

DRIVE UNITS FOR TAP CHANGERS



VOLTAP
ELFROM



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MOTOR DRIVE UNITS FOR TAP CHANGERS

[Motor drive unit MZ 4.4]



MZ 4.4 is the most used type. It is intended for all series of tap changers produced by Elprom Heavy Industries. It can be used for tap changers made by other manufacturers, as well as for replacement of outdated drives. The MDU box is made of aluminum alloy, and the front panel is protected from environmental influences by a protective cover (door). A standard drive is equipped with a lighting device, contact socket, a document pocket, etc. Additional functions can be added to the MDU according to the customer's requirements set out in the order specification sheets.

TECHNICAL DATA

Electrical motor rated power	kW	0,75 / 1,1 (0,9/1,3 for 60 Hz)
Rated frequency	Hz	50 / 60
Supply voltage	V	3 AC 380/400
Synchronous speed	min ⁻¹	1500 (1800 for 60 Hz)
Revolutions of hand crank per tap change operation	revs	33
Revolutions of outgoing shaft per tap change operation	revs	33
Drive shaft torque	Nm	17 / 24
Duration of the tap change operation	s	4,5
Maximum number of operating positions	-	35
Control circuit voltage	V	AC 220/230
Insulation level of voltage Ph - PE	kV	2
Heater elements power	W	300
Protective degree	IP	IP55
Weight	kg	104

The following special executions of motor drive are offered to meet the specific requirements of customers:

- Degree of protection IP 66.
- Revolutions of outgoing shaft per tap change operation: 0,5; 1; 6; 16,5.
- Various supply voltage for operation and control circuits at customer request.
- Execution for a cold climate with heater elements power 4x150 W for a minimum operating temperature of - 60°C.

[**Motor drive unit MZ 4.4
with single-phase el. motor**]



MZ 4.4 with single-phase el. motor can use power supply from a single-phase source. This motor drive is used in substations, where there isn't a three-phase source of supply, e.g. in hauling substations for the electrical transport, etc. A single-phase asynchronous electric motor is used with an electromagnetic brake, which gives an opportunity for realization of the mechanical blocking against undesired hand switching. This function is especially useful for the drive of off-load tap changers. An electromagnetic brake provides a reliable stop.

TECHNICAL DATA		
Electrical motor rated power	kW	1,5
Rated frequency	Hz	50
Supply voltage	V	AC 220/230
Synchronous speed	min ⁻¹	1500
Revolutions of hand crank per tap change operation	revs	33
Revolutions of outgoing shaft per tap change operation	revs	33
Drive shaft torque	Nm	32
Duration of the tap change operation	s	4,5
Maximum number of operating positions	-	35
Control circuit voltage	V	AC 220/230
Heater elements power	W	300
Protective degree	IP	IP55
Weight	kg	104
The following special executions of motor drive are offered to meet the specific requirements of customers:		
• Degree of protection IP 66.		
• Revolutions of outgoing shaft per tap change operation: 0,5; 1; 6; 16,5.		
• Execution for a cold climate with heater elements power 4x150 W for a minimum operating temperature of - 60°C.		

[Motor drive unit MZ 4.4.1 special variant]



A motor drive type MZ 4.4 is the most used drive. It is intended for all series of tap changers, produced in Elprom Heavy Industries. Can be used and for the tap changers of other producers, as and for replacement of old drives. The box of drive is made-out from an aluminum alloy, and the front panel is protected by a protective cover (a door) that protects a panel from atmospheric influences. A standard drive is equipped with a lighting device, contact socket, a pocket for the documents and other. To the motor drive can be added and complementary functions in accordance with the filled in by client questionnaire sheets.

TECHNICAL DATA		
Electrical motor rated power	kW	1,1
Rated frequency	Hz	50
Supply voltage	V	3 AC 380/400
Synchronous speed	min ⁻¹	1500
Revolutions of hand crank per tap change operation	revs	16.5/22
Revolutions of outgoing shaft per tap change operation	revs	16.5
Drive shaft torque	Nm	12
Duration of the tap change operation	s	2.25/2.6
Maximum number of operating positions		35
Control circuit voltage	V	AC 220/230
Insulation level of voltage Ph - PE	kV	2,5
Heater elements power	W	300
Protective degree		IP55
Weight	kg	104
The special executions of motor drive are offered, answering to the specific requirements of client as: • Degree of protection IP 66. • Various supply voltage for operation and control circuits by requiring of client. • Execution for a cold climate with power of heating elements 4x150 W for working temperatures to - 60°C.		

