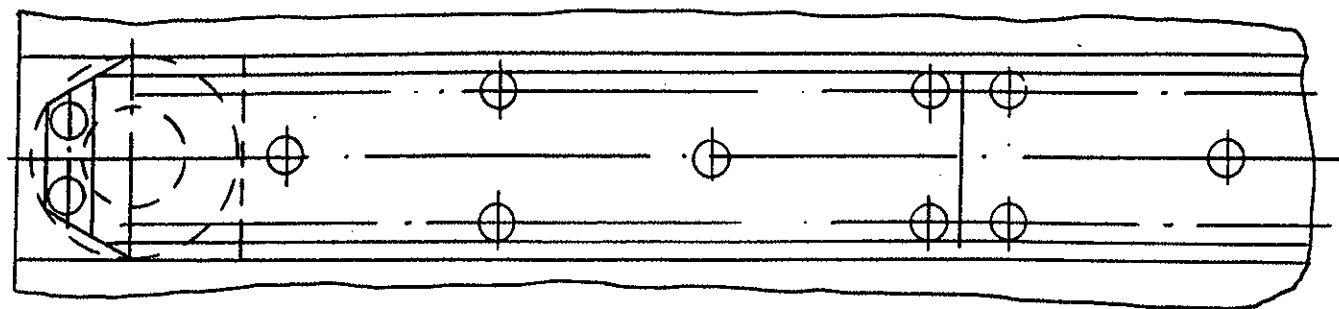
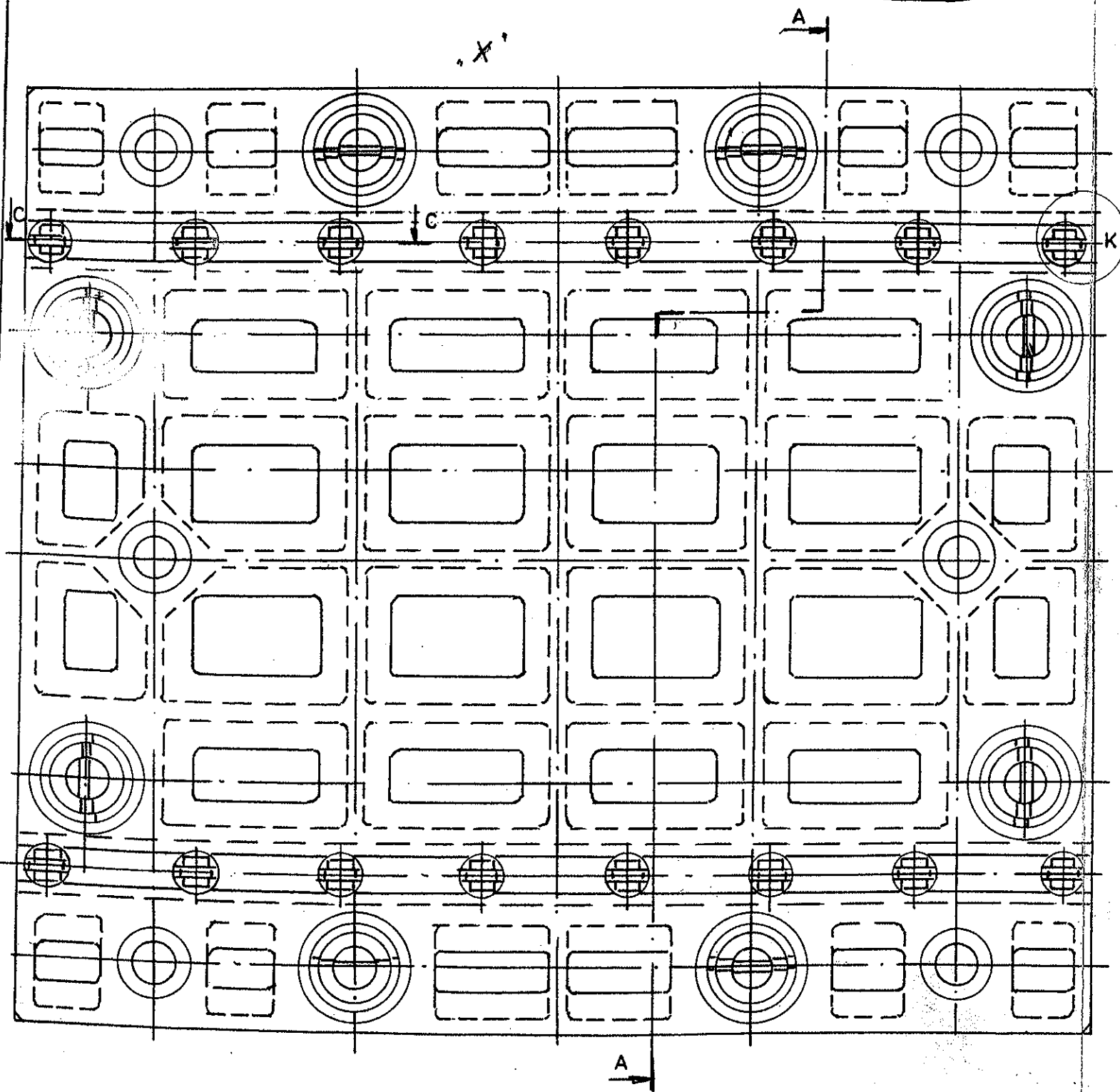


