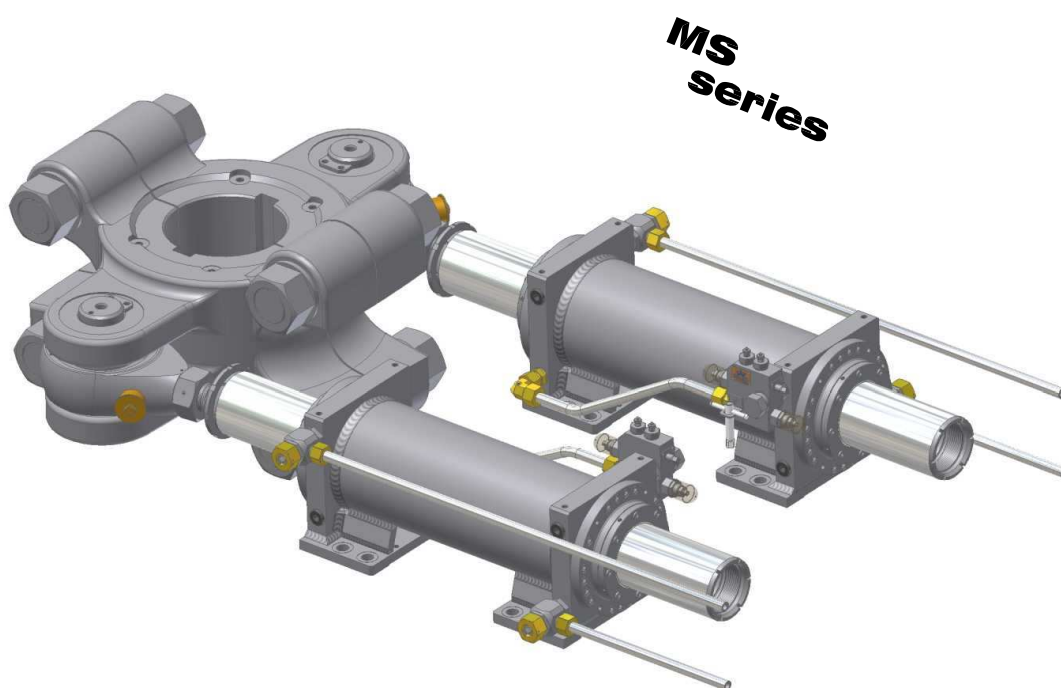


piston type
steering gears

catalogue card



HYDROSTER





Production overview

With more than 50 years experience HYDROSTER Ltd. has become serious market player in manufacturing of complete steering gears systems suitable for a wide range of seagoing vessels.

Leading product - piston type steering gear - designed with a range of rudder deflection angles up to 45 deg ensures high performance with max working torque of up to 6000 kNm.

Undisputed reliability has been achieved thanks to doubled hydraulic system. When an oil leakage occurs as a result of broken pipeline or other hydraulic element failure, the damaged part of system is isolated and the steering gear remains efficient and ensures continuous ship's control. Thanks to external joint connections maintenance have never been so easy.

HYDROSTER Ltd. piston type steering gears meet requirements of SOLAS Convention 1974 with all later amendments and are produced according to rules of all classification societies (society to be agreed with the client).

Desired working torque specifies kinds of pumps and amount of cylinders to be applied in the steering gear system. For working torques

- $M_r = 6,3 \div 320$ kNm - constant delivery pumps with two cylinders
- $M_r = 500 \div 3000$ kNm - variable delivery pumps with two cylinders
- $M_r > 1250$ kNm - variable delivery pumps with four cylinders

All steering gears are designed with maximum torque $M_k = 1,25 M_r$.

