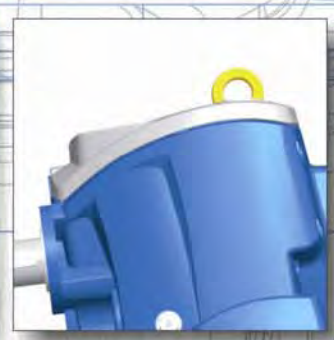
ROBUS IN-LINE HELICAL GEARBOX

rotomotive®



Rotomotive Powerdrives India Ltd. is a Joint Venture between Rotomag Motors & Controls Pvt. Ltd., India(www.rotomag.com) and Motive S.r.l., Italy (www.motive.it)

CERTIFICATE

TÜV INDIA

Management system as per
ISO 9001 : 2000

In accordance with TÜV INDIA procedures, it is hereby certified that

ROTOMOTIVE POWERDRIVES INDIA LTD.
2102/4, GIDC Vithal Udyognagar,
Anand - 388 121, India

operates a quality system in line with the above standard for the following scope

Design, Development, Manufacture, Marketing and After Sales Services of Delphi Series Asynchronous 3 Phase Motors, Delphi Series ATDC brake motors, Worm Gear Units and Custom Build Motors

Certificate Registration No. QM 02 06208
Audit Report No. Q 1997/2008

Valid until: 14.11.2010

TÜV INDIA Certification Body

Mumbai, 13.01.2009

This certification was conducted in accordance with the TÜV INDIA auditing and certification procedures and is subject to regular surveillance audits.
TÜV India Pvt. Ltd., 801, Ashoka Plaza - 1, L.B.S. Marg, Ghatkopar (W), Mumbai - 400 086, India www.tuvindia.co.in

TÜV Q NABCB

Our Manufacturing Plant in India

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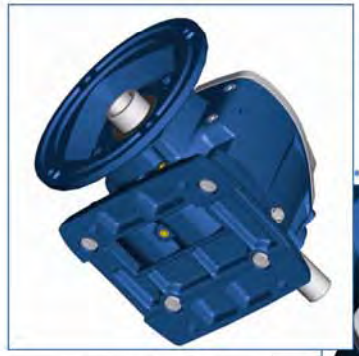
rotomotive®

TECHNICAL CHARACTERISTICS

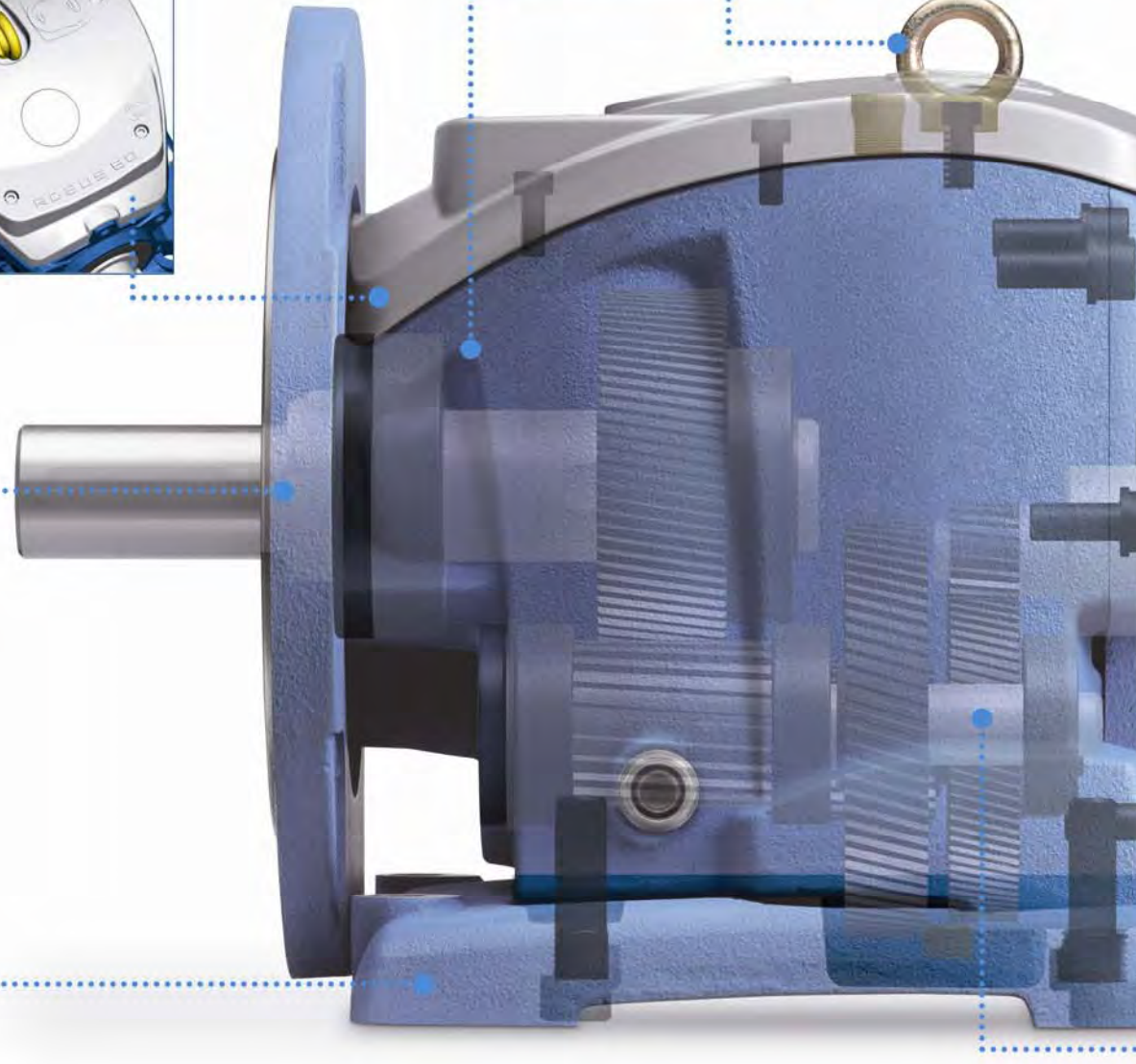


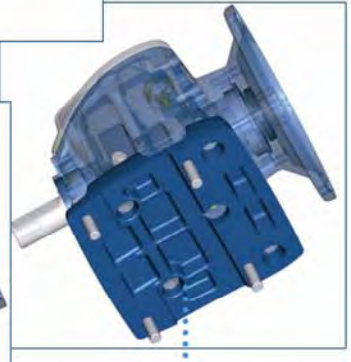
Uniquely contoured, rigid, precise, monobloc, cast iron Body, Base and Flange ensure extreme robustness.

A large top cover in light weight aluminium alloy facilitates the inspection

Except Robus 12, all Robus sizes have a screw-on lifting eyebolt

Modular design with detachable output flange and foot base allows easy and quick conversion between foot and flange mounting





Various detachable foot bases in solid cast iron make Robus interchangeable with any other gearbox brand

FLEXIBLE MOUNTING

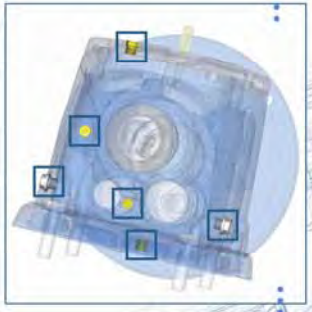
Easy to examine and maintain

Minimum maintenance requirement.
All sizes are supplied with long-life synthetic oil.

IEC flange and hollow shaft.

Choice of hollow input flanges permits direct mounting of any standard motor

Unique construction of Robus makes it possible to mount any size in any position.
This flexibility is achieved by:



+ ZZ shielded pre-lubricated bearings on input and output shaft

+ 6 interchangeable plugs, including one breather plug and a level plug

+ mechanical parts locked in their positions by snap rings and spacers. This also ensures better absorbtion of axial thrust and prolongs the life of bearings

ENGINEERED FOR HIGHER RELIABILITY

Use of high strength steels like 15CrMo4 and case hardening to 58 +2 HRC reduce the wear rate in wheels. All wheels are profile ground to Din 3962 class 6 accuracy for low noise and high efficiency.

Shafts are made from 42CrMo4 steel and tempered to reach a hardness of 23-35 HRC, thus increasing their capacity to withstand shearing stesses.

If the mechanical robustness and the service factor of a helical gearbox are mainly influenced by the centre distance of the last stage, Robus confirms to be very robust (see "X2" at page 13).

Single stages ratios between 2 and 6, together with proper gears sizes, result mathematically in higher teeth number and size (module) of each wheel and a better fractioned load among the reduction stages. That influences both durability and torque transmission capability.

Dual bearing support on the input shaft assures precise alignment of the first stage gears and reduces vibrations and consequent gear wear.

Intermediate shaft is rigidly supported by 3 bearings, with no overhang wheel, thus imparting greater flexural strength and better meshing. This increases the overloading capacity and takes to lower noise.

Smaller overhang distance of output shaft from supporting bearing in order to withstand higher redial loads.