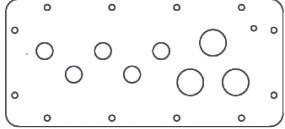
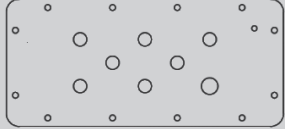
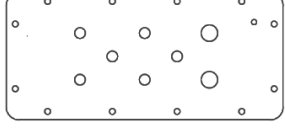
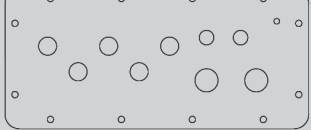
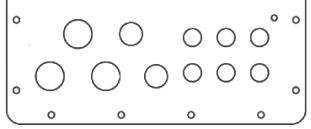
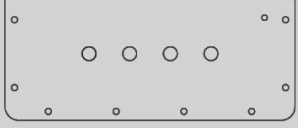
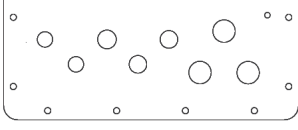
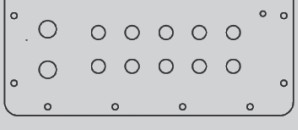
[Variants of motor drive unit execution]

A motor drive can be executed with different variants of plate for cable inputs and different types of buttons. Other executions are possible according to the questionnaire sheets or at customer request.

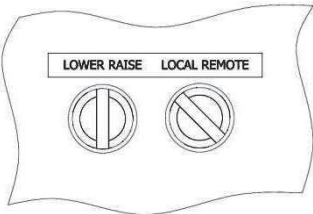
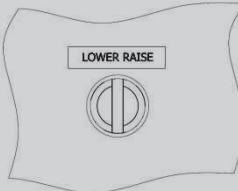
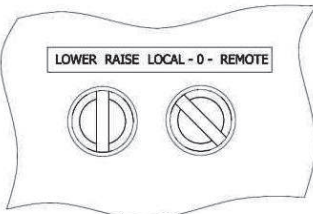
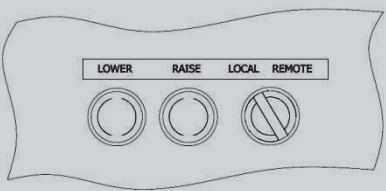
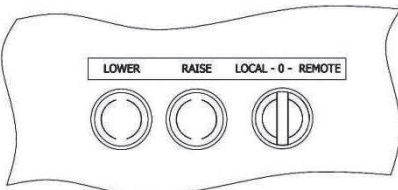
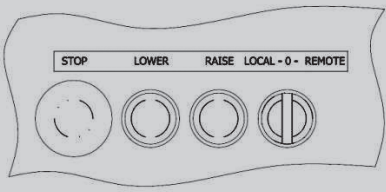
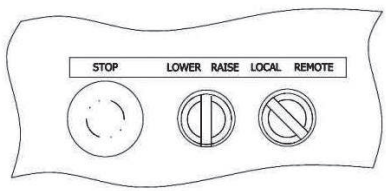
Plate variants for cable inputs of MDU (N 1-8) ◀

N	NUMBER AND DIMENSIONS OF CABLE INPUTS	TECHNICAL DOCUMENTATION VARIANT	OUTSIDE VIEW
1	2xM40; 2xM25	3020-10	
2	3xM40; 3xM25	3020-11	
3	2xM40; 3xM25	3020-12	
4	2xM25	3020-13	
5	4xM40; 3xM25	3020-14	
6	2xM40; 5xM25	3020-15	
7	2xM40; 3xM32	3020-16	
8	1xM40; 2xM16	3020-17	

Plate variants for cable inputs of MDU (N 9-16) ◀

N	NUMBER AND DIMENSIONS OF CABLE INPUTS	TECHNICAL DOCUMENTATION VARIANT	OUTSIDE VIEW
9	5xM25; 3xM40	3020-18	
10	7xM20; 1xM25	3020-19	
11	6xM16; 2xM25	3020-20	
12	5xM25; 2xM32	3020-21	
13	3xM40; 6xM25; 2xM32	3020-22	
14	4xM20	3020-23	
15	3xM20; 3xM25; 3xM32	3020-24	
16	2xM25; 10xM20	3020-26	

