ZOLLERN

Solid metals. Fine solutions.

Drive Technology

Rope winches and gearboxes

The ZOLLERN Group
ZOLLERN is one of the pioneers in the metal industry. At several locations in Europe, North America and Asia, 2,000 employees develop, produce and service a wide range of high-quality metal products. ZOLLERN supplies sophisticated solutions for a wide range of applications with its business areas of drive technology, investment casting, sand casting and forging as well as steel profiles.

Content Side

Winch Gearboxes

ZOLLERN Winch Gearboxes
have proved highly successful under extreme operating conditions. Their principal features and most significant advantages are

- compact dimensions
- ease of maintenance
- long operation life
- high performance
- modular design of gear unit
- functional design

With these characteristics the machine designer will get a ready to install unit and will achieve economic solutions even in confined space conditions.

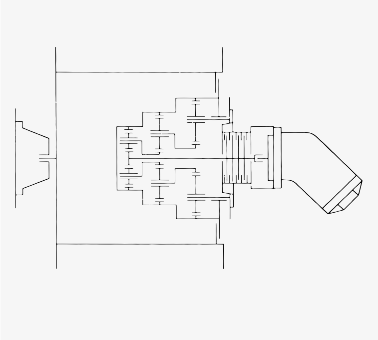
Potential applications:

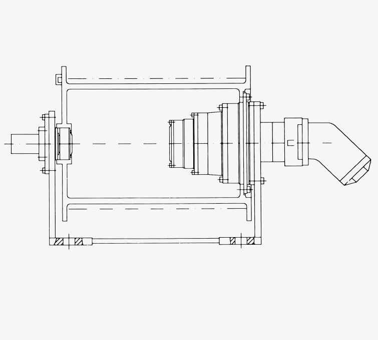
- mobile cranes
- construction cranes and conveyors
- material and working elevators
- loading and cargo handling cranes
- shipboard and deck cranes
- rescue and wrecker salvage trucks
- dockyard and harbour cranes
- offshore cranes
- container gantries
- access platforms

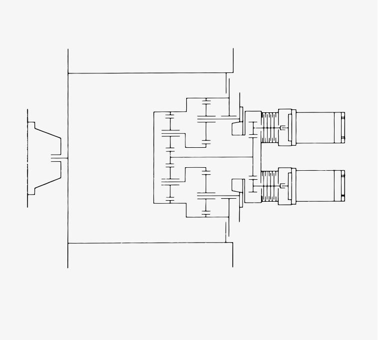
ZOLLERN gears use components common to our complete range (Winches, Slewing Units, Industrial Gears, Free Fall Winches) giving the advantage of volume production: cost savings from standard parts, reduced lead times, tested and proven designs across the whole range and readily available spares for units in service.


ABUS
ABUS

Design and Construction of Rope Winches with flange drive gearbox







2 stage planetary gearbox
Ratios from i = 21 to 29
Gearbox mounted inside winch drum, Parking Brake and Hydraulic motor flange mounted externally. Input and output in opposite sense of rotation.

3 stage planetary gearbox
Ratios from i = 45 to 147
Gearbox mounted inside winch drum, Parking Brake and Hydraulic motor flange mounted externally. Input and output in opposite sense of rotation.

2 stage planetary gearbox with spur stage input
Ratios from i = 40 to 150
Gearbox mounted inside winch drum, Parking Brake and Hydraulic motor flange mounted externally, twin motor/brake option. Input and output in opposite sense of rotation.

Winch Gearbox Range

Output torques: 1.750 to 1.500.000 Nm. Rope load: 17 to 1.950 kN. In calculating the rope load care must be taken to include reeving, hooks and an allowance for reeving efficiency (see page 13).

Notes

The output torques $T_{dyn\ max}$, listed on pages 14/15 are based on FEM Standards I/3rd edition/load conditions L2 running time classification T5, in accordance with Drive unit group M5. Ambient temperature +20 C° (FEM - Federation Europeenne de la Manutention).

Gear Design

Selected for optimum surface durability and bending strength; also for minimum sliding velocity, according DIN 3990. External gear teeth are case-hardened and ground; internal gears annealed and nitride hardened.

Bearings

All rotation parts run on rotation element bearings. Ball bearings are used to support the input gearing, needle roller bearings for the planet wheels and self aligning bearings for the drum support bearings.

Efficiency

The efficiency per planetary stage is 98% and about 99%for the drum bearings including seals. Example: Rope winch with 2 planetary gear stages

η_{total} = 0,98 x 0,98 x 0,99 = 0,95

Lubrication

All gears and antifriction bearings are splash lubricated. Service intervals and recommended lubricants are given in the table on page 18. The end support bearing can be grease packed for lifetime operation – requiring no further service attention.

Oil change

An external fill/breather/drain pipe is fitted to the drive flange of winch gearbox.

Oil level

Oil level is checked by either dip stick or sight glass.

Cooling

Cooling may be required where the unit is to operate continuously in direct sunlight or high ambient temperature environments. Cooling may be also required if the power on time is high. ZOLLERN can provide suitable coolers.

Input Options

ZOLLERN's modular system provides for hydraulic or electric motor input interfaces. Flange mounted or free shaftwith key to DIN 5480.

Seals

Input and output are protected with radial shaft seals of double lip type. This prevents oil leakage and protects the unit from ingress of dirt or water. Where the unit is be used offshore or on-ship additional protection is provided with greased felt strips and secondary radial seals.

Mounting position
Horizontal

Fitting
ZOLLERN's winch gearbox is designed to be flange mounted in a fabricated steel structure. The drive end mounting flange reacts rope load and transmission torque, the non drive end reacts rope loads only and can be safely removes to facilitate fitting of the winch drum and gearbox.

Backstop
For special applications a backstop can be incorporated between the gear transmission and the parking brake. It operates as follows.

Lifting of load
- Parking brake closed
- Backstop open

Lowering of load
- Parking brake open
- Backstop closed

Geared limit switch
a) electrical
an electrical signal can be generated at various rope travel or end limit position. The switch positions are infinitely adjustable. The switch is flange mounted with drive from the rope drum through the bearing support housing.

b) hydraulic
ZOLLERN geared limit switch operating as the electrical version – with a hydraulic signal.

Brakes
A hydraulic multi disc parking brake with spring applied, pressure release operation is fitted. This fail safe device is a self contained piston/ brake with release pressure of 15 bar, 300 bar max. Line transient pressure of 0.5 bar permitted. The connection ports are metric M 12 x 1.5. Multi disc, single disc or barrel brakes with direct connection to the rope drum can be fitted for additional safety back up.