Piston type steering gear main parts

- rudder actuator
 - split tiller joined with four bolts or conically holed tiller for hydraulic fit
 - two or four piston type cylinders
 - elements for connecting tiller with cylinders: bolts, eyes, connecting links, etc.
- two equivalent power pack units with necessary valve blocks, valves and hydraulic fittings
 - free-standing for steering gears with constant delivery pumps
 - directly placed on the steering gear cylinders for steering gears with variable delivery pumps
- spare oil tank with a hand pump
- electric equipment of drive and signaling system

Steering gears from size MS200 are fitted with fan air/oil coolers preventing against oil temperature excessive increase especially in tropical climates.

The steering gears are designed to mate with electrical remote control systems of such makers as Sperry Marine BV or Raytheon-Anschutz. Other producers to be agreed-upon.

The steering gear elements matching directly with remote control system are of "ON-OFF" type solenoid directional control valves, one for each pump unit of steering gear. All directional valves are fitted with hand levers for a local control.

Special design

When non-standard construction has to be applied, special design of steering gear is available. Years of experience in design and manufacture process have brought into many different solutions to meet client satisfaction.

Some of special solutions

- steering with two or more rudders
- steering gears for small vessels with rudder putting over time $t \leq 20$ s from $\alpha = -35^{\circ}$ to $\alpha = +30^{\circ}$ with 1 pump operating
- economic steering gears for all types of cargo ships with rudder putting over time $t \leq 28$ s from $\alpha = -35^{\circ}$ to $\alpha = +30^{\circ}$ with 2 pumps operating simultaneously. Electric motors power is twice smaller than in a standard design.

Key product benefits

- high reliability
- easy fitting on board
- easy maintenance
- wear of rudder carrier has no influence on actuator's work during operation
- easy to adapt in non-standard applications

Standard scope of supply

- actuator unit
- two independent power pack units, each comprise of
 - pump with electric motor (fan oil air cooler if necessary)
 - oil tank
 - valve blocks
 - directional control valve for local/remote control
 - auxiliary hydraulic fittings with signaling elements
- electric equipment of drive and signaling system (range to be agreed with the client)
- spare oil tank with a hand pump
- set of special tools and spare parts
- technical operation documentation
- classification society certificates and guarantee documents

Additionally available

- remote control system
- rudder angle indication system
- hydraulic nut

HYDROSTER ensures

- the guarantee and after guarantee service and 24/7 support
- spare parts delivery during complete life-cycle of the product

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Piston type steering gear with constant delivery pumps