Variants of motor drive control buttons ◀

N	NUMBER AND TYPE OF CONTROL BUTTONS / SWITCHES	TECHNICAL DOCUMENTATION VARIANT	OUTSIDE VIEW
9	One two-position switch for local / remote control	2307-03	
10	One two-position switch for raise / lower	2307-23	
11	One two-position switch for raise/lower One three-position switch for local / remote control	2307-33	
12	Two buttons for raise / lower One two-position switch for local / remote control	2307-53	
13	Two buttons for raise / lower One three-position switch for local / remote control	2307-63	
14	Two buttons for raise / lower One three-position (two-position*) switch for local / remote control STOP button	2307-43 *2307-83	
15	One switch for raise / lower One two-position (three-position*) switch for local / remote control STOP button	2307-73 *2307-93	

[**Hand drive ZR 03**]



ZR-03 serves exceptionally and only to operate the off-load tap changer (PBV) for operating a disconnected transformer. A drive operates a PBV by means of vertical and horizontal shafts, cardan connectors and bevel gear box. The design of hand drive is suitable for any types of climate.

TECHNICAL DATA		
Revolutions of hand crank per operation	revs	11
Outgoing shaft torque (maximal force of 200 N applied to the handle)	Nm	40
Control circuit voltage	V	AC 220/230
Insulation level	kV	2
Max. number of service positions	-	12
Heaters power	W	10
Weight	kg	17
The following special executions of hand drive are offered to meet the specific requirements of customers:		
• Degree of protection IP 66.		
• Locking by means of padlock.		
• Remote indication about switching and an open hand drive.		

▶ DRIVE UNITS FOR REPLACEMENT

Depending on the type of tap changer, it is possible to choose a drive with different number of outgoing shaft revolutions per operation and different duration of operation, according to the following table:

TYPE	OUTGOING SHAFT NUMBER OF REVOLUTIONS	DURATION OF OPERATION
MZ-4.4 (T)*	33	4.5 s
MZ-4.4.1	16.5	2.25 s/2.6s
MZ-4.4.2	1	4.5 s/3s/3.9s
MZ-4.4.3	6	4.5 s/5.2s
MZ-4.4.5	1/2	2.25 s/2.6s
MZ-4.4.6	5	4.5 s
MZ-4.4.8	8	5 s
MZ-4.4.9	2	4 s

*Motor drive MZ-4.4T serves heavy types of tap changers. The difference between this type of motor drive and a standard MZ-4.4 is that MZ-4.4T has a transmission of 44 revolutions of handle per operation, whereas MZ-4.4 has a transmission of 33 revolutions of handle per operation.

For operation of Voltap tap chargers, the following types of motor drives, as indicated in the table, are used:

TYPE OF TAP CHANGER	TYPE OF MOTOR DRIVE
RS5/RS5.3-III-200,400,630A	MZ-4.4
RS5/RS5.3-III-1250A	MZ-4.4T
RSV5.3-III-1250A	MZ-4.4T
RS6/RS6.3-III-1250A	MZ-4.4T
2xRS6/RS6.3-III-1250A	MZ-4.4T
RSV6.3-III-1200A	MZ-4.4T
3xRS7.3-I-200,400,630A	MZ-4.4
3xRSV7.3-I-400,550,700A	MZ-4.4T
3xRS9/RS9.3-I-200,400,630A	MZ-4.4
3xRSV9.3-I-400,550,700A	MZ-4.4
RS9.3-I-1200,1600A	MZ-4.4
3xRSV9.3-I-1200A	MZ-4.4T
RS9/RS9.3-I+II-200A,400,630A	MZ-4.4
RSV9.3-I+II-400A,550,700A	MZ-4.4
3xRS9.3-I-800,1200,1600A	MZ-4.4T
RSV9.3-III-400A	MZ-4.4
3xRS21-I-310A	MZ-4.4
RS12-III-200,400A	MZ-4.4T
3xRS12-I-200,400A	MZ-4.4T
RSV12-III-250,400,600A	MZ-4.4T
3xRSV12-I-250,400,600A	MZ-4.4T