Oversized bearings size (page 15), in order to withstand higher loads.

HIGHER SERVICE FACTOR IN COMPACT SIZE

Offered service factor

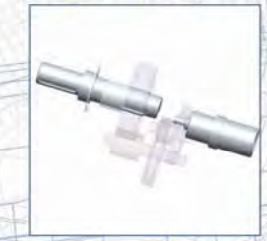
Which features determine the service factor offered by a helical gearbox ?

The service factor of a gearbox is its capacity to withstand operating load and overloads, a certain number of starts, the duration of operating time, mechanical shocks and vibrations. Thus, higher the service factor, greater is the possibility of trouble free operation and increased life. Without aiming to be completely exhaustive, we list here the main features that influence the service factor:

Amongst all parts, the last stage gears are subjected to highest mechanical stresses. Higher centre distance which in turn results in higher module considerably increases the service factor. ROBUS excels in the area (see measures at page 18)

Compared to fractioned or Aluminium body, the monobloc cast-iron body of ROBUS provides higher rigidity and mechanical robustness.

Use of high strength steels like 15CrMo4 and case hardening to 58 ±2 HRC reduce the wear rate in wheels. All wheels are profile ground to Din 3962 class 6 accuracy



Shafts are made from 42CrMo4 steel and tempered to reach hardness of 23-35 HRC, thus increasing their capacity to withstand shearing stresses and torsion effect.

Optimal ratios (between 2 and 6) in the several stages, together with appropriate centre distances, result in higher number of teeth and size (module) of each wheel and better torque transmission fractioning through various stages. This improves the overall durability.

Dual bearing support on the input shaft ensures precise alignment of the first stage gears and reduces vibrations and consequent gear wear

An intermediate shaft rigidly supported by 3 bearings instead of 2, with no overhang wheel, imparts greater flexural strength and smoother meshing

Oversized bearings (see ROBUS bearing list at page 15), allow the gearbox to withstand higher operating loads

Mechanical parts locked in their position by snap rings and spacers. This ensures better absorbtion of axial thrust and prolongs the life of bearings

Smaller overhang of output shaft from supporting bearing in order to withstand higher radial loads

CALCULATION OF PERFORMANCE PARAMETERS

Rated output torque M_{n2} (Nm)
Torque output transmissible under uniform loading and referred to the input speed n_1 and the corresponding output speed n_2. The output torque can be calculated with the following formula:

$$M_{n2} = \frac{P_{n1}\,[kW] \cdot 9550}{n_2} \cdot \eta$$

Torque demand M_{r2} (Nm)
Torque calculated based on application requirements. It must be < M_{n2} of the chosen ROBUS unit.

Input power P_{n1} (kW)
This is the power value of the motor applied to the input shaft and corresponding to a certain input speed n_1, a service factor $f_s = 1$ and a duty service S_1.
It is even possible to calculate the motor size necessary by using the formula:

$$P_{n1}\,[kW] = \frac{M_{r2} \cdot n_2}{9550 \cdot \eta}$$

Since the value calculated in this way could not really correspond to an input power actually available in the IEC standardised motors, it will be necessary to choose, among the input powers available, the one which is immediately higher, checking this in the Rotomotive catalogue of the motors.

Efficiency η (%)

An inherent factor in the selection helical gear boxes is the efficiency η, defined as the ratio between the mechanical power coming out from the output shaft, and the power in the input shaft:

$$\eta = \frac{P_{n2}}{P_{n1}}$$

The efficiency in helical gearboxes is mainly determined by the gearing and bearing friction.
The efficiency of ROBUS varies with the nr of stages: it's 94% when the reduction stages are 3, 96% when the stages are 2. The starting efficiency is always less than the efficiency at rated speed.

Gear ratio i
It is the relationship of the input speed n_1 and the output speed n_2

$$i = \frac{n_1}{n_2}$$

In the combined, the total ratio is the result of the product of the ratio of the two single gearboxes.

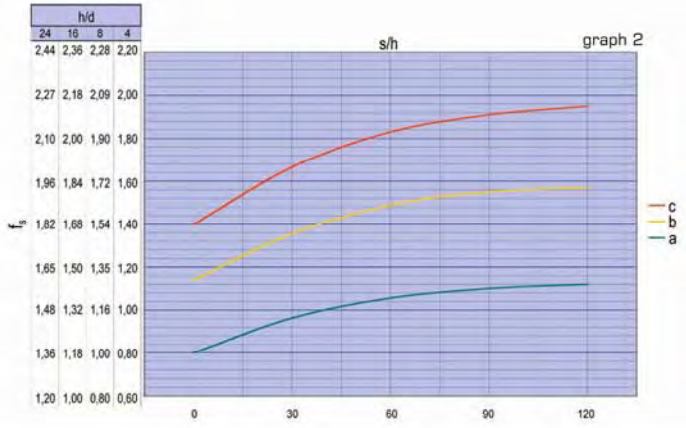
Input speed n_1 (rpm)
It is the speed the ROBUS unit is driven at.

Output speed n_2 (rpm)
It is the rotation speed of the output shaft.

Service factor f_s
It is a numeric value describing the ROBUS unit service duty. With unavoidable approximation, it takes into consideration:

- The daily working hours **h/d**
- The load classification (see table 2), and then the moment of inertia of the driven masses.
- The number of starts per hour **s/h**
- The presence of brake motors, for which it is necessary to multiply for 1.12 the service factor value deducted by the graph 2.
- The significance of the application in terms of safety, for example lifting of parts.

In the graph 2, the service factor f_{sr} required by a certain application can be attained, after having selected the proper "daily working hours" (h/d) column, by intersecting the number of starts per hour (s/h) and one of the a, b or c curves. The curves a, b and c are linked with the load classification described in the table 2.



graph 2

tab. 2

	load classification	application
c	uneven operation, heavy loads, larger masses to be accelerated	conveyors with violent jerks; compressors ad alternate pumps with 1 or more cylinders; machinery for bricks, tiles and clay; kneaders; milling machines; lifting winches with buckets; rotting furnaces; heavy fans or mining purposes; mixers for heavy materials; machine-tools; planing kinds; alternating saws; shears; tumbling barrels; vibrators; shredders; turntables
b	starting with moderate loads, uneven operating conditions, medium size masses to be accelerated	belt conveyors with varied load with transfer of bridge trucks for light duty; levelling machines; shakers and mixed for liquid with variable density and viscosity; machines for the food industry (kneading troughs, mincing machines, slicing machines, etc); sifting machines for sand gravel; textile industry machines; cranes, hoists, goodstifts; fertilizer scrapers; concrete mixers; folding machines; winches; crane mechanisms
a	easy starting, smooth operation, small masses be accelerated	belt conveyors for light material; centrifugal pumps; rotary gear pumps; screw feeders for light materials; lifts; bottling machines; auxiliary controls of tool machines; fans; power generators; fillers; small mixers

If, after the selection of the right M_{r2} and n_2 in the following performance tables, you don't find a ROBUS unit whose service factor f_s is > of the requested one f_{sr}, you can choose a ROBUS unit in which $M_{n2} > M_{r2}$.
In fact, in order to satisfy f_{sr}, you can choose another ROBUS unit whose output torque is > M_{c2} output torque, where:
$M_{c2} = M_{r2} \cdot f_{sr}$
Note: This rule is valid only if the new ROBUS unit that has been selected in this way has a service factor $f_s > 1$ in the performance tables.
From another point of view, the value of f_s in the performance tables refers to a case in which the effective torque requested by the application M_{r2} matches perfectly with the one appearing on the catalogue M_{n2}.
Whenever the torque indicated in the performance table is higher than the requested one, the offered service factor of the performance table can be increased according to the formula:

$$f_s \text{ real} = \frac{f_s \text{ on the table} \cdot M_{n2} \text{ on the table}}{M_{r2}}$$

The value of f_s calculated in this way must be ≥ f_{sr}.