working torques

$6,3 \div 320 \text{ kNm}$

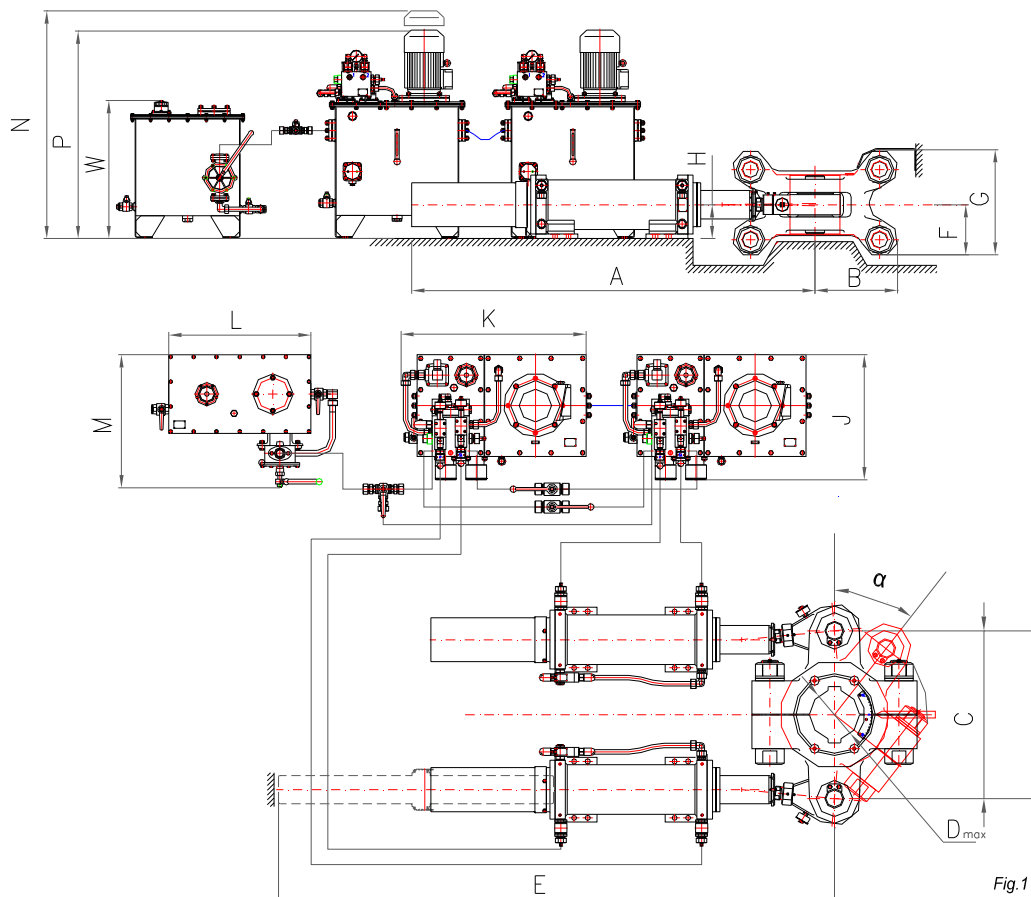


Fig.1 Dimensional sketch.

Type	Dimensions [mm]														
	A	B	C	D _{max}	E	F	G	H	J	K	L	M	N	P	W
MS 25-35	1048	160	600	140	1600	75	150	80	400	830	750	520	990	1080	500
MS 32-35	1133	228	700	170	1600	140	280	97	400	830	750	520	990	1080	680
MS 50-35	1283	298	800	220	1800	183	366	109	400	830	750	520	1045	1150	680
MS 80-35	1590	333	950	250	2200	198	396	125	660	385	840	610	1050	1150	700
MS 125-35	1744	374	1100	290	2450	215	430	150	475	750	840	610	1110	1200	1000
MS 200-35	2025	435	1250	340	2800	256	512	170	475	750	1230	680	1392	1510	840
MS 320-35	2462	500	1575	400	3360	283	566	185	620	1200	1230	680	1285	1645	1120

MS series steering gear technical specification with rudder deflection angle $\pm 35^\circ$.

Parameter	Symbol	Unit	MS20-35	MS32-35	MS50-35	MS80-35	MS125-35	MS200-35	MS320-35
Working torque at working pressure p_{nom} and rudder deflection angle $\alpha=35^\circ$	M_r	[kNm]	20	32	50	80	125	200	320
Design torque at open safety valve pressure p_{max} and rudder deflection angle $\alpha=35^\circ$	M_k	[kNm]	25	40	62,5	100	156	250	400
Maximal tiller turn angle limited by rudder actuator design	α_{max}	[deg]	± 38						
Rudder putting over time from $\alpha=-35^\circ$ to $\alpha=+30^\circ$	t_1	[s]	≤ 28						
	t_2	[s]	$\sim 0,5 t_1$						
Electric motors supply voltage	U_1	[V], [f]	3x380, 50						
	U_2	[V], [f]	3x440, 60						
Directional proportional valves supply voltage ¹	U	[V]	24 DC						
Power of solenoid	N	[W]	30						
Ambient temperature during steering gear operation	T_o	[K]/[°C]	$273 \div 318K$ ($0^\circ C \div +45^\circ C$)						
Ambient temperature permissible for idle steering gear	T_{od}	[K]/[°C]	$248 \div 343K$ ($-25^\circ C \div +70^\circ C$)						
Hydraulic oil operating temperature	T_{pr}	[K]/[°C]	$273 \div 353K$ ($0^\circ C \div +80^\circ C$)						
Hydraulic oil high temperature signalling	T_s	[K]/[°C]	$\geq 343K$ ($+70^\circ C$)						
Working medium			hydraulic mineral oils of kinematic viscosity $v=68mm^2/s$ (68 cSt) at $T=40^\circ C$ and viscosity index $W \geq 95$						