Technical data (comparative table) ◀

ITEM	UNIT	MZ-2	MZ-4	MZ4.1	MZ-4.4
Electrical motor					
- Power	kW	1.1	0.75 / 1.1		
- Supply power	V	3 AC 380-400 / 220-230 V			
- Current	A	2.9Y (5Δ)	2.3/2.9Y (4/5Δ)		
- Frequency	Hz	50 / 60			
- Synchronous speed	min ⁻¹	1500 / (1800 for 60 Hz)			
Outgoing shaft					
- Rated torque	Nm	25	17 / 25	17 / 24 / 32	
- Revolutions per minute	min ⁻¹	350	440		
- Direction of rotation at a "raise "	upper view	clockwise	counter clockwise		
- Revolutions per an operation	33				
- Duration of a tap change operation	s	5.6	4.5		
- Revolutions of hand crank per a tap change operation		12	33		
- Diameter of outgoing shaft	mm	Ø25	20 x 20		
Control					
- Supply voltage of el. control and heater circuits	V	AC 220 - 230			
- Number of service positions		max 38			max 35
- Contact rows		3	5		
- Heater power	W	3 x 125		250	2 x 150
- Test voltage to earth (without motor)	kW eff. 1 min	2			
Weight	kg	120	80	85	104

▶ STANDARD DELIVERY SET

1. Motor drive unit
2. Remote indicator of positions
3. Remote control panel
4. Shafts (at order)
5. Bevel gear box, protective pipes and cardan connectors.

Changes can be made in the delivery set if requested by the customer.

[Digital indicator of service positions]



A standard motor drive comes with a remote indicator of service positions, using as an incoming resistor signal from a potentiometer row. If requested by the customer, the remote indicator can use an incoming signal of 4-20 mA or another analogue signal.

Except analogue, the incoming signal from the remote indicator can also be digital. There is an option to choose between BCD, BIN и GRAY codes.

Technical parameters ◀

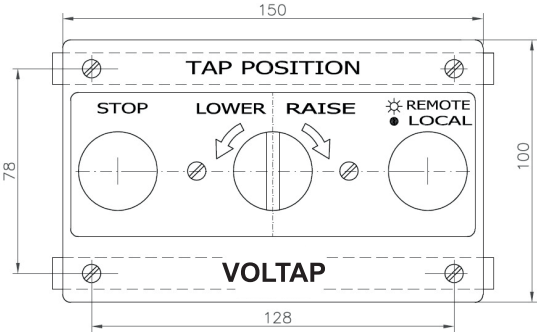
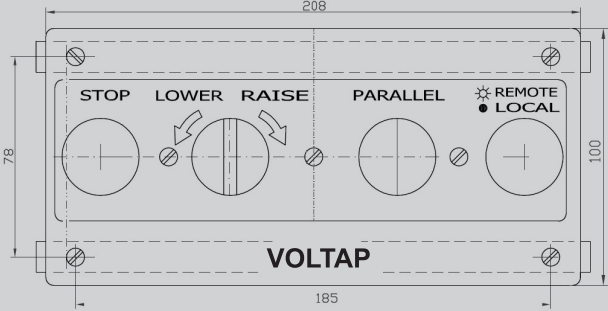
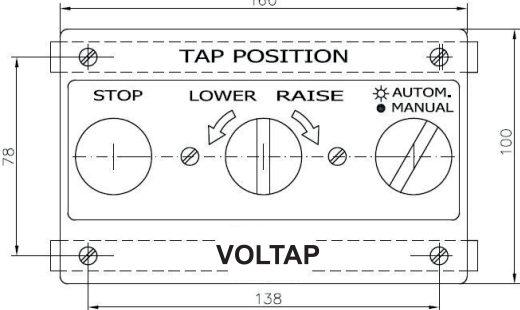
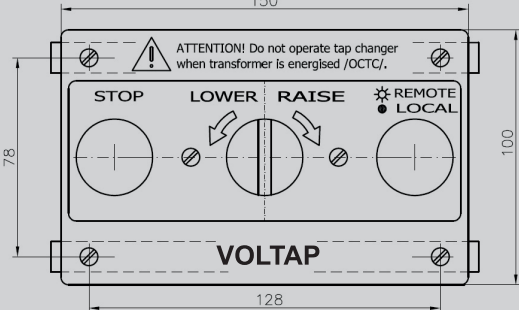
Range (steps)	39 steps
Screen: three-bit, shows the current step or "0" at presence of error	1, 2, 3, 4, ...36, 37, 38, 39
Operating conditions: - Ambient temperature: - Supply voltage: - Air relative humidity:	- 0÷55°C 220 / 230 VAC (50 / 60 Hz) - 45÷80%
Protective degree	IP42
Dimensions: - Front side - Connecting sizes	- 72 x 72 mm - 7 x 67 mm
Weight	350 g