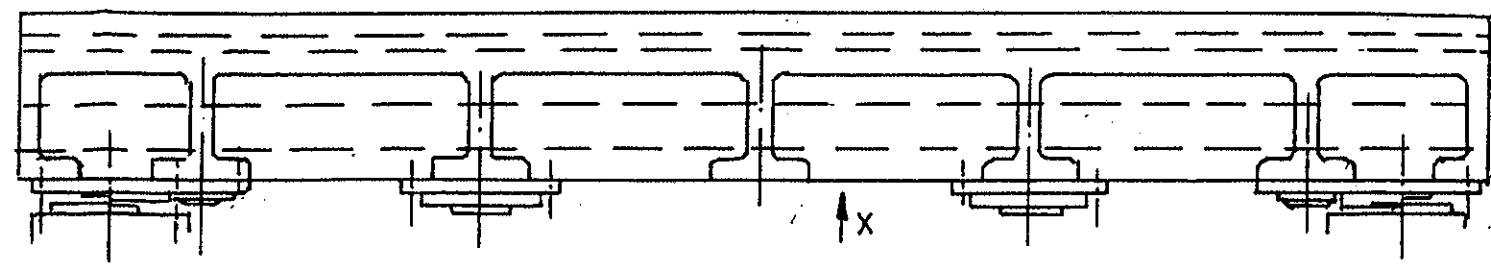
"V"