¹ Pump directional proportional valves cooperating with remote control system

Piston type steering gear
with variable delivery pumps
working torques
 $500 \div 3000 \text{ kNm}$

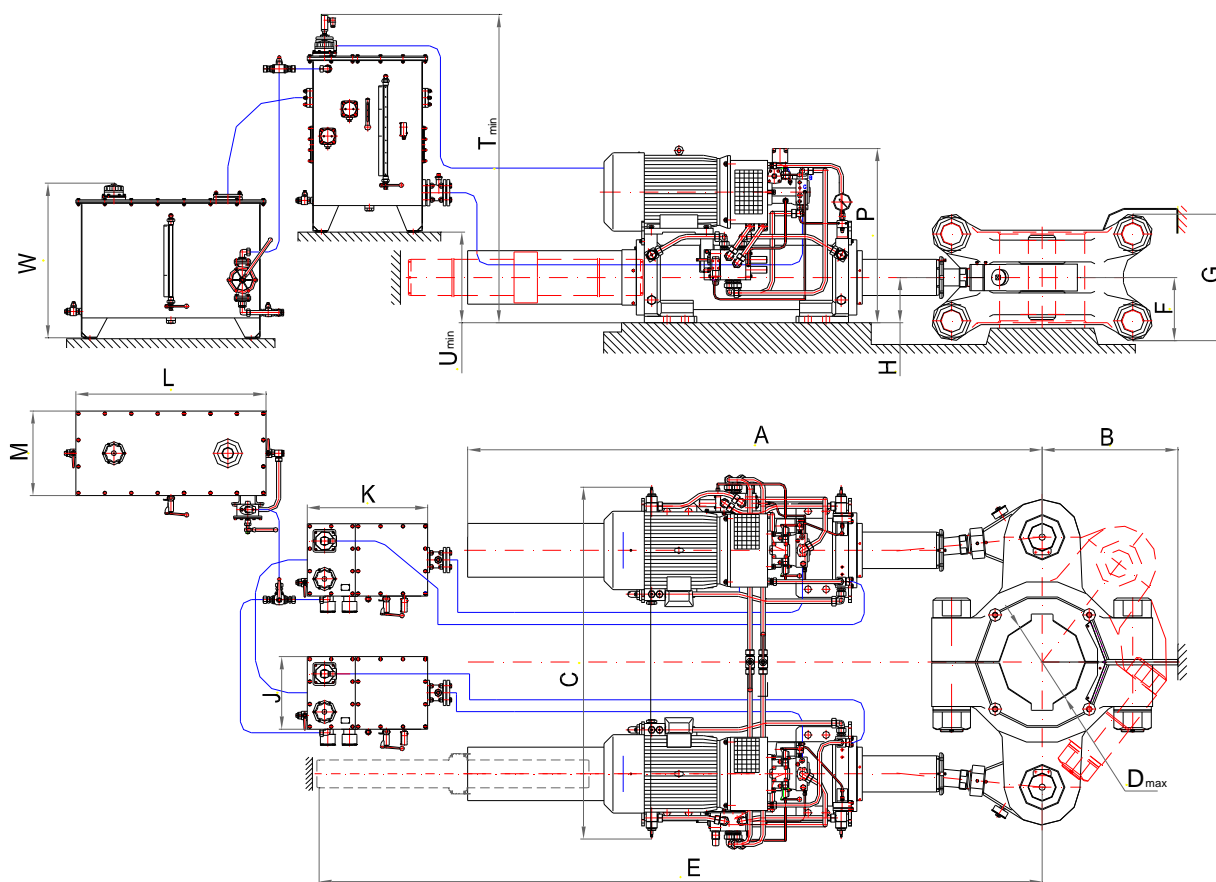


Fig.2 Dimensional sketch.