Depending on the incoming signal, digital indicators are grouped in the following series:

Type Pxx	Series Pxx uses a potentiometer signal with resistors of 6 Ω. (This type is not recommended for a long cable connection between a motor drive and the command hall (more than 150m), because of possible error as a result of conductor resistance).
Type Exx	Series Exx uses a potentiometer signal with resistors of 10 Ω. (This type is not recommended for a long cable connection between a motor drive and the command hall (more than 150m), because of possible error as a result of conductor resistance).
Type dxx	Series dxx uses digital signal (BCD, GREY code)
Type bxx	Series bxx uses digital signal (BIN code)
Type cxx	Series cxx uses analog incoming signal 4-20 mA

[Remote control panel]

The standard buttons of remote control are in compliance with M7.3.300.002.00. It is possible to choose between different variants of remote control, depending on the type of buttons and method of their connection, according to the table below.

Nº	DESIGNATION	GENERAL VIEW
1	M7.3.300.002.02	
2	M7.3.300.004.01	
3	M7.3.300.008.01	
4	M7.3.300.010.00	

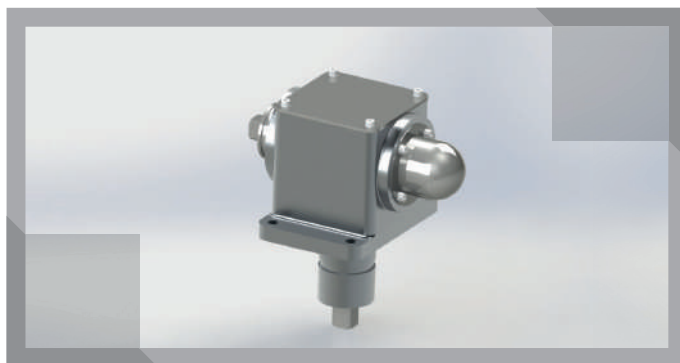
Nº	DESIGNATION	GENERAL VIEW
5	M7.3.300.014.03	
6	M7.3.300.016.00	
7	M7.3.300.022.00	
8	M7.3.300.018.00	

[Connecting elements]

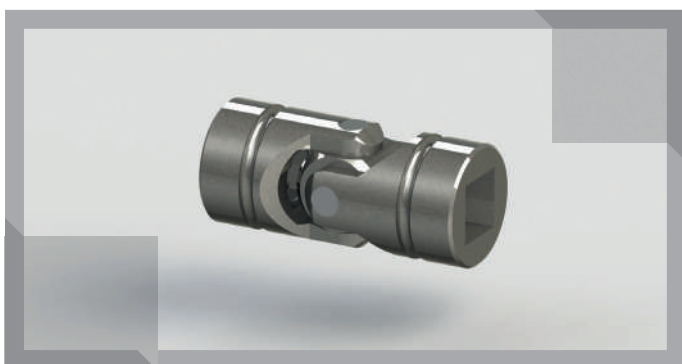
The connection between a motor drive and tap changers consists of drive shafts, cardan connectors, protective pipes and bevel gear boxes. There are different variants depending on the number of tap changers and their arrangement in a transformer, according to draft № 209.3.



CONNECTING SHAFTS (SHAFT SCHEME P8)



BEVEL GEAR (BOX)



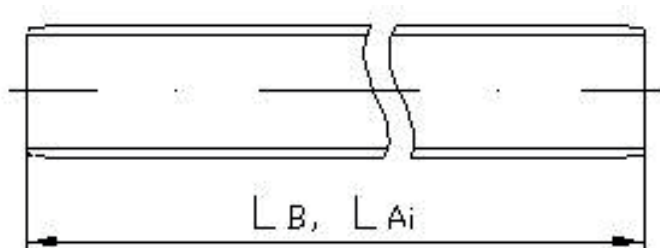
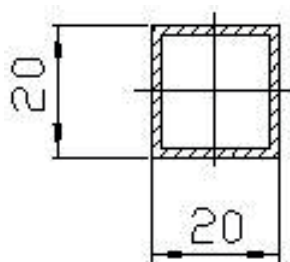
CARDAN CONNECTOR WITHOUT CUFF