Electric motor
Standard electric motors cannot be mounted inside the winch drum. As opposed to Electric-Compact-Winch.

Operating conditions
The gear systems are designed for use in Central European conditions. Permissible oil temperatures -20°C to +70°C. Environmental factors such as salt water, salt-laden air, dust, excessive air pressure, heavy vibration, high shock loads and extreme ambient temperatures, corrosive media, etc. must be stated.

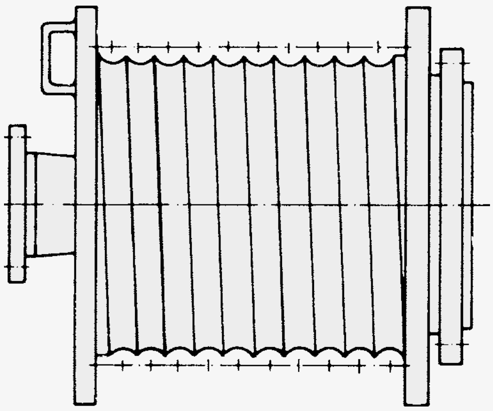
Paint Primer
This is a specially developed multi-primer with a two-component zinc-dust epoxy resin base. Colour: Grey white. A two component epoxy resin is most suitable for the finish coat.

Choice of gear unit
In order to select the correct rope winch for a given application the output torque Tdyn calculated from the rope load and rope drum diameter must be multiplied by the factor K.

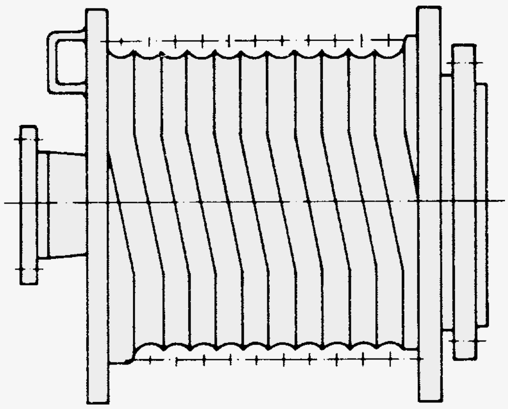
$$T_{nom} = T_{dyn} \times K \leq T_{dynz\ max}$$

For application factor K and calculation of the rope load see pages 12/13.

Integrated Rope drum



With normal grooves

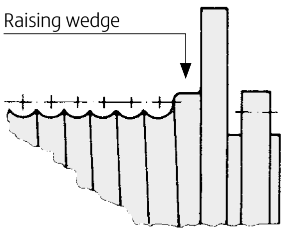


With special grooves
With grooves of this kind the difficulties encountered in multi-layer winding on to grooves of the usual kind do not arise, as the crossover points of the rope in each layer always lie in the same section of the drum and the lift of the rope into the next layer is precisely defined. 8 and more layers can be accommodated without difficulty.

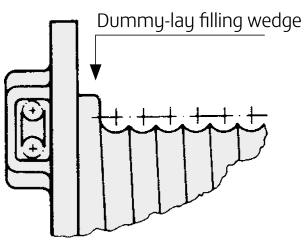
Material for rope drum

- ductile graphite iron (EN-GJS-400-15; EN-GJS-600-3)
- steel (S355J0)

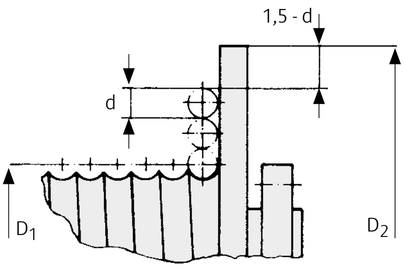
Other material available on request



This is cast on to the drum on the opposite side of the rope entry and guides the rope from the first to the second layer.



This is cast on to the drum at the rope entry point and serves to fill the gap between the drum flange and the first rope turn.



Rope drum diameter D1
D_1 = 20 x d or as specified

Drum flange diameter D2
$D_2 = D_1 + 2\,(z + 1)\,d$

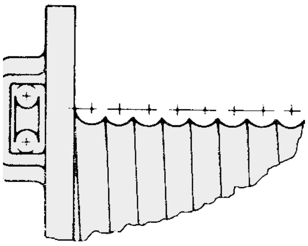
Length of rope
including 3 safety turns

$$L_s = \left(\frac{L_2}{p} - a\right)\left(D1 + 0{,}866 \cdot d\,(z-1)\right)\frac{z \cdot \pi}{1000}$$

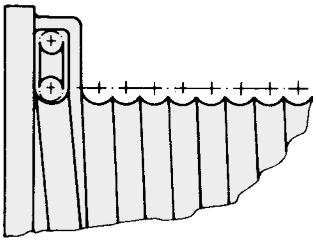
L_s = Length of rope (m)
L_2 = Length of drum (mm)
D_1 = Diameter of drum (mm)
d = Diameter of rope (mm)
p = Pitch of rope groove (mm)
z = Number of rope layers (–)
a = 1 for normal grooves (–)
= 0,5 for special grooves

Rope fixing

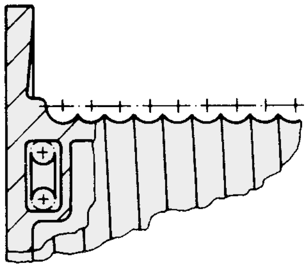
Wedge lock



a) on the outside of the drum flange

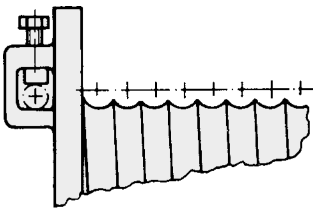


b) on the inside of the drum flange
(for up to 2 rope layers only)