Type	Dimensions [mm]															
	A	B	C	D _{max}	E	F	G	H	J	K	L	M	P	T _{min}	U _{min}	W
MS 500-35	2698	670	1660	460	3700	230	625	225	695	485	1230	680	950	1475	365	840
MS 800-35	3175	710	1930	500	4350	260	675	250	695	485	1230	680	1100	1510	400	840
MS 1250-35	3930	800	2310	550	5360	275	750	285	695	485	1230	680	1200	1560	450	1220
MS 3000-35	4690	900	2760	665	7500	500	1000	410	910	1480	1480	910	1530	2740	1130	1490

MS series steering gear technical specification with rudder deflection angle $\pm 35^\circ$.

Parameter	Symbol	Unit	MS 500-35	MS 800-35	MS 1250-35	MS 3000-35
Working torque at working pressure p_{nom} and rudder deflection angle $\alpha=35^\circ$	M_r	[kNm]	500	800	1250	3000
Design torque at open safety valve pressure p_{max} and rudder deflection angle $\alpha=35^\circ$	M_k	[kNm]	625	100	1562	3750
Maximal tiller turn angle limited by rudder actuator design	α_{max}	[deg]	± 38			
Rudder putting over time from $\alpha=-35^\circ$ to $\alpha=+30^\circ$	t_1	[s]	≤ 28			
	t_2	[s]	$\sim 0,5 t_1$			
Electric motors supply voltage	U_1	[V], [f]	3x380, 50			
	U_2	[V], [f]	3x440, 60			
Directional proportional valves supply voltage ²	U	[V]	24 DC			
Power of solenoid	N	[W]	30			
Ambient temperature during steering gear operation	T_o	[K]/[°C]	$273 \div 318K$ ($0^\circ C \div +45^\circ C$)			
Ambient temperature permissible for idle steering gear	T_{od}	[K]/[°C]	$248 \div 343K$ ($-25^\circ C \div +70^\circ C$)			
Hydraulic oil operating temperature	T_{pr}	[K]/[°C]	$273 \div 353K$ ($0^\circ C \div +80^\circ C$)			
Hydraulic oil high temperature signalling	T_s	[K]/[°C]	$\geq 343K$ ($+70^\circ C$)			
Working medium			hydraulic mineral oils of kinematic viscosity $v=68mm^2/s$ (68 cSt) at $T=40^\circ C$ and viscosity index $W \geq 95$			

² Pump directional proportional valves cooperating with remote control system

Piston type steering gear
with variable delivery pumps
working torques
 $1600 \div 6000 \text{ kNm}$