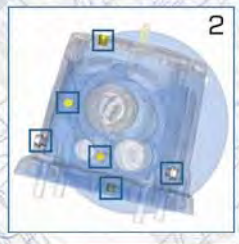
LUBRICATION

Each Robus is supplied with long-life synthetic oil and do not require any maintenance.
The oil quantity is suitable for B3 mounting position

ROBUS	oil (lt)						ISO	temp.	oil type
	B3	B6	B7	B8	V5	V6			
12	0,25	0,4	0,35	0,55	0,55	0,35	VG 220	-25 +80°C	Mobil SHC 630 Shell Tivela S220 Klubersynth GH6-220
21	0,3	0,75	0,95	0,95	1,05	0,85			
30	0,7	1,5	1,5	1,5	1,65	1,6			
60	1,1	1,8	2	2	3,5	1,6			
85	1,2	2,5	3,4	3,4	4,1	3,8			
150	2,3	6,3	6,5	6,5	7,7	6,7			
300	4,6	11,3	11,7	11,7	13,4	11,7			

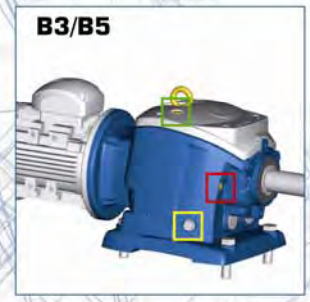
After adapting the oil quantity, each Robus, can be mounted in ANY position, thus giving big advantages in the inventory reduction and interchangeability due to the following 3 characteristics:

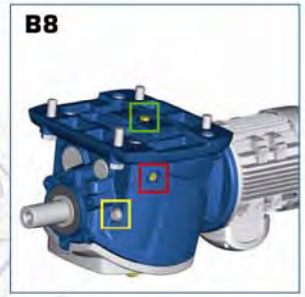
ZZ shielded pre-lubricated bearings on input and output shaft

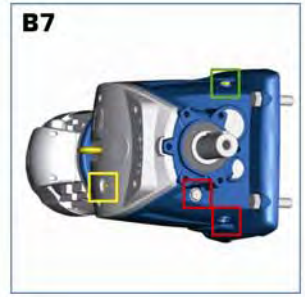


6 interchangeable plugs, including one breather plug and a level plug. Level and breather plug must be positioned according to this chart

Mechanical parts locked in their positions by circlips and spacers. This also ensures better absorbtion of axial thrust and prolongs the life of bearings



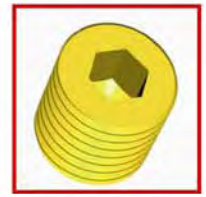




B5, V1 & V3 positions are for flange mounted

breather plug

level plug



filler plug

SELECTION GUIDE KW / SIZE / RATIO

service factor fs =1.5

input n_1 = 1440 RPM

input PAM	63		71		80		90		100/112			132		160		180		ROBUS ratio i:
	11 mm		14 mm		19 mm		24 mm		28 mm			38 mm		42 mm		48 mm		
P_{n1} KW	0.12	0.18	0.25	0,37	0,55	0,75	1,1	1,5	2,2	3	3.7	5,5	7,5	11	15	18,5	22	
P_{n1} HP	0.18	0.25	0.35	0,5	0,75	1	1,5	2	3	4	5	7,5	10	15	20	25	30	
120				30	60	60	85	150	150	300	300							120
110																		110
100																		100
90				21	30		60	85										90
80	12	12	12						85	150		300						80
70					21	30							300					70
60								60			150							60
55				12			30		60	85		150		300				55
50						21												50
45					12		21	30			85							45
40																		40
35									60	85		150		300				35
30																		30
25							21	30		60	85		150		300			25
20					12													20
15						12	12	21	30	30	60	85	85	150	150	300	300	15
10											30							10
5																		5

= 3 stages

= 2 stages

PERFORMANCE TABLE 12-21

Service factor fs=1.5 @ 1440 RPM

ROBUS 12

Peak Torque = 120 Nm

	Rated Ratio		**4**	**5**	**7.5**	**10**	**13**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**60**	**70**	**80**
	Real Ratio		4.05	4.99	7.44	10.04	12.65	15.02	19.69	24.76	29.36	35.17	39.61	45.45	49.9	59.23	68.73	79.85
	Stage		2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
Input:	Robus 12 with 2 Pole / 2880 RPM motors																	
63, 71, 80	KW	Frame	Torque (Nm)															
	Speed		711.1	577.2	387.1	286.9	227.7	191.7	146.3	116.3	98.1	81.9	72.7	63.4	57.7	48.6	41.9	36.1
	0.37	71A	4.7	5.7	8.5	11.5	14.5	17.2	21.4	26.9	31.9	38.3	43.1	49.4	54.3	64.4	74.8	86.9
	0.55	71B	6.9	8.5	12.7	17.1	21.6	25.6	31.8	40.0	47.5	56.9	64.0	73.5	80.7	95.8	111	Robus 21
	0.75	80A	9.4	11.6	17.3	23.4	29.4	35.0	43.4	54.6	64.7	77.5	87.3	100	110	Robus 21		
	1.1	80B	13.8	17.0	25.4	34.3	43.2	51.3	63.7	80.1	95.0	114	Robus 21				Robus 30	
Output:	Robus 12 with 4 Pole / 1440 RPM motors																	
63B5	Speed		355.6	288.6	193.5	143.4	113.8	95.9	73.1	58.2	49.0	40.9	36.4	31.7	28.9	24.3	21.0	18.0
	0.18	63B	4.5	5.6	8.3	11.2	14.1	16.8	20.8	26.2	31.1	37.2	41.9	48.1	52.8	62.7	72.7	84.5
	0.25	71A	6.3	7.7	11.5	15.6	19.6	23.3	28.9	36.4	43.2	51.7	58.2	66.8	73.4	87.1	101	117
	0.37	71B	9.3	11.5	17.1	23.1	29.1	34.5	42.8	53.9	63.9	76.5	86.2	98.9	109	Robus 21		
	0.55	80A	13.8	17.0	25.4	34.3	43.2	51.3	63.7	80.1	95.0	114	Robus 21				Robus 30	
	0.75	80B	18.9	23.2	34.6	46.7	58.9	69.9	86.8	109	Robus 21				Robus 30		Robus 60	
	1.1	80C	27.7	34.1	50.8	68.5	86.4	103	Robus 21			Robus 30		Robus 60				
	Robus 12 with 6 Pole / 960 RPM motors																	
Shaft:	Speed		237.0	192.4	129.0	95.6	75.9	63.9	48.8	38.8	32.7	27.3	24.2	21.1	19.2	16.2	14.0	12.0
20, 25	0.18	71A	6.8	8.4	12.5	16.8	21.2	25.2	31.3	39.3	46.6	55.8	62.9	72.2	79.2	94.0	109	Robus 21
	0.25	71B	9.4	11.6	17.3	23.4	29.4	35.0	43.4	54.6	64.7	77.5	87.3	100	110	Robus 21		
	0.37	80A	14.0	17.2	25.6	34.6	43.6	51.7	64.3	80.8	95.8	115	Robus 21				Robus 30	
	0.55	80B	19.6	24.2	36.1	48.7	61.4	72.9	95.5	120	Robus 21			Robus 30			Robus 60	

Service factor fs=1.5 @ 1440 RPM

ROBUS 21

Peak Torque = 210 Nm

	Rated Ratio		**4**	**5**	**7**	**10**	**13**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**70**	**80**	**90**	**100**	**110**	**120**
	Real Ratio		4	4.88	6.84	10.42	12.68	15.75	19.95	24.5	30.18	32.51	39.27	46.07	49.28	57.2	59.94	69.57	79.29	91.47	96.44	106.18	119.93
	Stage		2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
Input:	Robus 21 with 2 Pole / 2880 RPM motors																						
71, 80, 90	KW	Frame	Torque (Nm)																				
	Speed		720.0	590.0	421.1	276.4	227.1	182.9	144.4	117.6	95.4	88.6	73.3	62.5	58.4	50.3	48.0	41.4	36.3	31.5	29.9	27.1	24.0
	0.55	71B	Robus 12																128	148	156	172	194
	0.75	80A	Robus 12														132	153	175	Robus 30			
	1.1	80B	Robus 12										127	149	159	185	194	Robus 30		Robus 60			
	1.5	90S	18.6	22.7	31.8	48.5	59.0	73.3	92.9	114	133	143	173	Robus 30			Robus 60						
	2.2	90L	27.3	33.3	46.7	71.1	86.6	107	136	167	195	Robus 30		Robus 60					Robus 85				
Output:	Robus 21 with 4 Pole / 1440 RPM motors																						
71B5,	Speed		360.0	295.1	210.5	138.2	113.6	91.4	72.2	58.8	47.7	44.3	36.7	31.3	29.2	25.2	24.0	20.7	18.2	15.7	14.9	13.6	12.0
80/90B5	0.37	71B	Robus 12													124	130	151	173	199	Robus 30		
	0.55	80A	Robus 12										127	149	159	185	194	Robus 30			Robus 60		
	0.75	80B	Robus 12								133	143	173	203	Robus 30			Robus 60					
	1.1	90S	Robus 12						136	167	195	Robus 30		Robus 60						Robus 85			
	1.5	90L	37.2	45.4	63.7	97.0	118	147	186	Robus 30		Robus 60						Robus 85			Robus 150		
	Robus 21 with 6 Pole / 960 RPM motors																						
	Speed		240.0	196.7	140.4	92.1	75.7	61.0	48.1	39.2	31.8	29.5	24.4	20.8	19.5	16.8	16.0	13.8	12.1	10.5	10.0	9.0	8.0
	0.18	71A	Robus 12																126	145	153	169	190
Shaft:	0.25	71B	Robus 12														132	153	175	202	Robus 30		
25, 30	0.37	80A	Robus 12										128	150	161	187	196	Robus 30			Robus 60		
	0.55	80B	Robus 12								146	158	191	Robus 30				Robus 60					
	0.75	90S	27.9	34.1	47.8	72.8	88.5	110	139	171	197	Robus 30		Robus 60					Robus 85				
	1.1	90L	41.0	50.0	70.0	107	130	161	Robus 30			Robus 60						Robus 85		Robus 150			