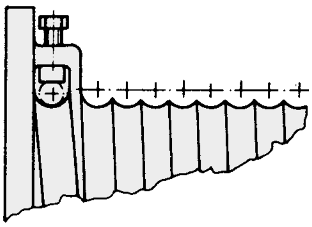


c) within the barrel shell

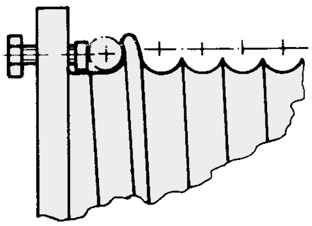
Rope Clamps



a) on the outside of the drum flange

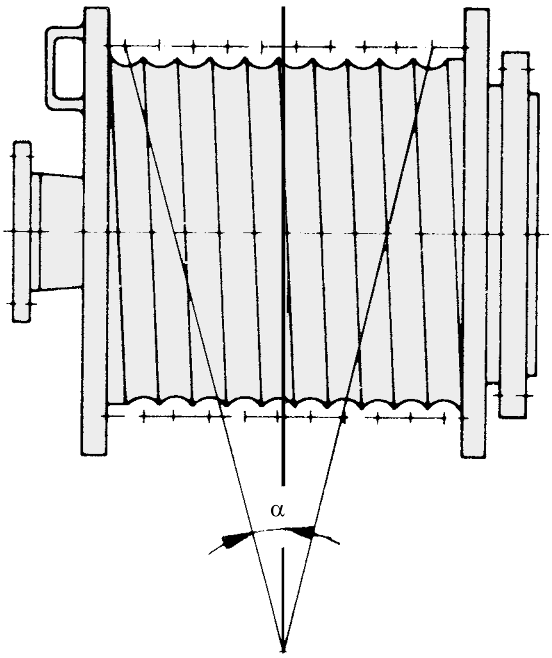


b) on the inside of the drum flange
(for up to 2 rope layers)



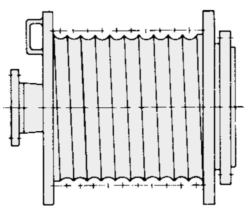
c) on the drum by means of clamps. In an emergency the rope can be pulled out of the fixing without damage to either rope or drum.

Rope grooves and Rope

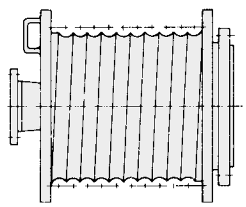


Rope grooves
On cast drums cleanly cast and trimmed, and at the flash line carefully ground. On welded drums all edges are de burred and radiussed.

Rope groove lead/pitch



Right-hand lead on standard design



Left-hand lead

Fleet angle
To achieve acceptable rope winding

- the deflection angle α must with special grooves be not less than 0,5° in order to prevent the rope from riding up the drum flange and to ensure that it is guided securely on to the next layer.
- the deflection angle ⊠ must not exceed 1,5° in order to pre vent the rope in the first layer being pulled against the grooves and, where a number of layers occur, to enable even winding up to the drum flanges. If the deflection angle is greater, the working life of the rope will be negatively affected.

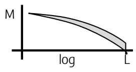
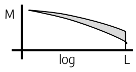
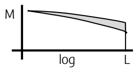
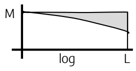
Direction of rope lay
Rope lay should be in the opposite sense to drum lead.

For example:

right-hand rope lay

left-hand rope lay

Application Factor K for Winches

	Symbol	T2	T3	T4	T5	T6	T7	T8
Running time classification	Mean running time per day in hours, related to one year	over 0,25 to 0,5	over 0,5 to 1	over 1 to 2	over 2 to 4	over 4 to 8	over 8 to 16	over 16
	Life in hours 8 years, 200 days/year	400 to 800	800 to 1.600	1.600 to 3.200	3.200 to 6.300	6.300 to 12.500	12.500 to 25.000	25.000 to 50.000
Load conditions	Collective coefficient k_m	Drive unit class Application Factor K						
L1	 to 0,125	M1 0,90	M2 0,90	M3 0,92	M4 0,92	M5 0,92	M6 1,1	M7 1,36
L2	 0,125 to 0,250	M2 0,90	M3 0,92	M4 0,96	M5 1	M6 1,07	M7 1,3	M8 1,6
L3	 0,250 to 0,500	M3 1,05	M4 1,09	M5 1,17	M6 1,23	M7 1,28	M8 1,53	M8 1,89
L4	 0,500 to 1.000	M4 1,32	M5 1,36	M6 1,46	M7 1,53	M8 1,58	M8 1,8	M8 2,22

Classification guidance

According FEM section I, 3rd edition, table T.2.1.3.5.

Type of appliance Designation	Particulars concerning nature of use (1)	Type of mechanism				
		Hoisting	Slewing	Luffing	Traverse	Travel
Erection cranes		M2 - M3	M2 - M3	M1 - M2	M1 - M2	M2 - M3
Stocking and reclaiming transporters	Hook duty	M5 - M6	M4	-	M4 - M5	M5 - M6
Stocking and reclaiming transporters	Grab or magnet	M7 - M8	M6	-	M6 - M7	M7 - M8
Workshop cranes		M6	M4	-	M4	M5
Overhead travelling cranes, pigbreaking cranes, scrapyard cranes	Grab oder magnet	M8	M6	-	M6 - M7	M7 - M8
Bridge cranes for unloading, bridge cranes for containers Other bridge cranes (with crab and/or slewing jib crane)	a) Hook or spreader duty b) Hook duty	M6 - M7 M4 - M5	M5 - M6 M4 - M5	M3 - M4 -	M6 - M7 M4 - M5	M4 - M5 M4 - M5
Bridge cranes for unloading, bridge cranes (with crab an/or slewing jib crane)	Grab or magnet	M8	M5 - M6	M3 - M4	M7 - M8	M4 - M5
Drydock cranes shipyard jib cranes, jib cranes for dismantling	Hook duty	M5 - M6	M4 - M5	M4 - M5	M4 - M5	M5 - M6
Dockside cranes (slewing, on gantry, etc.), floating cranes and pontoon derricks	Hook duty	M6 - M7	M5 - M6	M5 - M6	-	M3 - M4
Dockside cranes (slewing, on gantry, etc.), floating cranes and pontoon derricks	Grab or magnet	M7 - M8	M6 - M7	M6 - M7	-	M4 - M5
Floating cranes and pontoon derricks for very heavy loads (usually greater than 100 t)		M3 - M4	M3 - M4	M3 - M4	-	-
Deck cranes	Hook duty	M4	M3 - M4	M3 - M4	M2	M3
Deck cranes	Grab or magnet	M5 - M6	M3 -M4	M3 - M4	M4 - M5	M3 - M4
Tower cranes for building		M4	M5	M4	M3	M3
Derricks		M2 - M3	M1 - M2	M1 - M2	-	-
Railway cranes allowed to run in train		M3 - M4	M2 - M3	M2 - M3	-	-
Mobile cranes	Hook	M3 - M4	M2 - M3	M2 - M3	-	-

Calculation of Rope load F_{nom} on the Rope drum

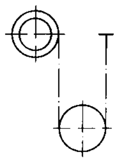
Rope load F_{nenn}

$$F_{nom} = (m_{Load} + m_{tackle})\, g \cdot \frac{1}{n \cdot \eta_S} \cdot \Psi \text{ (N)}$$

