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Технические характеристики

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ВАРИАТОРЫ VA–B

The mechanical variable speed chain gear-boxes are one of the systems of infinitely variable speed gears assuming a dominant position in the driving technique for the transmission of little and mean outputs.

Owing to their properties, such as:
- the sufficiently large control range
- the suitable control characteristic
- the minimum drop of speed when loaded
- the minimum claims for maintenance
- the simple manipulation
- the mechanical variable speed gear-boxes with plate-link chains range with the most demanded types.

Conception
Variators in the basic design solve all requirements for infinitely variable gears from 0.85 to 21 kW outputs, with control range up to max. 1:6 and with optional output speed. All this is achieved by a purposeful division of the variable speed gearbox sizes and by a suitable connection with countershafts of unit-construction design on input and output sides.

Variable speed gear-boxes hold the speed at an optional value even at a variable load, as the power transmission is without slip. The advantage of these machines is the minimum requirements for space.

The output of the basic variable speed gear-box may be increased up to 55 kW by connecting a differential countershaft on the variable speed gear-box input side with the simultaneous reduction of the control range.

The output speed range may be increased, further, by connecting a satellite or movable layshaft on the variable speed gear-box output side.

Variable speed change
Basic elements of the infinitely variable speed change variable by the speed gear-boxes are two pairs of conical grooved disks and a plate-link chain. Grooved disks are fitted on driving and driven shafts and are axially movable on the same. Between these two pairs of disks there is directed and endless platelink chain which connects both pairs of disks – it changes the rotary motion of driving disks to the rectilinear one and on driven disks to the rotary motion again. The endless plate-link chain consists of a number of links which are mutually connected with pins; crosswise slidable plates are arranged inside the links.

The gear ratio may be changed so that disks of one pair are forced together, disks of the other pair are removed in dependence upon the first pair. In the pair of disks forced to each other, the chain gets moved to a larger diameter, in the opposite pair of disks, it gets moved to a smaller diameter. The required gear ratio is set up by means of two-armed levers being pivoted on a centric bolt.

Service factors
The values of outputs and torques stated in the tables apply to a normal single-shift operation and for not too frequent starting. In case of other operating conditions, an equivalent output must be ascertained for the determination of the variable speed gear-box size. To this effect the coefficients stated in the following table should be applied:

Operating conditions		Coefficient	
Number of starts in a hour	10	1	k_s
	above 10	1,3	
Number of operating hours	up to 8	1	k_h
	from 6 up 16	1,3	
	from 16 up 24	1,5	
Character of load	permanent	1	k_z
	intermittent	1,3	
	impact	1,5	

Determination of equivalent output

Example:

The determination of the variable speed gear-box size for driving a machine with following requirements:

Infinitely variable speed control within ……		420-1250
Output N_s	at n_{min} ……	approx. 0,75kW
	at n_{max} ……..	approx. 1kW
Number of startings ……		up to 10/hour
Character of operation ……		continuous
Load ……		impact

Determination of equivalent output:

N_{min}	$= N_s \times k_s \times k_h \times k_z$ = 0,75 x 1 x 1,5 x 1,5 = 1,68 kW
N_{max}	$= N_s \times k_s \times k_h \times k_z$ = 1 x 1 x 1,5 x 1,5 = 2,25 kW

On the basis of calculated values, there should be chosen „2“ variable speed gear-box with following values according to tables:

Driving speed	n	= 720 ot/rpm
Output speed	n_{min}	= 415 ot/rpm
	n_{max}	= 1245 ot/rpm
Output	N_{min}	= 1,9 kW
	N_{max}	= 2,6 kW

Control range

The control range of the variable speed gear-box is understood the ratio of the minimum and maximum output speeds. The maximum control range variable speed gear-boxes is 1:6.

Typified control ranges with which the variable speed gear-boxes are currently delivered rate 1:3, 1:4.5 and 1:6. Upon the buyer’s wish, the variable speed gear-box may be adjusted for any control range up to 1:6.

Speed, output, torque of variable speed gear-box

The upper limit recommended for the variable speed gear-box output shaft speed is 1800 r.p.m. and the recommended lower limit is 200 r.p.m.

The typified variable speed gear-boxes (with driving speeds specified in tables) includes the optimum number of gear ratio kinds mutually tuned up with output. The values of output and torques are stated with respect to the efficiency of gears on the countershaft.

Every basic variable speed gear-box type has several variants according to the selected control way and position of the control system, according to the arrangement of input and output shafts and according to the cover position in vertical variable speed gear-boxes.

Technical specification of variators‘ regulating mechanism

The shaft ends are designed according to the ISO. Standards at k7 and provided with tapped pits according to Czechoslovak State Standard LSN 01 4917. Keys according to Czechoslovak State Standard ESN 02 2562. The axial height of shafts is within

tolerance of ± 1/600 H

The indicator and the control wheel must be situated on the same side of the variable speed gear-box. In the place of the control wheel there may be used the mechanical or electrical remote control.

The upper cover may be on A or B sides.

The variable speed gear-box should be situated so that the upper cover may be accessible for the reason of adjusting the variable speed gear-box or replacing the chain and oil. The mentioned oil quantity and mass are average values. A part view of the control part of the variable speed gear-box shows the design with pin control. The control by the regulating pin is not self-locking.

Supplied flange electromotors for sizes 0-6:

Size	Transmission ratio	Regulating screw		Regulating pin	
		Output speed	Torque	Adjusting angle	Torque
0	1:3	9	0,5	41°	1
	1:4,5	10,25		51°	
	1:6	12		60°	
1	1:3	8,15	0,7	48°	2
	1:4,5	9,45		57°	
	1:6	10,75		66°	
2	1:3	8,2	0,85	39°	4
	1:4,5	10		47°	
	1:6	10,8		51°	
3	1:3	10,5	1	45°	6
	1:4,5	12,65		52°	
	1:6	13,25		56°	
4	1:3	12,2	1,3	42°	10
	1:4,5	14,7		57°	
	1:6	17,4		63°	
5	1:3	15,3	1,5	48°	18
	1:4,5	18,3		54°	
	1:6	19,6		58°	
6	1:3	15	2	48°	30
	1:4,5	18,6		53°	
	1:6	19,6		59°	

Size	Motor	kW	V	Hz
„0“	4 AP 80-4	0,75	380/220	50 (60)
„1“	4 AP 90 L-4	1,5	380/220	50 (60)
„2“	4 AP 100 L-4	3	380/220	50 (60)
„3“	4 AP 112 M-4	5,6 (4)	380/220	50 (60)
„4“	4 AP 132 M-4	7,5	380/220	50 (60)
„5“	VC 160 L-4	15	380/220	50 (60)
„6“	VC 180 L-4	22	380/220	50 (60)

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