CARDAN CONNECTOR WITH CUFF

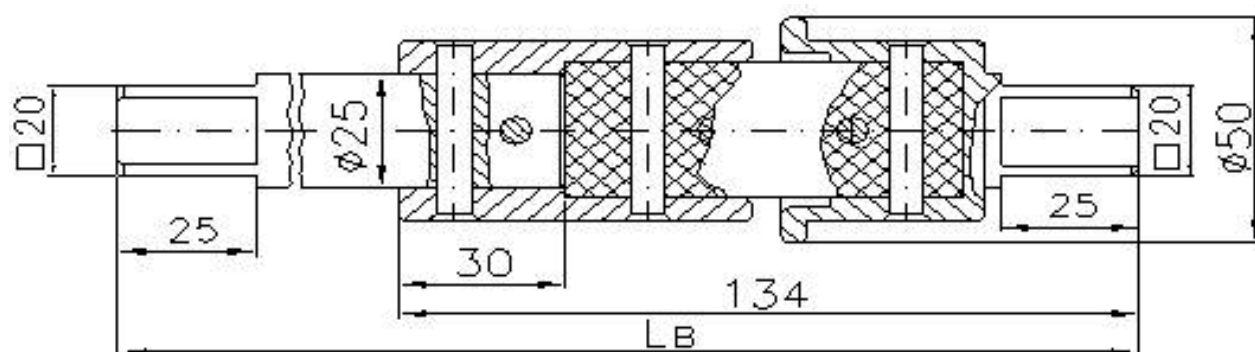
[Drive shafts of standard execution]

Drive shafts are supplied to the client as material - square pipe, longer than as required or calculated using formulas for the respective arrangement schemes (sch. P1; P2; P3...).



[Insulating drive shaft]

Insulating drive shaft is used in the cases when there should be no potential electrical connection between the corps of the motor (hand) drive and the transformer.



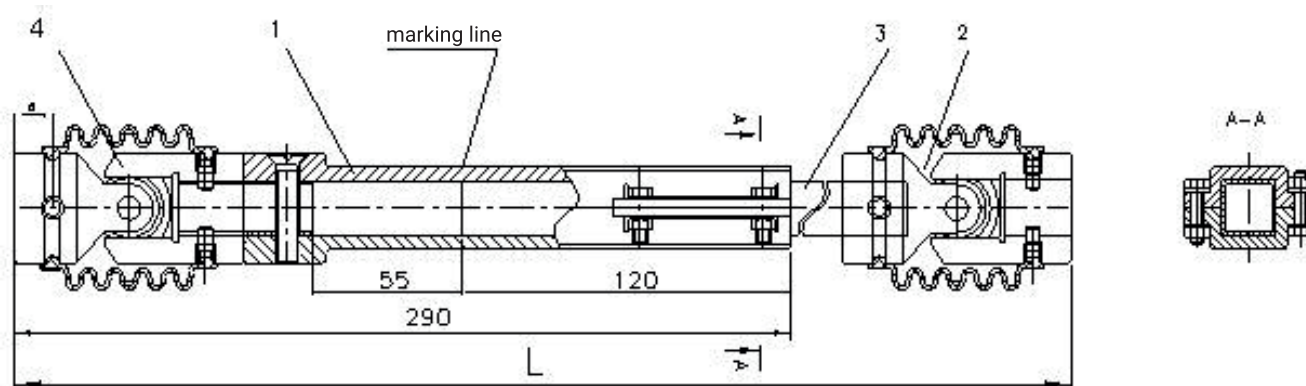
[Drive shaft of variable length (compensating shaft)]

A compensating shaft is used when it is impossible to calculate the exact length of a shaft, e.g. for connection of tap changers, built-in separate transformers.

Maximum length of compensating shaft - 1500 mm.

Maximum compensation ± 55 mm.

Length of compensating shaft is specified, as shown below.

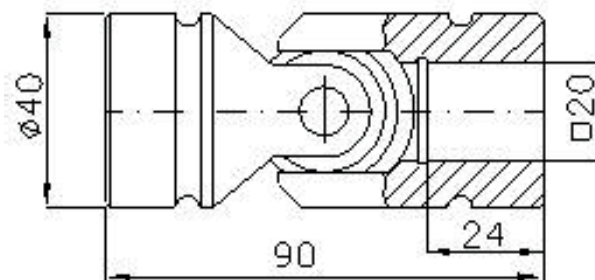


[Cardan connectors]

A cardan connector allows for a vertical deviation from the connecting shafts axle up to 25° . Assembled either with round shafts $\phi 25$ mm with a dihedral or square end (20 mm, length 25 mm) or with shaft-pipes with a square section of 20x20 mm. Upon assembly of the shafts with the cardan connectors, one of the connecting elements (e.g. bevel gear) must have a dismantling option.