PERFORMANCE TABLE 30-60

Service factor fs=1.5 @ 1440 RPM

ROBUS 30 — Peak Torque = 300 Nm

	Rated Ratio		4	5	7	10	15	18	20	23	25	30	35	40	45	50	55	60	70	80	90	100	110	120
	Real Ratio		4.05	5.66	6.79	9.96	14.27	18.37	20.36	23.02	25.38	30.44	35.46	39.26	47.66	49.45	55.56	60.16	72.29	84.26	91.24	102.47	106.3	120.2
	Stage		2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Input:	Robus 30 with 2 Pole / 2880 RPM motors																							
	KW	Frame	Torque (Nm)																					
71, 80, 90*,	Speed		711.1	508.8	424.2	289.2	201.8	156.8	141.5	125.1	113.5	94.6	81.2	73.4	60.4	58.2	51.8	47.9	39.8	34.2	31.6	28.1	27.1	24.0
100*, 112*	0.75	80A	Robus 12															Robus 21			201	226	234	265
	1.1	80B	Robus 12											Robus 21					234	273	295	Robus 60		
	1.5	90S	Robus 21												210	218	245	265	Robus 60					
	2.2	90L	Robus 21										229	254	Robus 60						Robus 85			
Output:	3.7	100LB	46.5	65.0	78.0	114	164	211	234	264	276	Robus 60					Robus 85			Robus 150				
	Robus 30 with 4 Pole / 1440 RPM motors																							
	Speed		355.6	254.4	212.1	144.6	100.9	78.4	70.7	62.6	56.7	47.3	40.6	36.7	30.2	29.1	25.9	23.9	19.9	17.1	15.8	14.1	13.5	12.0
71B5,	0.37	71B	Robus 12															Robus 21				223	231	262
80/90B5	0.55	80A	Robus 12											Robus 21					234	273	295	Robus 60		
	0.75	80B	Robus 12									Robus 21				218	245	265	Robus 60					
	1.1	90S	Robus 12						Robus 21				229	254	Robus 60						Robus 85			
	1.5	90L	Robus 21							214	224	269	Robus 60						Robus 85		Robus 150			
	2.2	100L	55.3	77.3	92.7	136	195	251	278	Robus 60						Robus 85			Robus 150					
Shaft:	3.7	112MB	93.0	130	156	229	Robus 60			Robus 85			Robus 150						Robus 300					
	Robus 30 with 6 Pole / 960 RPM motors																							
	Speed		237.0	169.6	141.4	96.4	67.3	52.3	47.2	41.7	37.8	31.5	27.1	24.5	20.1	19.4	17.3	16.0	13.3	11.4	10.5	9.4	9.0	8.0
30, 35	0.25	71B	Robus 12															Robus 21				226	234	265
	0.37	80A	Robus 12											Robus 21					236	275	298	Robus 60		
	0.55	80B	Robus 12									Robus 21			231	240	270	292	Robus 60					
	0.75	90S	Robus 21										235	260	Robus 60						Robus 85			
	1.1	90L	Robus 21					188	209	235	246	295	Robus 60						Robus 85		Robus 150			
	1.5	100L	56.6	79.0	94.8	139	199	257	284	Robus 60					Robus 85						Robus 150			Robus 300
	2.2	112M	83.0	116	139	204	292	Robus 60					Robus 85		Robus 150					Robus 300				

*For ROBUS 30 : Input 90 available upto 60 ratio • Input 100/112 available upto 40 ratio

Service factor fs=1.5 @ 1440 RPM

ROBUS 60 — Peak Torque = 600 Nm

	Rated Ratio		4	5	8	10	13	15	20	25	30	35	40	45	50	55	60	70	80	90	100	110	120
	Real Ratio		3.96	5.23	7.46	10.05	12.53	15.07	18.79	26.4	30.17	34.25	41.29	46.13	50.82	55.61	59.29	68.44	79.85	84.7	98.82	105.6	123.2
	Stage		2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
Input:	Robus 60 with 2 Pole / 2880 RPM motors																						
	KW	Frame	Torque (Nm)																				
80, 90*,	Speed		727.3	550.7	386.1	286.6	229.8	191.1	153.3	109.1	95.5	84.1	69.8	62.4	56.7	51.8	48.6	42.1	36.1	34.0	29.1	27.3	23.4
100*, 112*	1.1	80B	Robus 12										Robus 21					Robus 30			320	342	398
	1.5	90S	Robus 21											Robus 30				302	352	374	Robus 85		
	2.2	90L	Robus 21									Robus 30		298	329	360	384	443	517	548	Robus 85		
	3.7	100LB	Robus 30								328	373	449	502	553	Robus 85					Robus 150		
Output:	Robus 60 with 4 Pole / 1440 RPM motors																						
	Speed		363.6	275.3	193.0	143.3	114.9	95.6	76.6	54.5	47.7	42.0	34.9	31.2	28.3	25.9	24.3	21.0	18.0	17.0	14.6	13.6	11.7
80/90B5,	0.55	80A	Robus 12											Robus 21				Robus 30			320	342	398
100/112B5	0.75	80B	Robus 12									Robus 21			Robus 30			302	352	374	436	466	543
	1.1	90S	Robus 12					Robus 21			Robus 30		298	329	360	384		443	517	548	Robus 85		
	1.5	90L	Robus 21						Robus 30		302	364	407	448	491	523		Robus 85			Robus 150		
	2.2	100L	Robus 30								390	443	534	597	Robus 85				Robus 150				
Shaft:	3.7	112MB	Robus 30				288	346	432	Robus 85			Robus 150						Robus 300				
	Robus 60 with 6 Pole / 960 RPM motors																						
	Speed		242.4	183.6	128.7	95.5	76.6	63.7	51.1	36.4	31.8	28.0	23.3	20.8	18.9	17.3	16.2	14.0	12.0	11.3	9.7	9.1	7.8
35, 40	0.37	80A	Robus 12										Robus 21					Robus 30			323	345	402
	0.55	80B	Robus 12								Robus 21			Robus 30				332	387	411	479	512	598
	0.75	90S	Robus 21									Robus 30		305	336	368	392	453	528	Robus 85			
	1.1	90L	Robus 21						Robus 30			332	401	448	493	540	575	Robus 85		Robus 150			
	1.5	100L	Robus 30								399	453	546	Robus 85						Robus 150			Robus 300
	2.2	112M	Robus 30						385		585	Robus 85		Robus 150					Robus 300				

*For ROBUS 60 : Input 90 available upto 20 (2 stage) ratio & upto 90 (3 stage) ratio • Input 100/112 available upto 20 (2 stage) ratio & upto 60 (3 stage) ratio

PERFORMANCE TABLE 85-150

Service factor fs=1.5 @ 1440 RPM

ROBUS 85

Peak Torque = 850 Nm

	Rated Ratio		4	5	7	10	13	15	20	23	25	30	35	40	45	50	55	60	70	80	90	100	110	120
	Real Ratio		4.03	4.78	6.65	9.96	13.54	14.83	21.27	23.31	24.05	31.94	33.98	40.81	44.46	50.25	52.92	63.05	70.75	79.23	92.4	101.24	105.99	116.13
	Stage		2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
Input: 90, 100*, 112*, 132*	Robus 85 with 2 Pole / 2880 RPM motors																							
	KW	Frame	Torque (Nm)																					
	Speed		714.6	602.5	433.1	289.2	212.7	194.2	135.4	123.6	119.8	90.2	84.8	70.6	64.8	57.3	54.4	45.7	40.7	36.3	31.2	28.4	27.2	24.8
	2.2	90L	Robus 21										Robus 30		Robus 60							655	686	751
	3.7	100LB	Robus 30									Robus 60					576	686	770	Robus 150				
	5.5	132S	68.8	81.6	114	170	231					517	Robus 150								Robus 300			
	7.5	132M	93.8	111	155	232	315					704	Robus 150								Robus 300			
Output: 100/112B5, 132B5	Robus 85 with 4 Pole / 1440 RPM motors																							
	Speed		357.3	301.3	216.5	144.6	106.4	97.1	67.7	61.8	59.9	45.1	42.4	35.3	32.4	28.7	27.2	22.8	20.4	18.2	15.6	14.2	13.6	12.4
	1.1	90S	Robus 12						Robus 21				Robus 30		Robus 60							655	686	751
	1.5	90L	Robus 21							Robus 30			Robus 60						624	699	815	Robus 150		
	2.2	100L	Robus 30							Robus 60						650	685	816	Robus 150					
	3.7	112MB	Robus 30				Robus 60				552	695	739	Robus 150					Robus 300					
	5.5	132S	138	163	227	340	462	Robus 150								Robus 300								
	7.5	132M	188	223	310	464	630	Robus 150						Robus 300										
Shaft: 40, 50	Robus 85 with 6 Pole / 960 RPM motors																							
	Speed		238.2	200.8	144.4	96.4	70.9	64.7	45.1	41.2	39.9	30.1	28.3	23.5	21.6	19.1	18.1	15.2	13.6	12.1	10.4	9.5	9.1	8.3
	0.75	90S	Robus 21										Robus 30		Robus 60						611	670	701	768
	1.1	90L	Robus 21						Robus 30				Robus 60						686	769	Robus 150			
	1.5	100L	Robus 30							Robus 60					588	665	700	834	Robus 150					Robus 300
	2.2	112M	Robus 30						Robus 60				659	792	Robus 150					Robus 300				
	3.7	132MA	139	165	229	343	466	Robus 150								Robus 300								
	5.5	132MB	206	245	341	510	693	Robus 150					Robus 300											

