_{5} \geq 75$ (5 µm absolute)
Installation options	any position, fixed or movable
Vibration	30 g, 3 axes
Mass	1,1 kg
Degree of protection	EN 60529: class IP 65, with mating connector mounted
Shipping plate	Delivered with an oil sealed shipping plate



Valve flow diagram
Valve flow for maximum valve opening (100% command signal) as a function of the valve pressure drop



D765 Series
Technical data

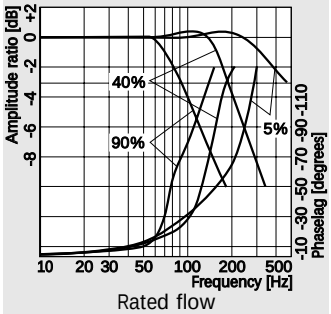
Model ... Type			**D765- .....**				
Mounting pattern			ISO 10372-04-04-0-92				
Valve body version			4-way				
			2-stage with spool-bushing assembly				
Pilot stage			Nozzle / Flapper, Highflow				
Pilot connection	optional, internal or external		X				
Rated flow	(± 10 %) at Δp_N = 35 bar per land						
	Standard	[l/min]	**4**	**10**	**19**	**38**	**63**
	High response	[l/min]	**4**	**10**	**19**	**38**	**—**
Response time*	Standard, typical	[ms]	4	4	4	4	8
	High response, typical	[ms]	2	2	2	3	—
Threshold*		[%]	< 0,1				
Hysteresis*		[%]	< 0,3				
Null shift	with ΔT = 55 K	[%]	< 1				
Null leakage flow*	max.	[l/min]	1,5 to 2,3				
Pilot leakage flow*	typical	[l/min]	0,8				
Pilot flow*	for 100 % step input	[l/min]	0,4				
Spool drive area	Standard	[cm²]	0,49				
	High response	[cm²]	0,34				

* At 210 bar pilot or operating pressure, fluid viscosity of 32 mm²/s and fluid temperature of 40 °C

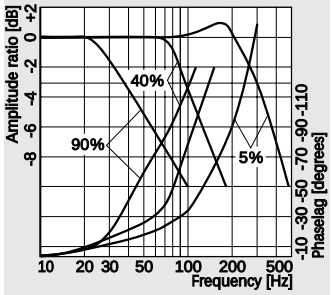
Flow gain in the null region (± 3 % signal) typically 50 to 200% nominal gain

Typical characteristic curves with ± 5 %, ± 40 % and ± 90 % input signal, at 210 bar pilot or operating pressure, fluid viscosity of 32 mm²/s and fluid temperature of 40 °C