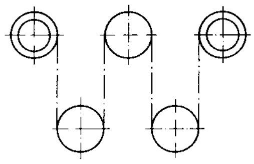
Meaning:

i is the number of rope pulleys between the rope drum and pulley block or load (e. g. with the lifting gear on jib cranes)

n is the number of rope strands in a single pulley block. A single pulley block is the total number of rope strands and rope pulleys for a single rope running on to a rope drum (see illustration)



2-stranded pulley block n = 2



Twin pulley tackle
4-stranded, comprising
2 pulley blocks each 2-stranded
2 x (n = 2)

Efficiency of rope drives

$$\eta_S = (\eta_R)^i \cdot \eta_F = (\eta_R)^i \cdot \frac{1}{n} \cdot \frac{1 - (\eta_R)^n}{1 - \eta_R}$$

η_R is the efficiency of a single rope pulley
η_F is the efficiency of the pulley block
η_S is the efficiency of the rope drive

The efficiency of a rope pulley depends not only from its type of bearing used in it (friction or antifriction), but also upon the ratio rope pulley diameter: rope diameter (D:d), upon the design of the rope and upon the rope lubrication. If no more exact values have been obtained by experiment, the following values are to apply

- with friction bearings η_R = 0,96
- with antifriction bearings η_R = 0,98

For compensating pulleys no efficiency value must be considered.

For Ψ = vibration coefficient see FEM-Section 1, 3. Edition October 1998

Calculation of Rope diameters and Rope drum diameters

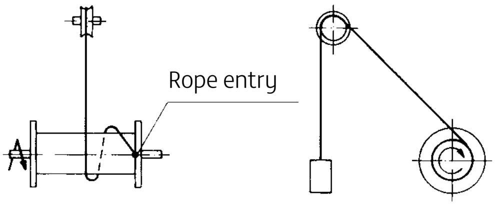
in acc. with DIN 15020

Gear drive group	Coefficient c Rope diameter $d_{min} = c \cdot \sqrt{S}$ S = Rope pull in N C = Coefficient in mm/√ N Non rotationfree wire ropes Nominal strength of individual wires in N/mm²					Rotationfree wire ropes Nominal strength of individual wires in N/mm²			Coefficient h_1 (Coefficient h_2 = 1) Rope drum diameter $D_{min} = h_1 \cdot h_2 \cdot d_{min}$	
	1.570	1.770	1.960	2.160	2.450	1.570	1.770	1.960	Non rotationfree wire rope	Rotationfree or low-rotation wire rope
$1\,B_m$	0,0850	0,0800	0,0750	–	–	0,0900	0,0850	0,0800	14	16
$1\,A_m$	0,0900	0,0850		–	–	0,0950		0,0900	16	18
2_m	0,0950			–	–	0,106			18	20
3_m	0,106			–	–	0,118			20	22,4
4_m	0,118			–	–	0,132			22,4	25
5_m	0,132			–	–	0,150			25	28

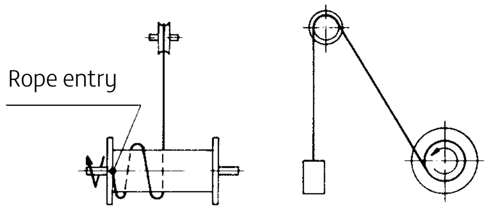
Winding direction on Rope drums

Right-hand

Rope pull overshot

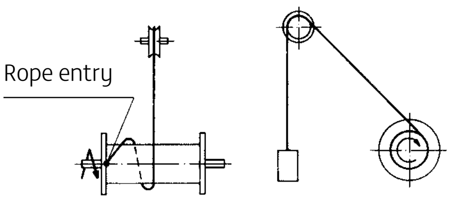


Rope pull undershot

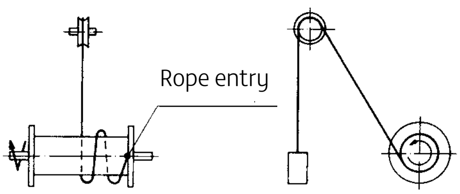


Left-hand

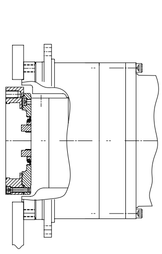
Rope pull overshot



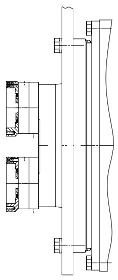
Rope pull undershot



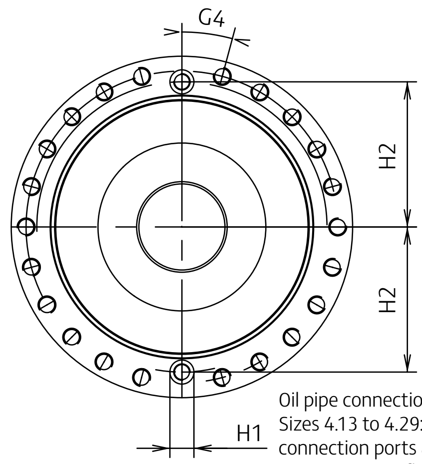
Technical Data



Integrated drive unit



Drive unit with spur gear



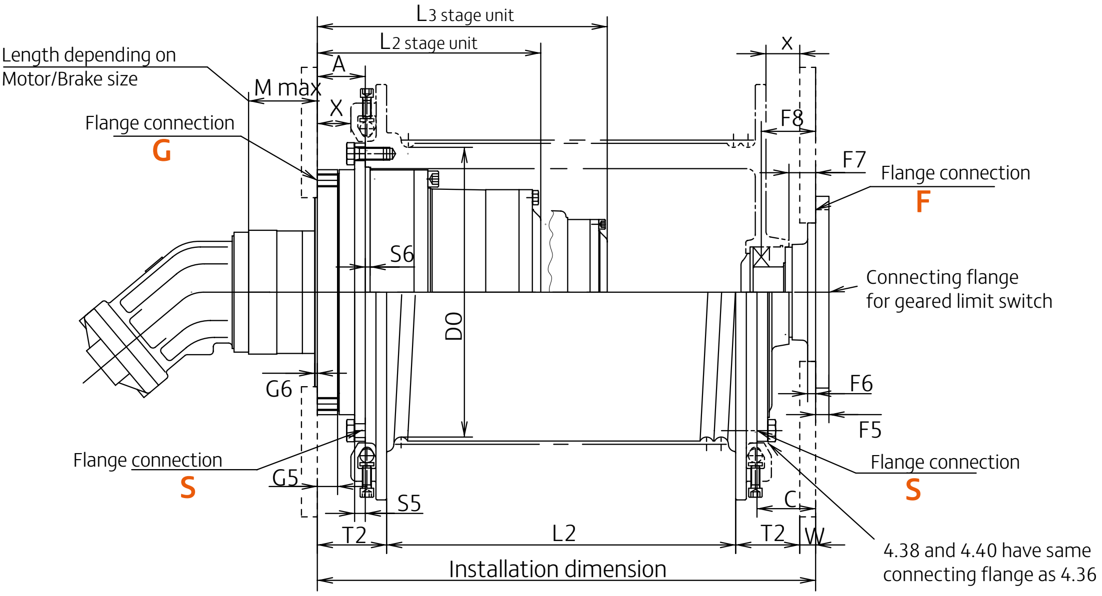
Oil pipe connection ports
Sizes 4.13 to 4.29: the oil pipe connection ports are on the gear mounting flange.
Sizes 4.31 and above: the oil pipe connection is on the gearbox face.