*For ROBUS 85 : Input 100/112 available upto 70 ratio • Input 132 available upto 13 (2 stage) ratio & upto 30 (3 stage) ratio

Service factor fs=1.5 @ 1440 RPM

ROBUS 150

Peak Torque = 1550 Nm

	Rated Ratio		4	5	8	10	15	18	20	23	25	30	35	40	45	50	55	60	70	80	90	100	110	120
	Real Ratio		4.06	5.02	8.03	10.37	15.29	18.15	19.83	22.83	27.5	29.9	34.47	38.78	45.12	50.35	57.74	61.99	72.13	80.06	92.13	100.7	107.2	117.17
	Stage		2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Input: 90,100,112 132*, 160*	Robus 150 with 2 Pole / 2880 RPM motors																							
	KW	Frame	Torque (Nm)																					
	Speed		709.4	573.7	358.7	277.7	188.4	158.7	145.2	126.1	104.7	96.3	83.6	74.3	63.8	57.2	49.9	46.5	39.9	36.0	31.3	28.6	26.9	24.6
	3.7	100LB	Robus 30									Robus 60					Robus 85			871	1002	1095	1166	1275
	5.5	132SA	Robus 85														934	1002	Robus 300					
	7.5	132SB	Robus 85											855	995	1110	1273	1367	Robus 300					
	11	160MB	139	171	274	354	522	Robus 300																
	15	160MC	189	234	374	483	712	Robus 300																
	18.5	160L	233	288	461	595	878	Robus 300																
Output: 132B5 160/180B5	Robus 150 with 4 Pole / 1440 RPM motors																							
	Speed		354.7	286.9	179.3	138.9	94.2	79.3	72.6	63.1	52.4	48.2	41.8	37.1	31.9	28.6	24.9	23.2	20.0	18.0	15.6	14.3	13.4	12.3
	1.5	90L	Robus 21							Robus 30			Robus 60						Robus 85			888	946	1033
	2.2	100L	Robus 30							Robus 60						Robus 85			933	1036	1192	1303	1387	1516
	3.7	112MB	Robus 30				Robus 60				Robus 85			844	982	1095	1256	1349	Robus 300					
	5.5	132S	Robus 85								889	967	1115	1254	1459	Robus 300								
	7.5	132M	Robus 85					845	923		1213	1319	1520	Robus 300										
	11	160M	277	343	548	708	1044	Robus 300																
	15	160L	378	467	748	965	1424	Robus 300																
Shaft: 50, 60	Robus 150 with 6 Pole / 960 RPM motors																							
	Speed		236.5	191.2	119.6	92.6	62.8	52.9	48.4	42.0	34.9	32.1	27.9	24.8	21.3	19.1	16.6	15.5	13.3	12.0	10.4	9.5	9.0	8.2
	1.1	90L	Robus 21						Robus 30				Robus 60						Robus 85		894	977	1040	1137
	1.5	100L	Robus 30							Robus 60					Robus 85				954	1059	1219	1332	1418	Robus 300
	2.2	112M	Robus 30						Robus 60				Robus 85		876	977	1120	1203	1400	Robus 300				
	3.7	132MA	Robus 85									976	1125	1266	1472	Robus 300								
	5.5	132MB	Robus 85						1015		1334	1450	Robus 300											
	7.5	132MC	284	351	561	724	1068	1267	1385	Robus 300														
	11	160M	416	514	822	1062	Robus 300																	

*For ROBUS 150 : Input 132 available upto 20 (2 stage) ratio & upto 60 (3 stage) ratio • Input 160 available upto 15 ratio

PERFORMANCE TABLE 300

Service factor fs=1.5 @ 1440 RPM

ROBUS 300 — Peak Torque = 3000 Nm

			4	**5**	**7**	**10**	**13**	**15**	**17**	**20**	**23**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**70**	**80**	**90**	**100**	**110**	**120**
	Real Ratio		4	5.42	7.34	9.74	13.38	15.26	16.75	20.92	22.96	24.63	28.33	35.72	38.36	44.72	48.03	55.42	60.82	69.95	81.51	89.28	101.79	111.72	115.43
	Stage		2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Input: 100, 112, 132, 160*, 180*	Robus 300 with 2 Pole / 2880 RPM motors																								
	KW	Frame	Torque (Nm)																						
	Speed		720.0	531.4	392.4	295.7	215.2	188.7	171.9	137.7	125.4	116.9	101.7	80.6	75.1	64.4	60.0	52.0	47.4	41.2	35.3	32.3	28.3	25.8	25.0
	5.5	132SA	Robus 85														Robus 150						1646	1807	1867
	7.5	132SB	Robus 85														Robus 150			1542	1797	1969	2245	2463	2545
	11	160MB	Robus 150														1553	1792							
	15	160MC	Robus 150											1575	1692	1972	2118	2444							
Output: 160/180B5, 225B5	18.5	160L	Robus 150										1541	1943	2086	2432	2612								
	22	180M	273	370	501	665	914	1042				1593	1832												
	Robus 300 with 4 Pole / 1440 RPM motors																								
	Speed		360.0	265.7	196.2	147.8	107.6	94.4	86.0	68.8	62.7	58.5	50.8	40.3	37.5	32.2	30.0	26.0	23.7	20.6	17.7	16.1	14.1	12.9	12.5
	3	112MA	Robus 30						Robus 60					Robus 85			Robus 150					1575	1796	1971	2036
	3.7	112MB	Robus 30				Robus 60					Robus 85					Robus 150			1522	1773	1942	2215	2431	2511
	5.5	132S	Robus 85								Robus 150						1553	1792	1967	2262	2636				
	7.5	132M	Robus 85						Robus 150						1692	1972	2118	2444	2682						
	11	160M	Robus 150									1593	1832	2310	2481	2893									
	15	160L	Robus 150									2172	2499												
	18.5	180M	459	622	843	1118	1536	1752				2679													
	22	180L	546	740	1002	1330	1827	2084																	
Shaft: 60, 70	Robus 300 with 6 Pole / 960 RPM motors																								
	Speed		240.0	177.1	130.8	98.6	71.7	62.9	57.3	45.9	41.8	39.0	33.9	26.9	25.0	21.5	20.0	17.3	15.8	13.7	11.8	10.8	9.4	8.6	8.3
	1.5	100L	Robus 30								Robus 60					Robus 85				Robus 150					1527
	2.2	112M	Robus 30							Robus 60				Robus 85			Robus 150				1582	1732	1975	2168	2240
	3	132S	Robus 85												Robus 150				1609	1851	2157	2362	2693		
	3.7	132MA	Robus 85											Robus 150			1567	1809	1985	2283	2660	2914			
	5.5	132MB	Robus 85							Robus 150				1733	1861	2169	2330	2688	2950						
	7.5	132MC	Robus 150								1603	1629	1874	2363	2538	2958									
	11	160M	Robus 150					1563				2390	2749												
	15	160L	559	757	1025	1360	1869	2131																	

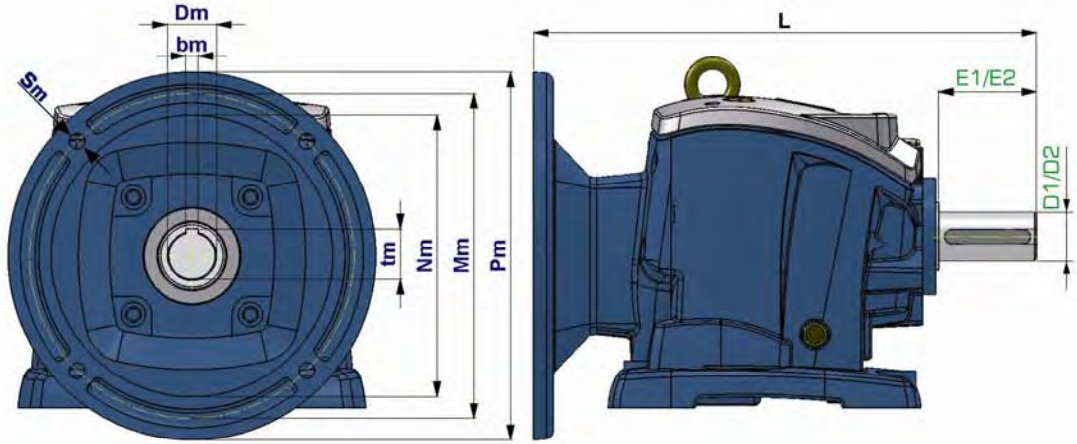
*For ROBUS 300 : Input 160 available upto15 (2 stage) ratio & upto 55 (3 stage) ratio • Input 180 available upto 15 (2 stage) ratio & upto 40 (3 stage) ratio

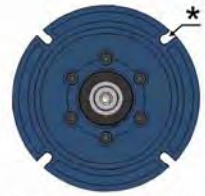
Note: Efficiency is computed considering the frictional losses of output seals, bearing frictional losses and lubrication losses. Torque increases by 3% in 2 stage gearboxes and 5% in 3 stage gearboxes if these losses are not considered.