Standard valves

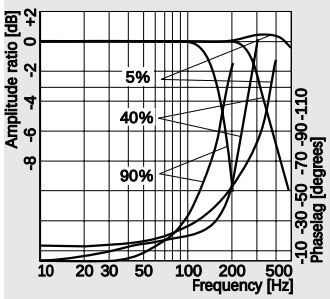


Rated flow
4, 10, 19 and 38 l/min

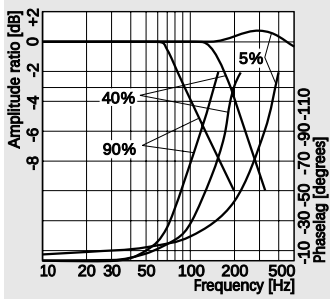


Rated flow 63 l/min

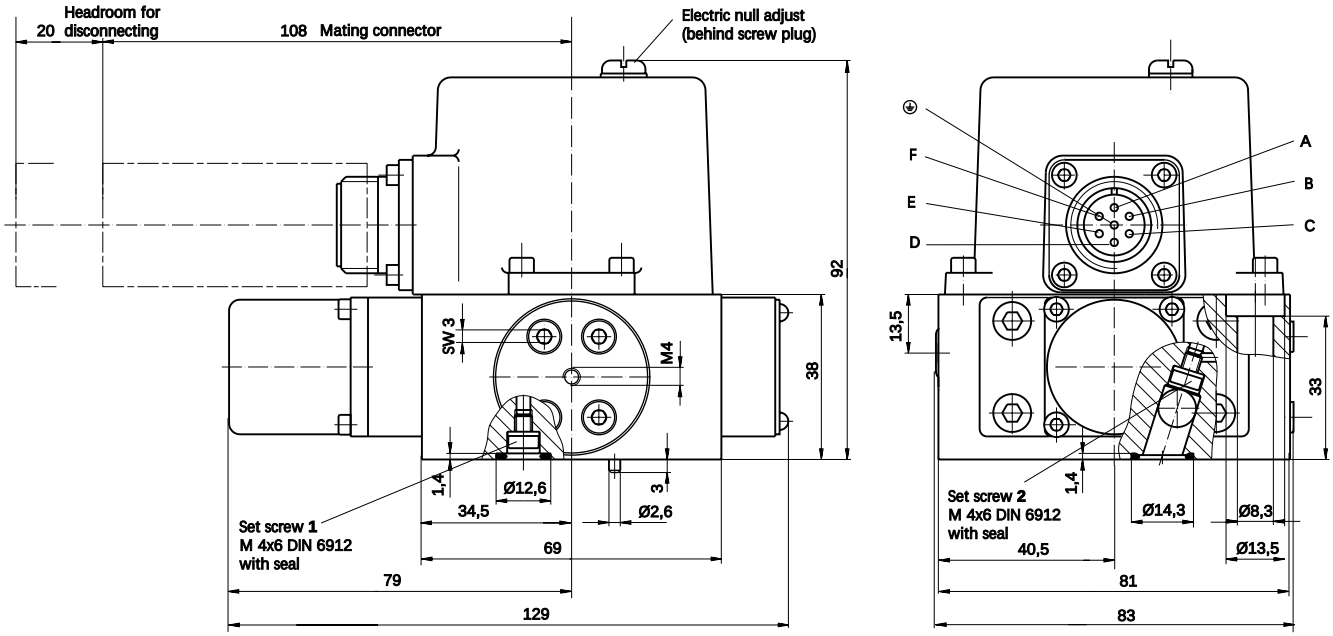
High response valves



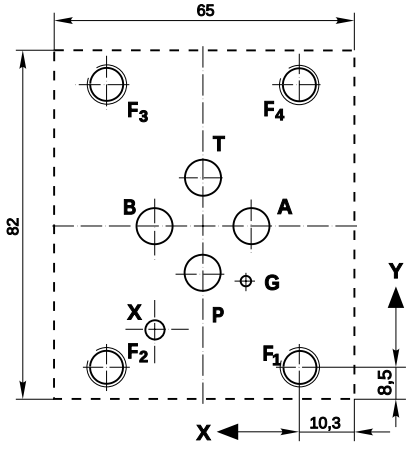
Rated flow 4, 10 and 19 l/min



Rated flow 38 l/min



The mounting manifold must conform to ISO 10372-04-04-0-92.
Mounting surface needs to be flat within 0,01 mm. Average surface finish value, Ra, better than 0,8µm.



	P	A	T	B	G	X
	Ø8,2	**Ø8,2**	**Ø8,2**	**Ø8,2**	Ø3,5	Ø5
X	22,2	11,1	22,2	33,3	12,3	33,3
Y	21,4	32,5	43,6	32,5	19,8	8,7
	F1	**F2**	**F3**	**F4**		
	M8	M8	M8	M8		
X	0	44,4	44,4	0		
Y	0	0	65	65		

Conversion instruction

for operation with internal or external pilot connection	Pilot flow supply	Set screw **1** (M 4 x 6 DIN 6912)	**2**
	internal P	closed	open
	external X	open	closed

Spare parts and accessories

O-rings (included in delivery),		FPM 85 Shore
for P, T, A and B	ID 10,82 x 1,78	42082 022
for X	ID 9,25 x 1,78	42082 013
Mating connector, waterproof IP 65 (not included in delivery)		
6+PE-pole	EN 175201 part 804*	B97007 061
Flushing plate,	(int.) 55127 001	(ext.) 55127 002