Type	Nominal gearbox ratings					G Flange connection – Gear unit to frame Bolts class 10.9						S Flange connection – Gear unit to drum Bolts class 8.8						F
ZHP / EG	Output torque (Nm) Tdyn max I ≤ 70 I > 70	Tstat max I ≤ 70 I > 70	Typical line pull F_{nnom} (kN)	Max input speed $n_{max.}$ (rpm)	D O approx ca.	G 1 loca-tion Ø	G 2 pcd Ø ± 0,2	G 3 outer Ø	G 4 fixing	G 5	G 6	S 1 loca-tion Ø	S 2 pcd Ø ± 0,2	S 3 outer Ø	S 4 fixing	S 5	S 6	F 1 loca-tion Ø
4.13	1.650 1.750	2.650 2.800	17 18	Depending on motor and brake arrangement 2000...5000 rpm	180	125	145	167	30° 12 * M 10	16	5	145	185	203	30° 12 * Ø 11	10	9	120
4.15	4.000 4.150	6.400 6.650	33 34		260	155	185	213	20° 16 * M 12	24	5	225	245	265	20° 18 * Ø 11	10	9	150
4.19	7.000 7.300	11.200 11.700	46 48		300	190	225	255	20° 16 * M 16	25	5	265	290	310	15° 24 * Ø 14	12	9	175
4.20	11.200 11.600	18.000 18.500	67 69		340	200	255	285	20° 16 * M 16	25	5	295	320	340	15° 24 * Ø 14	12	9	175
4.22	18.800 19.400	30.000 31.000	95 98		390	230	280	315	15° 22 * M 16	25	5	330	360	390	20° 18 * Ø 18	16	9	200
4.24	25.000 25.500	40.000 41.000	116 119		440	270	320	355	15° 22 * M 16	25	5	370	400	430	15° 24 * Ø 18	16	9	200
4.25	35.000 36.000	56.000 57.500	143 147		480	300	350	385	15° 22 * M 20	30	5	400	440	480	20° 18 * Ø 22	20	9	230
4.26	47.000 48.000	75.000 77.000	180 184		520	330	390	425	15° 22 * M 20	30	5	440	480	520	15° 24 * Ø 22	20	9	260
4.27	61.000 63.000	97.500 101.000	213 220		570	355	420	460	15° 22 * M 24	38	5	470	520	560	20° 18 * Ø 26	24	9	260
4.29	102.000 105.000	163.000 168.000	304 313		670	430	480	530	15° 22 * M 24	38	5	550	590	630	15° 24 * Ø 26	24	9	300
4.31	150.000 155.000	240.000 248.000	395 408		770	515	565	615	15° 24 * M 30	47	5	640	690	750	15° 24 * Ø 33	30	9	325
4.32	229.000 236.000	366.500 377.500	549 566		830	580	630	680	15° 24 * M 30	47	5	700	755	815	15° 24 * Ø 33	30	9	325
4.33	300.000 311.000	480.000 497.500	637 660		930	670	720	770	12° 30 * M 30	47	5	790	840	890	12° 30 * Ø 33	30	9	375
4.34	392.000 406.000	627.000 649.500	760 787		1.030	720	770	820	10° 36 * M 30	47	5	850	900	950	10° 36 * Ø 33	30	9	375
4.36	623.000 644.000	997.000 1.030.500	1.038 1.073		1.200	840	900	960	10° 36 * M 36	56	5	1.000	1.055	1.120	10° 36 * Ø 39	36	9	430
4.38	1.050.000 1.100.000	1.680.000 1.760.000	1.450 1.520		1.360	1.060	1.140	1.210	# 10° 36 * M 30	78	26	1.240	1.320	1.390	# 10° 36 * Ø 33	45	13	600
4.40	1.400.000 1.500.000	2.240.000 2.400.000	1.820 1.950		1.530	1.160	1.240	1.310	# 10° 36 * M 30	78	26	1.340	1.420	1.490	# 10° 36 * Ø 33	45	13	600
4.44	2.400.000 2.500.000	3.840.000 4.000.000	2.540 2.650		1.800	1.250	1.350	1.441	# 7,5° 48 * M 30	105	25	1.630	1.725	1.820	# 7,5° 48 * M 33	55	25	750

Rating according to FEM section I

Drive unit class M5
Load condition L 2 (P = const./ n_{ab} = 15 rpm)
Running time class T5
With clamping sleeves