DIMENSIONS

ROBUS	motor type		Nm	Mm	Pm	Sm	Dm	tm	bm	L	
										D1	D2
12	63	B14	60	75	90	Ø6	11	12,8	4	203,0	213,0
	71	B14	70	85	105	Ø7	14	16,3	5	210,0	220,0
	80	B14	80	100	120		19	21,8	6	230,0	240,0
21	71	B5	110	130	160	M8	14	16,3	5	273,0	283,0
	71	B14	70	85	105	Ø7					
	80	B5	130	165	200	M10	19	21,8	6	274,0	284,0
	80	B14	80	100	120	Ø7					
	90	B5	130	165	200	M10	24	27,3	8	274,0	284,0
	90	B14	95	115	140	Ø9					
30	71	B5	110	130	160	M8	14	16,3	5	317,6	327,6
	80	B5	130	165	200	M10	19	21,8	6	326,6	336,6
	90 *a	B5					24	27,3	8		
	100/112 *b	B5	180	215	250	M12	28	31,3	8	327,6	337,6
	100/112 *b	B14	110	130	160	Ø9					
60	80	B5	130	165	200	M10	19	21,8	6	366,0	376,0
	90 *c	B5					24	27,3	8		
	100/112 *d	B5	180	215	250	M12	28	31,3	8	367,0	377,0
85	90	B5	130	165	200	M10	24	27,3	8	396,5	416,5
	100/112 *e	B5	180	215	250	M12	28	31,3	8	398,5	418,5
	132 *f	B5	230	265	300		38	41,3	12	410,5	430,5
150	90	B5	130	165	200	M10	24	27,3	8	447,0	467,0
	100/112	B5	180	215	250	M12	28	31,3	8	450,0	470,0
	132 *g	B5	230	265	300		38	41,3	12	520,0	540,0
	160 *h	B5	250	300	350	M16	42	45,3	12		
300	100/112	B5	180	215	250	M12	28	31,3	8	567,4	587,4
	132	B5	230	265	300		38	41,3	12		
	160 *i	B5	250	300	350	M16	42	45,3	12	585,6	605,6
	180 *j	B5					48	51,8	14		

*a : Upto ratio 60 only
*b : Upto ratio 40 only
*c : In 2 stages upto ratio 20 only
In 3 stages upto ratio 90 only
*d : In 2 stages upto ratio 20 only
In 3 stages upto ratio 60 only
*e : Upto ratio 70 only
*f : In 2 stages upto ratio 13 only
In 3stages upto ratio 30 only
*g : In 2 stages upto ratio 20 obly
In 3 stages upto ratio 60 obly
*h : Upto ratio 15 obly
*I : In 2 stages upto ratio 15 only
In 3 stages upto ratio 55 only
*j : In 2 stages upto ratio 15 only
In 3 stages upto ratio 40 only

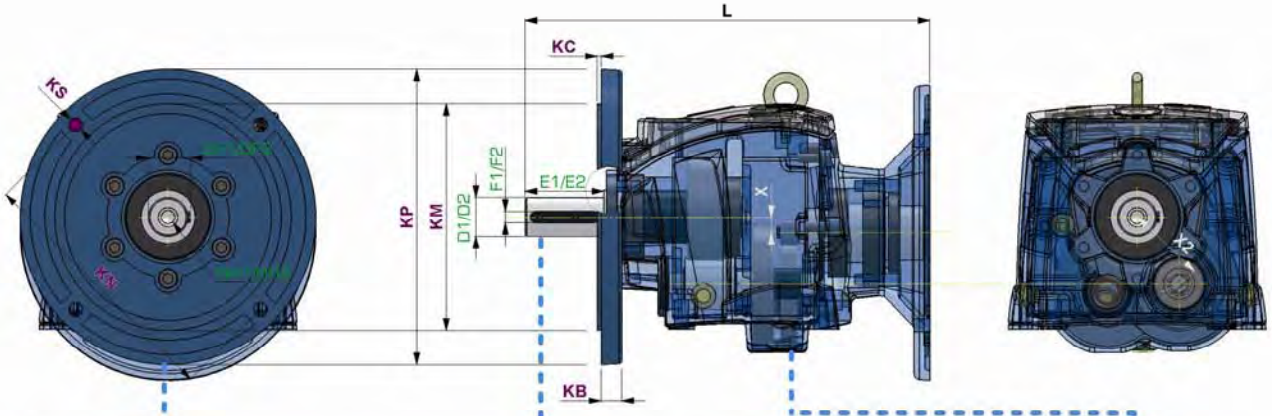


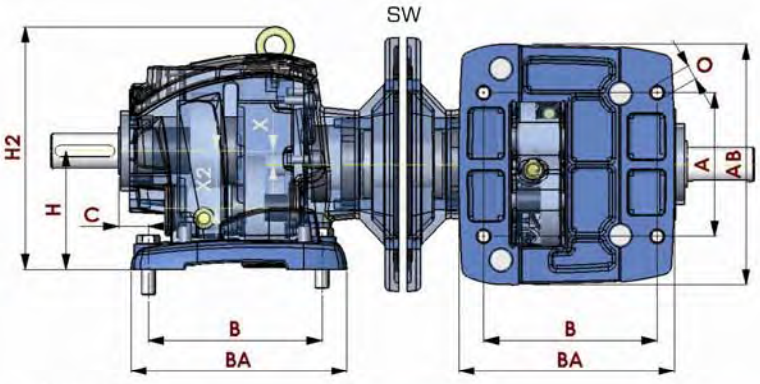


Output Flange with Slot

Output Flange with Hole

DIMENSIONS





flange mounting

ROBUS	IEC	KP	KM	KN	KS	KC	KB
12	63B5#	140	95	115	10	3	9
21	80/90B5#	200	130	165	11	3,5	12
	71B5*	160	110	130	9	3,5	10
30	80/90B5#	200	130	165	11	3,5	12
	71B5*	160	110	130	9	3,5	10
60	100/112B5#	250	180	215	14	4	15
	80/90B5*	200	130	165	11	4	12
85	132B5#	300	230	265	14	4	21
	100/112B5*	250	180	215	14	4	19
150	160/180B5#	350	250	300	18	5	21
	132B5*	300	230	265	14	4	19
300	225B5#	450	350	400	18	5	25
	160/180B5*	350	250	300	18	5	21