* formerly DIN 43563

Mounting bolts (not included in delivery)	
M 8 x 45 DIN EN ISO 4762-10.9 (4 pieces)	A03665 080 045
required torque	18 Nm
Replaceable filter	A67999 065
O-rings for filter change (2 pieces)	A25163 013 015
Screw internal/external M4 x 6 DIN 6912	76689 040 006
Seal for screw internal/external	A25528 040
Seal for null adjust screw plug	76425 050

D765 Series
Valve electronics with supply voltage ± 15 Volt

Command signal 0 to ±10 mA
Valves with current command input, floating

The spool stroke of the valve is proportional to $I_D = -I_E$. 100% valve opening P ◗ B and A ◗ T is achieved at I_D = +10 mA. At 0 mA command the spool is in centred position.

The input pins D and E are inverting. Either pin D or E is used according to the required operating direction. The other pin is connected to signal ground ⊥ (0 V) at cabinet side.

Command signal 0 to ±10 V
Valves with voltage command input

The spool stroke of the valve is proportional to differential input ($U_D - U_E$). 100% valve opening P ◗ B and A ◗ T is achieved at ($U_D - U_E$) = +10 V. At 0 V command the spool is in centred position.

If only one command signal is available, pin D or E is connected to signal ground according to the required operating direction (to be done at cabinet side).

Actual value 0 to ±10 mA
Valves with current command input

The actual spool position value can be measured at pin F. This signal can be used for monitoring and fault detection purposes.

The spool stroke range corresponds to ±10 mA. +10 mA corresponds to 100% valve opening P ◗ B and A ◗ T.

Actual value 0 to ±10 V
Valves with voltage command input

The actual spool position value can be measured at pin F. This signal can be used for monitoring and fault detection purposes.

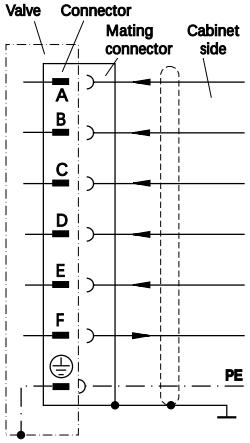
The spool stroke range corresponds to ±10 V. +10 V corresponds to 100% valve opening P ◗ B and A ◗ T.

General requirements

- ❒ Supply ± 15 VDC ± 3%. Ripple < 50 mV_{PP}. Current consumption max. ± 100 mA
- ❒ All signal lines, also those of external transducers, shielded
- ❒ Shielding connected radially to ⊥ (0V), power supply side, and connected to the mating connector housing (EMC)
- ❒ **EMC**: Meets the requirements of EN 55011/03.91, class B, EN 50081-1/01.92, and EN 50082-2/03.95, performance criterion class A.
- ❒ Minimum cross section of all leads ≥ 0,75mm². Consider voltage losses between cabinet and valve.
- ❒ Note: When making electric connections to the valve (shield, protective earth) appropriate measures must be taken to ensure that locally different earth potentials do not result in excessive ground currents. See also MOOG Application Note AM 353 E.

Wiring for valves with 6+PE pole connector

to EN 175201 part 804[1]) and mating connector (type R and S, metal shell) with leading protective earth connection ⏚.



Function	Current command	Voltage command
Supply	+ 15 VDC ± 3 %, ripple < 50 mV_{PP}	
Supply	– 15 VDC ± 3 %, ripple < 50 mV_{PP}	
Supply / signal ground	⊥ (0V)	
Input rated command Valve flow	0 to ± 10 mA Load resistance (diff.) 1 kΩ	0 to ± 10 V Input resistance 10 kΩ
Input inverted rated command Valve flow	0 to ± 10 mA Load resistance (diff.) 1 kΩ	0 to ± 10 V Input resistance 10 kΩ
Output actual value [2]) Spool position	0 to ± 10 mA Load resistance max. 1 kΩ	0 to ± 10 V Load resistance min. 1 kΩ
Protective grounding		

[1]) formerly DIN 43563 [2]) referenced to ⊥ (0V)

Ordering information

Model number

D765 . . . . . .