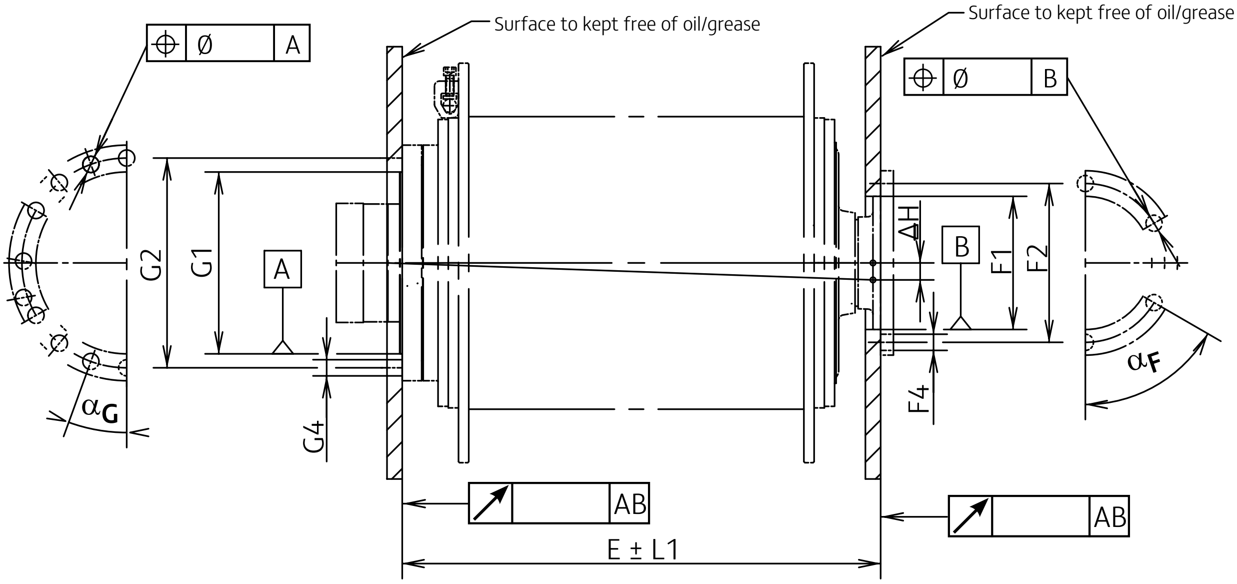
ZOLLERN have a policy of continuous product improvement, and detail may be changed without notice.



Flange Connection – End support bearing to frame – Bolts class 8.8									Assembly length = L2 + 2 • T2 + W depending on design										Type
F 2 pcd Ø ± 0,2	F 3 outer Ø	F 4 fixing	F 5	F 6	F 7	F 8	H 1 Ø	H 2	A	C	$M_{max.}$	T 1 min. 2-stages	T 1 min. 3-stages	T 2	W approx frame thickness	L 2-stages	L 3-stages	x min.	ZHP EG
140	160	60° 6 * Ø 9	12	8	20	36	–	–	40	55	130	165	–	70	10	170	–	10	4.13
175	200	60° 6 * Ø 11	15	8	25	50	26	93,5	55	70	140	185	255	85	15	225	295	15	4.15
200	225	60° 6 * Ø 11	15	10	30	64	26	111	60	75	170	190	290	95	15	245	340	15	4.19
200	225	60° 6 * Ø 11	15	10	30	64	26	117	60	75	140	225	295	95	15	270	350	15	4.20
230	260	60° 6 * Ø 14	18	12	35	71	26	132	60	75	170	245	345	100	15	300	410	15	4.22
230	260	60° 6 * Ø 14	18	12	35	71	26	152	60	80	170	270	405	100	20	325	460	20	4.24
260	290	60° 6 * Ø 18	18	15	40	78	30	168	75	95	160	270	395	120	20	350	480	20	4.25
310	360	60° 6 * Ø 22	25	15	50	92	30	184	75	95	210	305	445	120	20	375	510	20	4.26
310	360	60° 6 * Ø 22	25	15	50	92	30	195,5	90	110	200	325	455	140	20	420	560	20	4.27
350	400	60° 6 * Ø 22	30	15	50	104	30	233	90	115	200	370	520	145	25	465	620	25	4.29
375	425	60° 6 * Ø 26	35	15	70	134	–	235	110	140	200	375	540	180	30	515	685	30	4.31
375	425	60° 6 * Ø 26	35	15	70	134	–	268	110	140	150	465	695	180	30	590	815	30	4.32
435	500	60° 6 * Ø 33	40	15	80	144	–	298	110	160	150	470	720	180	40	675	925	40	4.33
435	500	60° 6 * Ø 33	40	15	80	144	–	335	120	160	140	495	760	200	40	700	975	40	4.34
490	550	60° 6 * Ø 33	40	15	90	180	–	385	120	190	110	685	970	240	50	875	1.160	50	4.36
680	750	30° 12 * Ø 33	50	20	80	180	–	460 / 497	130	170	–	960	1.320	230	60	1.195	1.555	50	4.38
680	750	30° 12 * Ø 33	50	20	80	180	–	460 / 545	130	170	–	1.235	1.650	195	60	1.320	1.735	50	4.40
850	950	15° 24 * Ø 33	60	25	110	230	–	675 / 675	115	210	–	–	1.750	220	80	–	1.690	70	4.44

Supporting frame machining tolerances

To ensure correct operation of the winch, the frame location centres must be within the specified tolerances and the flange pieces square to the base plate. Care should be taken to design an adequately rigid support and sub support as deflec tions during installation and subsequent operation can take up working tolerances. These are given in the accompa-nying table.



Type ZHP	G/Box flange connection			Support frame connection				Maximum permitted deviation ΔH from the centreline in relation to L1							Type ZHP
	↗ AB	⌖ Ø A	α_G	↗ AB	⌖ Ø B	α_F	L_1	250	500	750	1.000	1.500	2.000	2.500	
4.13	0,1	0,3	20°	0,2	0,2	60°	1	0,1	0,2	0,2	0,3				4.13
4.15	0,1	0,3	20°	0,2	0,3	60°	1		0,2	0,2	0,3				4.15
4.19	0,1	0,4	20°	0,2	0,3	60°	2		0,2	0,2	0,3				4.19
4.20	0,1	0,4	20°	0,2	0,3	60°	2		0,2	0,2	0,3	0,4			4.20
4.22	0,1	0,4	15°	0,2	0,3	60°	2		0,2	0,2	0,3	0,4			4.22
4.24	0,1	0,4	15°	0,2	0,3	60°	2			0,2	0,3	0,4	0,5		4.24
4.25	0,1	0,5	15°	0,4	0,5	60°	2			0,2	0,3	0,4	0,5		4.25
4.26	0,1	0,5	15°	0,4	0,5	60°	3			0,2	0,3	0,4	0,5		4.26
4.27	0,1	0,5	15°	0,4	0,5	60°	3				0,3	0,4	0,5		4.27
4.29	0,1	0,5	15°	0,4	0,5	60°	3				0,3	0,4	0,5		4.29
4.31	0,2	0,5	15°	0,6	0,5	60°	3				0,3	0,4	0,5		4.31
4.32	0,2	0,5	15°	0,6	0,5	60°	3				0,3	0,4	0,5	0,7	4.32
4.33	0,2	0,5	12°	0,6	0,5	60°	3				0,3	0,4	0,5	0,7	4.33
4.34	0,2	0,5	10°	0,6	0,5	60°	3				0,3	0,4	0,5	0,7	4.34
4.36	0,3	0,5	10°	0,8	0,5	60°	3				0,3	0,4	0,5	0,7	4.36
4.38	0,3	0,1	10°	0,8	0,5	60°	3					0,4	0,5	0,7	4.38
4.40	0,3	0,1	10°	0,8	0,5	60°	3					0,4	0,5	0,7	4.40

⌖ Ø 0,1 B

The fixing hole centres should lie within 0,1 of a theoretical cylinder about the winch centreline.