output shaft

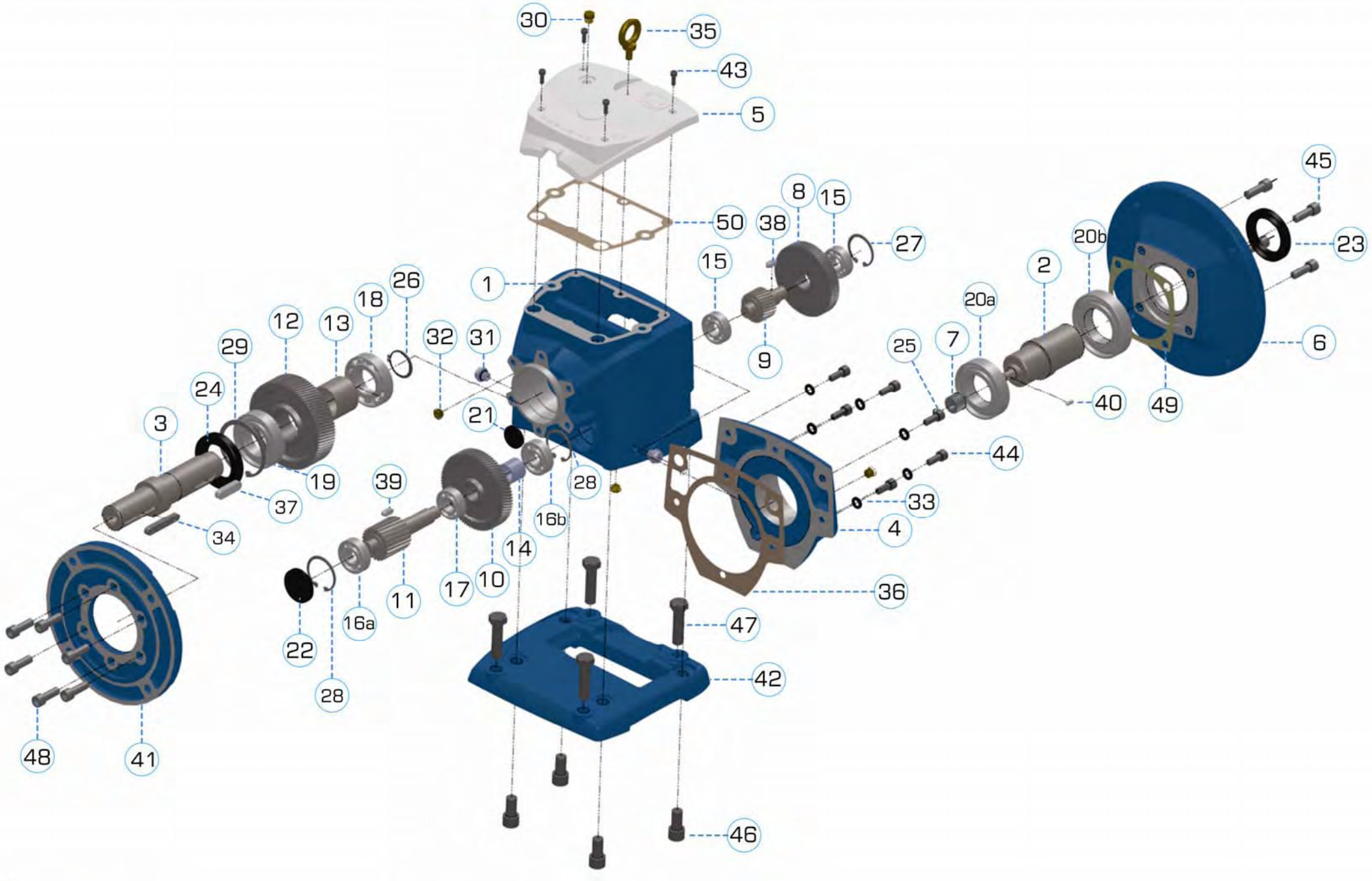
D1/D2	E1/E2	F1/F2	DF1/DF2	DH1/DH2	X	X2
20 (k6)/ 25 (k6)	40/ 50	6/ 8	23/ 28	M5x12,5/ M10x20	25	51.9
25 (k6)/ 30 (k6)	50/ 60	8/ 8	28/ 33	M10x20/ M10x20	11	52,5
30 (k6)/ 35 (k6)	60/ 70	8/ 10	33/ 38	M10x20/ M12x24	13,5	66
35 (k6)/ 40 (k6)	70/ 80	10/ 12	38/ 43	M12x24/ M16x32	17	72
40 (k6)/ 50 (k6)	80/ 100	12/ 14	43/ 53,5	M16x32/ M16x32	16	80
50 (k6)/ 60 (m6)	100/ 120	14/ 18	53,5/ 64	M16x32/ M20x40	18	103
60 (m6)/ 70 (m6)	120/ 140	18/ 20	64/ 74.5	M20x40/ M20x40	20	120

foot mounting

type	B	BA	A	AB	O	H	H2	C
SW	110	140	110	162	9	105	162	18
SW	130	172	110	182	9	90 (100**)	193,6	25
SW	165	203	135	233	14	115	238,6	30
SW	195	238	150	258	14	130	264	30
SW	205	256	170	293	18	140	287	35
SW	260	336	215	364	18	180	357	40
SW	310	382	250	430	22	225	428	40

**H = 100 for B14 input flange

LIST OF COMPONENTS ROBUS (3 REDUCTION STAGES)



LIST OF COMPONENTS ROBUS (3 REDUCTION STAGES)

		ROBUS12-3		ROBUS21-3		ROBUS30-3		ROBUS60-3		ROBUS85-3		ROBUS150-3		ROBUS300-3	
item	code	description	q.ty	description	q.ty	description	q.ty	description	q.ty	description	q.ty	description	q.ty	description	q.ty
1	HOU	housing	1	housing	1	housing	1	housing	1	housing	1	housing	1	housing	1
2	ISH	input shaft	1	input shaft	1	input shaft	1	input shaft	1	input shaft	1	input shaft	1	input shaft	1
3	OSH	output shaft	1	output shaft	1	output shaft	1	output shaft	1	output shaft	1	output shaft	1	output shaft	1
4	ICV	input cover	1	input cover	1	input cover	1	input cover	1	input cover	1	input cover	1	input cover	1
5	TCV	-	1	top cover	1	top cover	1	top cover	1	top cover	1	top cover	1	top cover	1
6	IFL	input flange 63B14 71B14 80B14	1	input flange 71B5, 71B14 80B5, 80B14 90B5, 90B14	1	input flange 71B5 80B5 90B5 100/112B5 100/112B14	1	input flange 80B5 90B5 100/112B5	1	input flange 80B5 90B5 100/112B5 132B5	1	input flange 90B5 100/112B5 132B5 160B5	1	input flange 100/112B5 132B5 160B5 180B5	1
7	P1	pinion 1	1	pinion 1	1	pinion 1	1	pinion 1	1	pinion 1	1	pinion 1	1	pinion 1	1
8	G1	gear 1*	1	gear 1*	1	gear 1*	1	gear 1*	1	gear 1*	1	gear 1*	1	gear 1*	1
9	P2	pinion 2*	1	pinion 2*	1	pinion 2*	1	pinion 2*	1	pinion 2*	1	pinion 2*	1	pinion 2*	1
10	G2	gear 2	1	gear 2	1	gear 2	1	gear 2	1	gear 2	1	gear 2	1	gear 2	1
11	P3	pinion 3	1	pinion 3	1	pinion 3	1	pinion 3	1	pinion 3	1	pinion 3	1	pinion 3	1
12	G3	gear 3	1	gear 3	1	gear 3	1	gear 3	1	gear 3	1	gear 3	1	gear 3	1
13	SP	snap ring	1	spacer	1	spacer	1	spacer	1	spacer	1	spacer	1	spacer	1
14	SP	spacer	1	spacer	1	spacer	1	spacer	1	spacer	1	spacer	1	spacer	1
15	BEA	bearing 6202*	2	bearing 6002*	2	bearing 6003*	2	bearing 6203*	2	bearing 6204*	2	bearing 6206*	2	bearing 6207*	2
16a	BEA	bearing 6202	1	bearing 6202	1	bearing 6302	1	bearing 6304	1	bearing 6304	1	bearing 6306	1	bearing 6307	1
16b	BEA	bearing 6202	1	bearing 6202	1	bearing 6203	1	bearing 6204	1	bearing 6304	1	bearing 6306	1	bearing 6307	1
17	BEA	-		bearing 6003	1	bearing 6004	1	bearing 6205	1	bearing 6205	1	bearing 6207	1	bearing 6208	1
18	BEA	bearing NKIA5903	1	bearing 6205	1	bearing 6206	1	bearing 6207	1	bearing 6208	1	bearing 6210	1	bearing 6212	1
19	BEA	bearing 6206ZZ	1	bearing 6206ZZ	1	bearing 6207ZZ	1	bearing 6208ZZ	1	bearing 6209ZZ	1	bearing 6311ZZ	1	bearing 6313ZZ	1
20a }	BEA	bearing 6003ZZ	1							bearing 6210ZZ	1	bearing 6212ZZ } **	1	bearing 6215ZZ	1
20b } ↕	BEA	bearing 6005ZZ	1							bearing 6211ZZ	1	bearing 6213ZZ } **	1	bearing 6216ZZ	1
20 ↕	BEA			bearing 6008ZZ	2	bearing 6009ZZ	2	bearing 6009ZZ	2			bearing 6009ZZ***	2		
21	COV			plug seal D25	1	plug seal D30	1	plug seal D35	1	plug seal D35	1	plug seal D42	1	plug seal D52	1
22	COV			plug seal D35	1	plug seal D42	1	plug seal D52	1	plug seal D52	1	plug seal D72	1	plug seal D80	1
23	OS	oil seal 17x25x4	1	oil seal 40x55x8	1	oil seal 45x60x9	1	oil seal 45x60x9	1	oil seal 55x80x10	1	oil seal 65x90x12	1	oil seal 80x105x13	1
24	OS	oil seal 30x42x12	1	oil seal 35x62x11	1	oil seal 40x72x10	1	oil seal 50x80x12	1	oil seal 55x85x12	1	oil seal 65x120x15	1	oil seal 72x140x12	1
25	SNR			snap ring	1	snap ring	1	snap ring	1	snap ring	1	snap ring	1	snap ring	1
26	SNR	-		snap ring	1	snap ring	1	snap ring	1	snap ring	1	snap ring	1	snap ring	1
27	SNR	-		snap ring*	2	snap ring*	2	snap ring*	2	snap ring*	2	snap ring*	2	snap ring*	1
28	SNR			snap ring	2	snap ring	2	snap ring	2	snap ring	2	snap ring	2	snap ring	2
29	SNR	snap ring	1	snap ring	1	snap ring	1	snap ring	1	snap ring	1	snap ring	1	snap ring	1
30	BPL	breather plug	1	breather plug	1	breather plug	1	breather plug	1	breather plug	1	breather plug	1	breather plug	1
31	FPL	filler plug	6	filler plug	6	filler plug	6	filler plug	6	filler plug	6	filler plug	6	filler plug	6
32	LPL	level plug		level plug	1	level plug	1	level plug	1	level plug	1	level plug	1	level plug	1
33	WSH														
34	KEY	key	1	key	1	key	1	key	1	key	1	key	1	key	1
35	EB			eye-bolt, M8	1	eye-bolt, M8	1	eye-bolt, M8	1	eye-bolt, M10	1	eye-bolt, M10	1	eye-bolt, M12	1
36	GK36	gasket	1	gasket	1	gasket	1	gasket	1	gasket	1	gasket	1	gasket	1
37	KEY	key	1	key	1	key	1	key	1	key	1	key	1	key	1
38	KEY	key*	1	key*	1	key*	1	key*	1	key*	1	key*	1	key*	1
39	KEY	key	1	key	1	key	1	key	1	key	1	key	1	key	1
40	KEY			Key	1	Key	1	Key	1	Key	1	Key	1	Key	1
41	OFL	output flange 140	1	output flange 200, 160	1	output flange 200, 160	1	output flange 250, 200	1	output flange 300, 250	1	output flange 350, 300	1	output flange 450 , 350	1
42	FSW	base SW	1	base SW	1	base SW	1	base SW	1	base SW	1	base SW	1	base SW	1
43	SCR			screw	6	screw	6	screw	6	screw	6	screw	6	screw	6
44	SCR	screw	4	screw	6	screw	6	screw	6	screw	6	screw	6	screw	6
45	SCR			screw	4	screw	4	screw	4	screw	4	screw	4	screw	4
46	SCR			screw	4	screw	4	screw	4	screw	4	screw	4	screw	4
47	SCR			screw	4	screw	4	screw	4	screw	4	screw	4	screw	4
48	SCR	screw	6	screw	6	screw	6	screw	6	screw	6	screw	6	screw	6
49	GK49	gasket	1	gasket	1	gasket	1	gasket	1	gasket	1	gasket	1	gasket	1
50	GK50	gasket	1	gasket	1	gasket	1	gasket	1	gasket	1	gasket	1	gasket	1