Type designation

. . . . . .

Specification status

–	Series specification
E	Preseries specification
Z	Special specification

Model designation

	assigned at the factory

Factory identification

Valve version

S	Standard
H	High response

Rated flow

	Q_N [l/min] at Δp_N = 35 bar per land		
	Standard	High response	
04	4	4	
10	10	10	
19	19	19	
38	38	38	(only to 250 bar)
63	63	—	

Maximum operating pressure p_p and body material

F	210 bar · aluminum
J	315 bar · aluminum
K	350 bar · steel

Bushing spool type

O	Axis cut, linear characteristic
	others on request

Pilot stage

G	with additional mechanical feedback

Spool position without electric supply

A	P ◗ B, A ◗ T
B	P ◗ A, B ◗ T
M	Mid position

Pilot connections and pressure

	Pressure [bar]	Supply
A	15 to 210	internal
C	15 to 210	external
E	15 to 315	internal
G	15 to 315	external
J	25 to 350	internal
L	25 to 350	external

Seal material

V	FPM (Viton)
	others on request

Valve connector

R	6 + PE pole EN 175201 part 804	over port A
S	6 + PE pole EN 175201 part 804	over port B

Signals for 100% spool stroke

	Command	Output
A	± 10 V	± 10 V
X	± 10 mA, floating	± 10 mA

Supply voltage

0	± 15 VDC ± 3%, ripple < 50 mV_{PP}

Preferred configurations are highlighted.
All combinations may not be available.
Please contact MOOG.

Options may increase price.
Technical changes are reserved.

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Austria	Vienna
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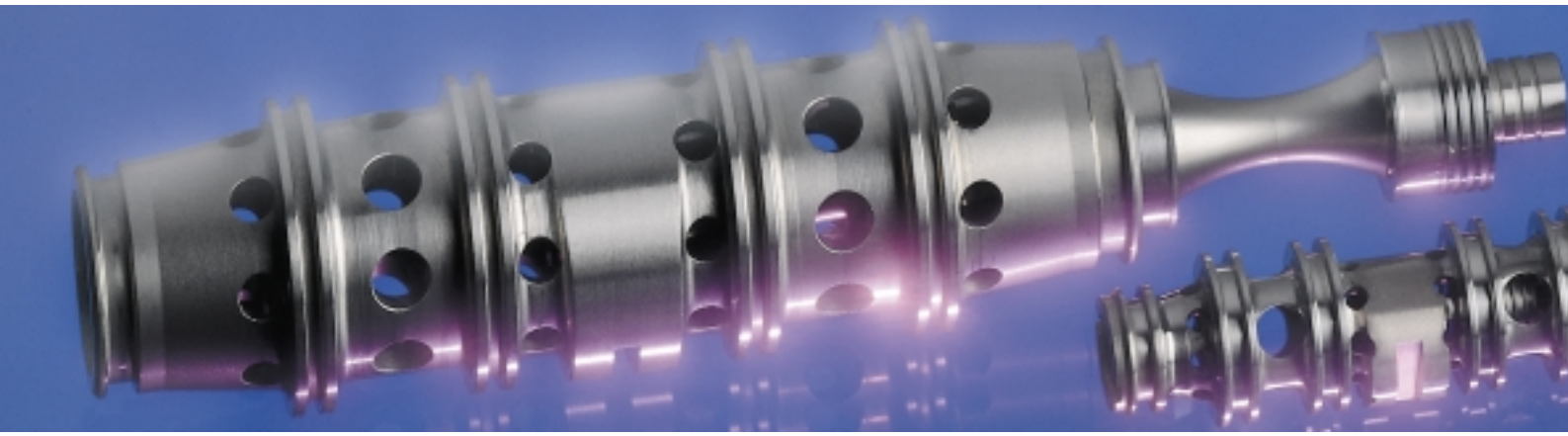
China	Shanghai
China	Hong Kong
England	Tewkesbury
Finland	Espoo
France	Rungis



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