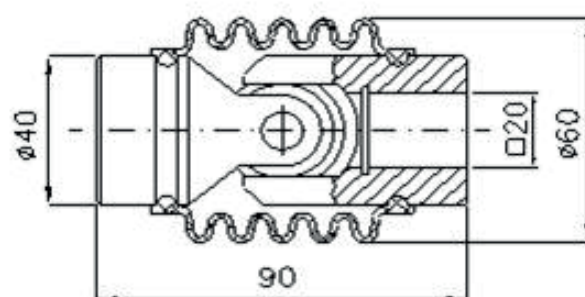
CARDAN CONNECTOR – BASIC EXECUTION WITHOUT CUFF

At assembling of vertical shaft in protective pipes (drwg. 442.3).



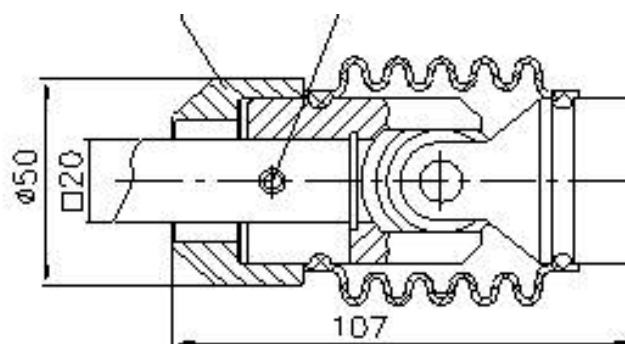
CARDAN CONNECTOR – BASIC EXECUTION WITH CUFF

For shafts with protective covers and for vertical shaft without protective pipe (drwg. 442.3.1).



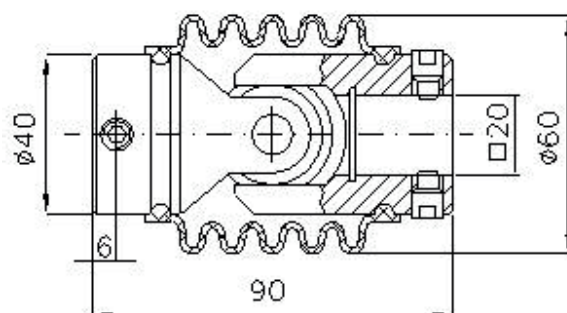
CARDAN CONNECTOR WITH CUT AND BUSH

Used in cases when connecting elements can't be dismantled



CARDAN CONNECTORS WITH SCREWS

Used in composition of a compensating shaft and other special cases



[Intermediate supports for vertical and horizontal shafts]

Intermediate supports are used in the cases when the length of the shafts is longer than indicated (drawing M5.1.044.107.01 and M5.1.044.153.02):

- LB >2800 mm (at ZR) and >2200mm (at MZ) for a vertical shaft;
- LX> 1500 mm for a horizontal shaft.

When a vertical shaft is in protective pipes, then it is assembled only in direct position at an angle $\alpha < 1^\circ$, and when a shaft is without protective pipes (with protective cover), then it can be assembled under inclination at an angle $\alpha < 25^\circ$.

▶ APPENDIXES

1.	Motor drive MZ 4.4 – assembly drawing	M5.1.044.107.01
2.	Motor drive MZ 4.4.10 – assembly drawing	M5.1.044.153.02
3.	Remote indicator – assembly drawing	M7.3.600.005.01
4.	Standard control panel – assembly drawing	M7.3.300.002.02
5.	Bevel gear box – assembly drawing	M5.3.200.002.01
6.	Cardan connector with cuff – drawing	442.3
7.	Cardan connector without cuff – drawing	442.3.1
8.	Motor drive MZ 4.4 – el. scheme	EV5.AP0A.0.0
9.	Motor drive MZ 4.4 (1 ph) – el. scheme	HZ5.AP0A.0.0
10.	Control panel MZ 4.4 – el. scheme	M7.3.300.001.14
11.	Shafts arrangement	209.3
12.	Questionnaire sheet	OD 04-0000-06

DRIVE UNITS FOR
TAP CHANGERS

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