* In 3 stages only. ** for input flange 132-160 *** for input flange 90-112

WEIGHTS

input			Weights including oil in Kg													
			ROBUS12		ROBUS21		ROBUS30		ROBUS60		ROBUS85		ROBUS150		ROBUS300	
			2	3	2	3	2	3	2	3	2	3	2	3	2	3
63	B14	UNV	7,3	7,7	-	-	-	-	-	-	-	-	-	-	-	-
71	B14		7,5	7,9	-	-	-	-	-	-	-	-	-	-	-	-
80	B14		8,8	9,0	-	-	-	-	-	-	-	-	-	-	-	-
63/71	B5		-	-	12,8	13,4	22,2	23,4	32,0	33,5	-	-	-	-	-	-
80/90	B5		-	-	13,7	14,3	23,4	24,2	32,5	34,2	39,4	41,7	74,0	78,6	-	-
100/112	B5		-	-	-	-	24,7	25,7	34,2	35,7	40,9	43,1	75,1	82,9	135,8	141,2
132	B5		-	-	-	-	-	-	-	-	47,3	49,6	87,5	92,0	136,9	142,3
160	B5		-	-	-	-	-	-	-	-	-	-	89,9	-	139,3	144,3
180	B5		-	-	-	-	-	-	-	-	-	-	-	-	139,0	144,4
63	B14	FSW	8,8	9,2	-	-	-	-	-	-	-	-	-	-	-	-
71	B14		9,0	9,4	-	-	-	-	-	-	-	-	-	-	-	-
80	B14		10,3	10,5	-	-	-	-	-	-	-	-	-	-	-	-
63/71	B5		-	-	14,7	15,3	25,8	27,0	37,2	38,7	-	-	-	-	-	-
80/90	B5		-	-	15,6	16,2	27,0	27,8	37,7	39,4	45,9	48,2	88,0	92,6	-	-
100/112	B5		-	-			28,3	29,3	39,4	40,9	47,4	49,6	89,1	96,9	164,8	170,2
132	B5		-	-	-	-	-	-	-	-	53,8	56,1	101,5	106,0	165,9	171,3
160	B5		-	-	-	-	-	-	-	-	-	-	103,9	-	168,3	173,3
180	B5		-	-	-	-	-	-	-	-	-	-	-	-	168,0	173,4
120	56B5		=UNV+0,4													
160	71B5				=UNV+0,9		=UNV+0,9									
200	80/90B5				=UNV+1,7		=UNV+1,7		=UNV+1,8							
250	100/112B5								=UNV+3,8		=UNV+4,1					
300	132B5										=UNV+7,2		=UNV+5,8			
350	160/180B5												=UNV+9,8		=UNV+8,9	
450	200B5														=UNV+19,9	

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Rotomotive Bangalore
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Rotomotive Delhi
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Plot no.23, Karkardooma Community Center
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Rotomotive Ludhiana
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SCO-146, 3rd Floor
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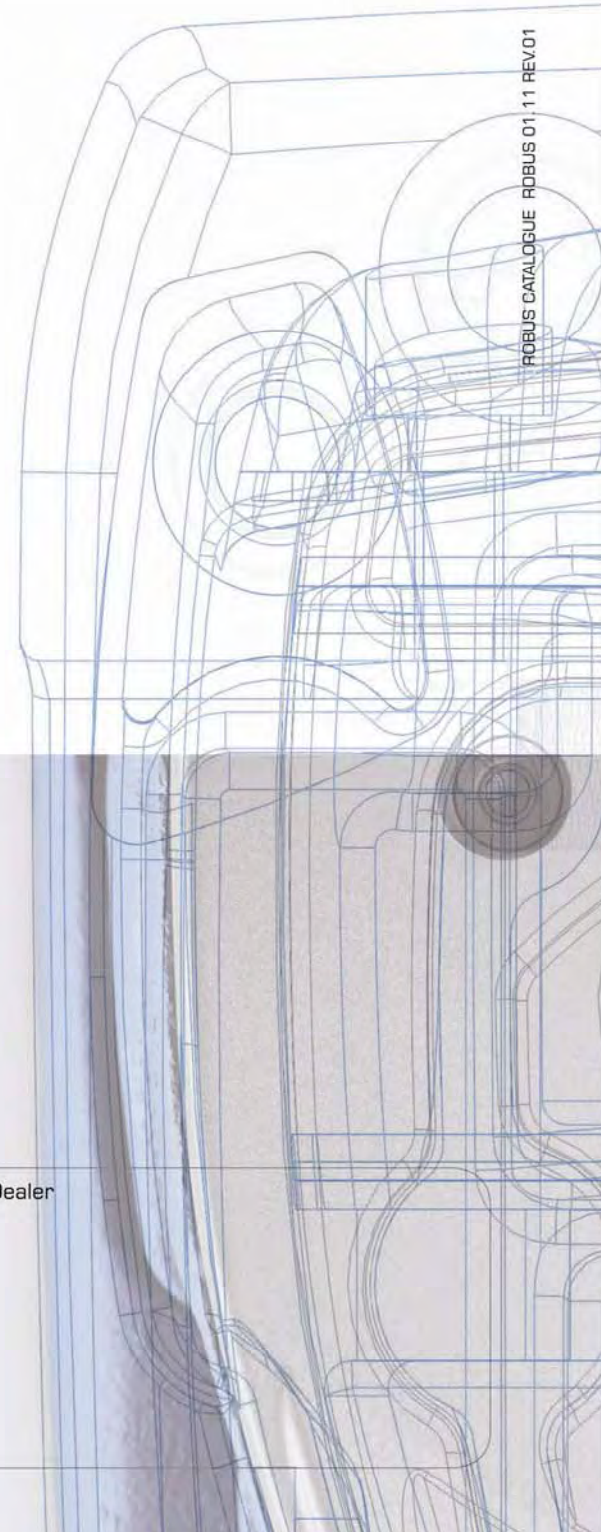
Ludhiana - 141 001
Tel. No.: +91-161- 4621407
Cell No.: 093165 73407 / 093579 60111
E-mail: nikhil.vedi@rotomotive.com

Rotomotive Mumbai
Rotomotive Powerdrives India Ltd.
B-43 Station Plaza Commercial Complex
Station Road, Bhandup (W), Mumbai – 400 078
Tel. No.: +91-22- 67253048
Cell No.: 093240 64643 / 093232 20023
E-mail: sd.kulkarni@rotomotive.com

Rotomotive Secunderabad
Rotomotive Powerdrives India Ltd.
No 6013, VI Floor, Emerald House
S.D. Road, Secunderabad - 500 003
Cell No.: 093466 16807
E-mail: ashok.kumar@rotomotive.com

rotomotive®

Rotomotive Powerdrives India ltd.
2102/4, Vitthal Udhyognagar, Near Anand
Gujarat - 388 121, INDIA.
Ph.: +91 - 2692 - 230173, 230174
Fax: +91 - 2692 - 235209
e-mail: info@rotomotive.com
Web site: www.rotomotive.com



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