↗ 0,2 AB

The locating flange diameter should be flat within 0,2 about the winch centreline.

Gear reduction ratios

// 2-stages – coaxial

Ratio	21	25	29	34
4.15	•	•	•	•
4.19	•	•	•	•
4.20	•	•	•	•
4.22 – 4.36	•	•	•	•
4.38	•	•	•	•
4.40	•	•	•	•
4.44	•	•	•	•

// 3-stages – coaxial

Ratio	45	53	60	63	70	71	80	83	93	99	107	112	129	136	147	153	176
4.15	•	•	•	•	•	•		•		•				•			
4.19	•	•	•	•	•	•		•		•				•			
4.20	•	•	•	•	•	•	•	•	•	•		•		•		•	
4.22 – 4.36	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
4.38							•		•		•	•	•		•	•	•
4.40							•		•		•	•	•		•	•	•
4.44							•										

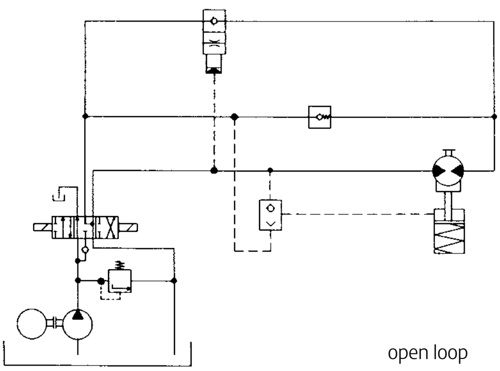
// 4-stages – coaxial

Ratio	206	225	232	245	267	276	301	310	317	321	348	357	364	381	402	413	429	464	474	487	495	502	537	548	557	566	596	633	644	670	732	761	774	880	1.000	1.058	1.202
4.15	•	•	•	•	•	•	•		•	•	•		•	•		•			•		•	•					•										
4.19	•	•	•	•	•	•	•		•	•	•		•	•		•			•		•	•					•										
4.20	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•		•	•		•		•					
4.22 – 4.36	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
4.38								•				•			•		•	•		•			•	•	•	•		•	•	•	•	•	•	•	•	•	•
4.40								•				•			•		•	•		•			•	•	•	•		•	•	•	•	•	•	•	•	•	•
4.44								•							•									•													

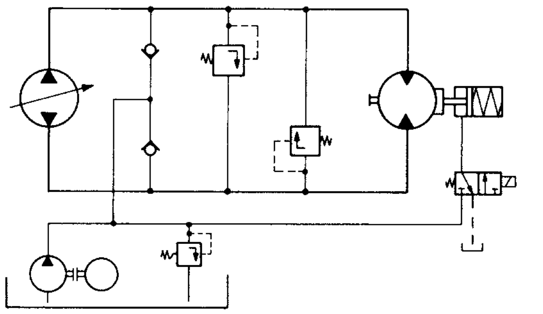
Other ratios available on request

Hydraulic control layouts

Simplified view



open loop



closed loop

Recommended lubricants for ZOLLERN Rope winches

Table of Lubricants

Type/ Specification	Lubricants to DIN 51502			
	Mineral Olic acc. DIN 51 517 T3 CLP 220	**Synthetic Lubricants acc.** DIN 51 517 T3 CLP HC (PAO) 220	**Synthetic Lubricants acc.** DIN 51 517 T3 CLP PG 220	**Grease acc.** DIN 51 825 KP 2 K
Aral	Degol BG 220	-	Degol GS 220	Aralub HLP 2
Avia	Gear RSX 220	Synthogear PE 220	-	-
	-	Avilub Gear PAO 220	Gear VSG 220	Avialith 2 EP
BP	Energol GR-XP 220	-	-	Energrease LS-EP 2
Castrol	Alpha EP 220	Alphasyn EP 220	Alphasyn GS 220	Longtime PD2
	Alpha SP 220	Optigear Synthetic A 220	Alphasyn PG 220	Spheerol EPL 2
	Optigear BM 220	Optigear Synthetic PD 220	Tribol 800/220	Tribol 4020/220-2
	Tribol 1100/220	-	-	-
Fuchs	Renolin CLP 220	Renolin Unisyn CLP 220	Renolin PG 220	Renolit LZR 2 H
	Renolin CLP 220 Plus	-	-	Renolit EP 2
Mobil	Mobilgear 600 XP 220	Mobil SHC 630	Mobil Glygoyle 220	Mobilux EP 2
	-	Mobil SHC Gear 220	-	Mobilgrase XHP 222
Shell	Omala 220	Omala HD 220	Tivela S 220	Alvania EP (LF) 2
	Omala S2 G 220	Omala S4 GX 220	Omala S4 WE 220	Gadus S2 V220 2
Total	Carter EP 220	-	-	Multis EP 2
	Carter XEP 220	Carter SH 220	Carter SY 220	Lical EP 2

Attention: Mineral and PAO-based gearbox oils are not to be mixed with PG (polyglycol)-based synthetic oil.

Greases with different soap bases are not to be mixed.

Lubrication frequency

Oil 1st oil change after 200 operating hours
2nd oil change after 1000 operating hours further oil change after every 1000 operating hours; at least once a year

Grease Once a week or on recommissioningWiederin-betriebnahme.

Lubrication type only according indication in the installation drawing resp. in the maintenance manual.