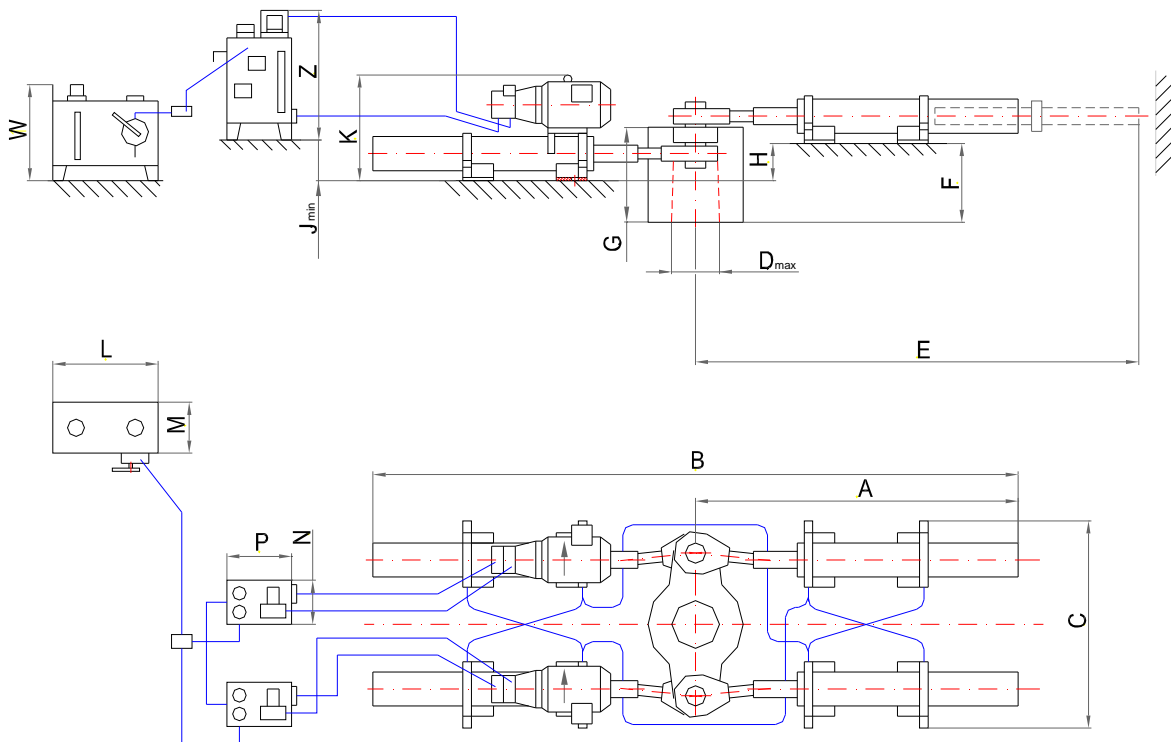


Fig.3 Dimensional sketch.

Type	Dimensions [mm]															
	A	B	C	D _{max}	E	F	G	H	J _{min}	K	L	M	N	P	W	Z
MS 1600-35A	3175	6350	1930	500	4350	595	765	360	400	1055	1480	910	1079	550	1010	1475
MS 1600-35										950	1230	680	695	485	840	1255
MS 2500-35A	3931	7862	2350	610	5350	740	930	470	700	1160	1480	910	1079	550	1010	1475
MS 2500-35										1035	1230	680	1079	500	1220	1095
MS 6000-35	4690	9380	2760	825	7500	1120	1400	600	1000	1730	1710	1030	910	1480	1490	1610

MS series steering gear technical specification with rudder deflection angle $\pm 35^\circ$.

Parameter	Symbol	Unit	MS 1600-35A	MS 1600-35	MS 2500-35A	MS 2500-35A	MS 6000-35
Working torque at working pressure p_{nom} and rudder deflection angle $\alpha=35^\circ$	M_r	[kNm]	1600		2500		6000
Design torque at open safety valve pressure p_{max} and rudder deflection angle $\alpha=35^\circ$	M_k	[kNm]	2000		3125		7500
Maximal tiller turn angle limited by rudder actuator design	α_{max}	[deg]	±38				
Rudder putting over time from $\alpha=-35^\circ$ to $\alpha=+30^\circ$	t₁	[s]	≤28				
	t₂	[s]	~ 0,5 t ₁				
Electric motors supply voltage	U₁	[V], [f]	3x380, 50				
	U₂	[V], [f]	3x440, 60				
Directional proportional valves supply voltage ³	U	[V]	24 DC				
Power of solenoid	N	[W]	30				
Ambient temperature during steering gear operation	T_o	[K]/[°C]	273 ÷ 318K (0°C ÷ +45°C)				
Ambient temperature permissible for idle steering gear	T_{od}	[K]/[°C]	248 ÷ 343K (-25°C ÷ +70°C)				
Hydraulic oil operating temperature	T_{pr}	[K]/[°C]	273 ÷ 353K (0°C÷ +80°C)				
Hydraulic oil high temperature signalling	T_s	[K]/[°C]	≥ 343K (+70°C)				
Working medium			hydraulic mineral oils of kinematic viscosity $v=68\text{mm}^2/\text{s}$ (68 cSt) at T=40°C and viscosity index W≥95				

³ Pump directional proportional valves cooperating with remote control system