Accessories (on request)

• Winch frame • Lay-on roller • Spooling guide • Load holding valve • Rope limit switch • Fail save brake •Rope tension control • Cam limit switch (hydraulic/electric) • Bevel gear input • Switch speed gearbox (hydraulic/manual) • Differential (Vario-speed) drive system

Winch Gearboxes Application Questionnaire

Company/Address ____ Date ____

Proper department ____ Person concerned ____ Number of inquiry ____

Phone ____ Fax ____ e-mail ____

Demand ____ Application (e.g. mobile crane, ship-offshore-harbour cranes, tower cranes) ____ Used for (e.g. hoisting-, luffing-, pulling winch) ____

Operating conditions – Design criteria (All values related to ☐ first / ☐ top rope layer)

Rope loads and winch ratings

No. of ropes on drum w ____

Nominal line pull (for each rope)

Line pull at drum F_1 ____ (kN)

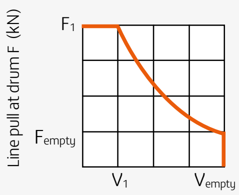
Rope speed V_1 ____ (m/min)

Empty hook

Line pull at drum F_{empty} ____ (kN)

Rope speed V_{empty} ____ (m/min)

Installed power P ____ (kW)



Rope speed v (m/min.)
for P = constant

Rating acc. to FEM Section I

Drive unit class	Load conditions	Betriebsklasse
❑ M	❑ L	❑ T

Approval acc. to classification society

❑ ABS ❑ DNV ❑ GL

❑ LRS ❑ RMRS ❑ Others ____

Alternative rating

Load cond.	F_1 (kN)	T_{dyn} (Nm)	V_1 (m/min)	n_1 (min^{-1})	Time slice (%)
1					
2					
3					
4					
					100 %

Calculated life time ____ (hour)

Safety against ____ (–)

❑ Yield strength ❑ Break

with

❑ T_{dyn} ❑ T_{stat} ____ (Nm)

❑ F_{dyn} ❑ F_{stat} ____ (kN)

// Technical data

Diameter of rope drum D_1 ____ (mm)

Length of drum between flanges L_2 ____ (mm)

Rope diameter d ____ (mm)

Rope groove pitch p ____ (mm)

Drum Lead

❑ right ❑ left

Type of rope groove

❑ DIN 15061 ❑ Special ❑ grooveless

Position of rope anchor

❑ drive side ❑ opposite to drive

No. of rope layers z ____ (-)

Length of rope to be wound including 3 safety turns L_S ____ (m)

Diameter of drum flanges D_2 ____ (mm)

Ratio i ____ (-)

// Drive electric motor

Manufacturer ____

Type ____

Power ____ (kW)

Speed ____ (min.)

Control (Frequency inverter; ON/OFF; Softstarter) ____

Voltage, AC/DC ____

Starting torque T_A ____ (Nm)

Breakdown torque T_k ____ (Nm)

Power-on time ED ____ (%)

Starting per hour ____

// Brake

Apply as

❑ Parking brake ❑ Service brake

Design

❑ Spring loaded multi disc brake

❑ with backstop

❑ Brake motor

❑ Disc brake

❑ Drum brake

Actuation

❑ hydraulically min. release pressure ____ (bar)

❑ electric max. release pressure ____ (bar)

expected back pressure ____ (bar)

// Scope of supply

❑ Motor
❑ Load holding valve
❑ Brake for drive unit
❑ Motor flange
❑ Reaction torque arm
❑ Winch frame
❑ Steel mesh guard
❑ Rope guard
❑ Rope drum
❑ End support bearing
❑ End support bearing with plate
❑ Fail save brake
❑ Lay-on roller
❑ Rope spooling device
❑ Rope tension control
❑ Rope
❑ Rope limit switch
❑ Geared limit switch
❑ Incremental encoder
❑ Hydraulic power pack
❑ Frequency control
❑ Hydraulic control
❑ Approval
❑ Material Certificates

// Drive hydraulic motor

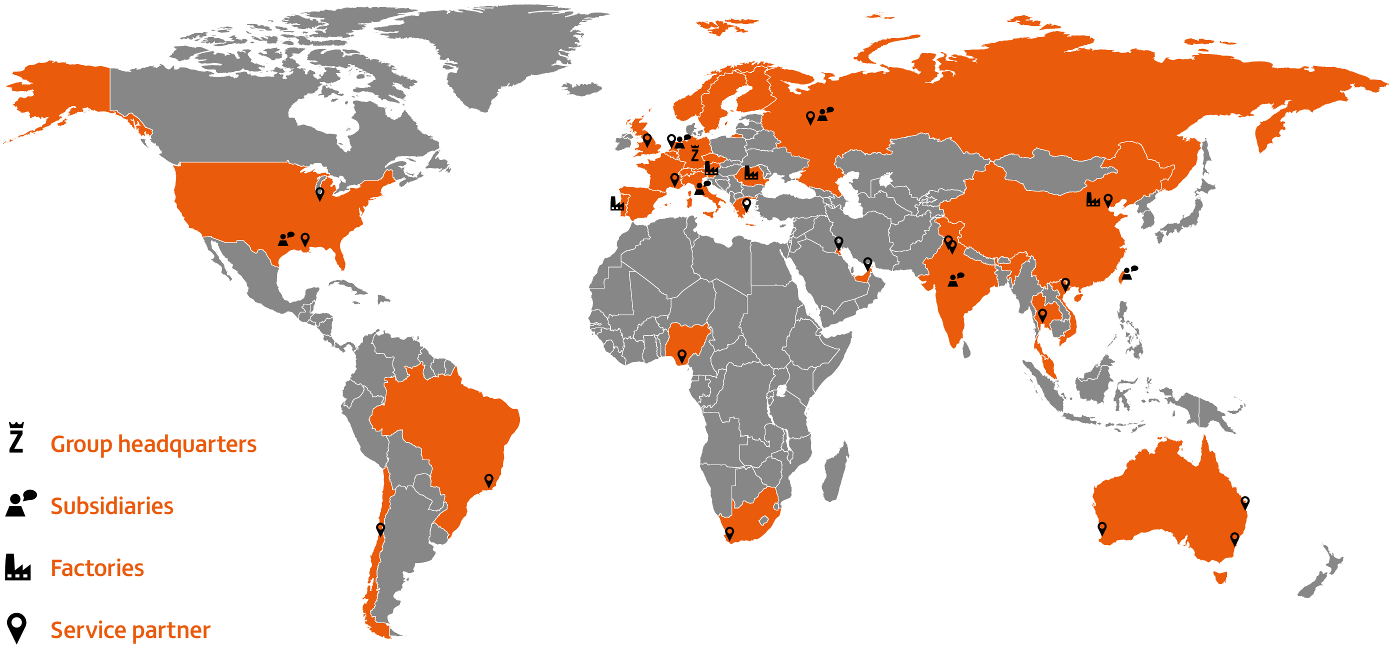
Manufacturer ____

Type ____

Available oil flow Q ____ (l/min)

Available differential pressure Øp ____ (bar)

// Remarks and special operating conditions



ZOLLERN

ZOLLERN GmbH & Co. KG

Heustrasse 1
88518 Herbertingen
Germany
T +49 7586 959-0
F +49 7586 959-575
zat@zollern.com
www.zollern.com