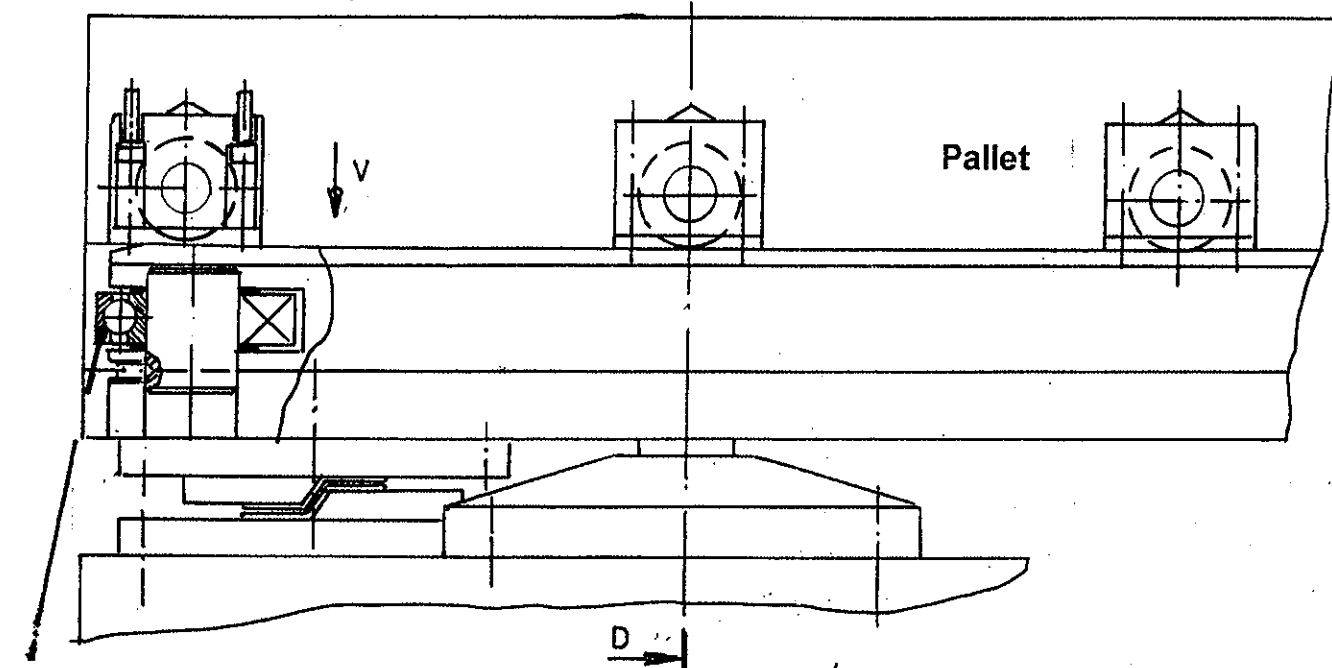
"X"



B-B

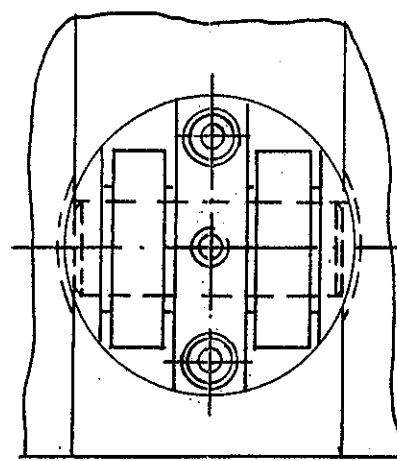


D C-C



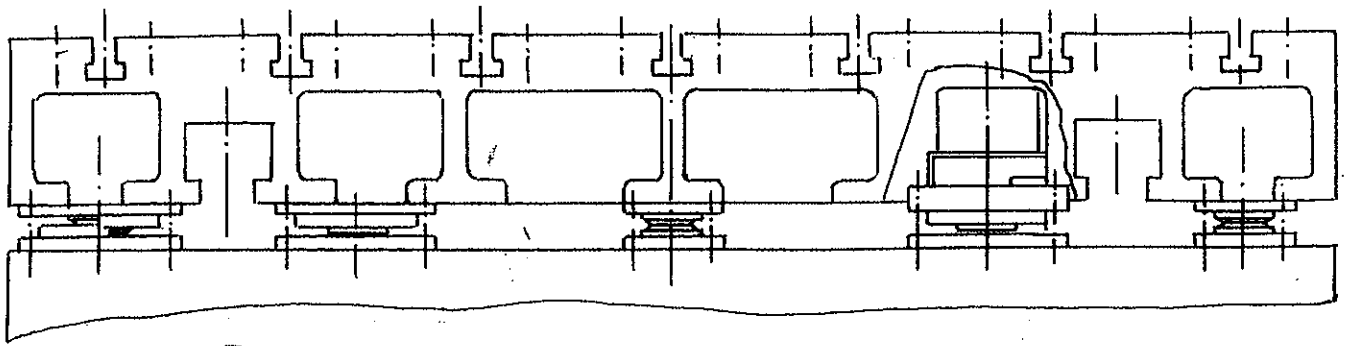
Ball bearings
6310 2RSR

D "K"



PALLET 1/2

A - A



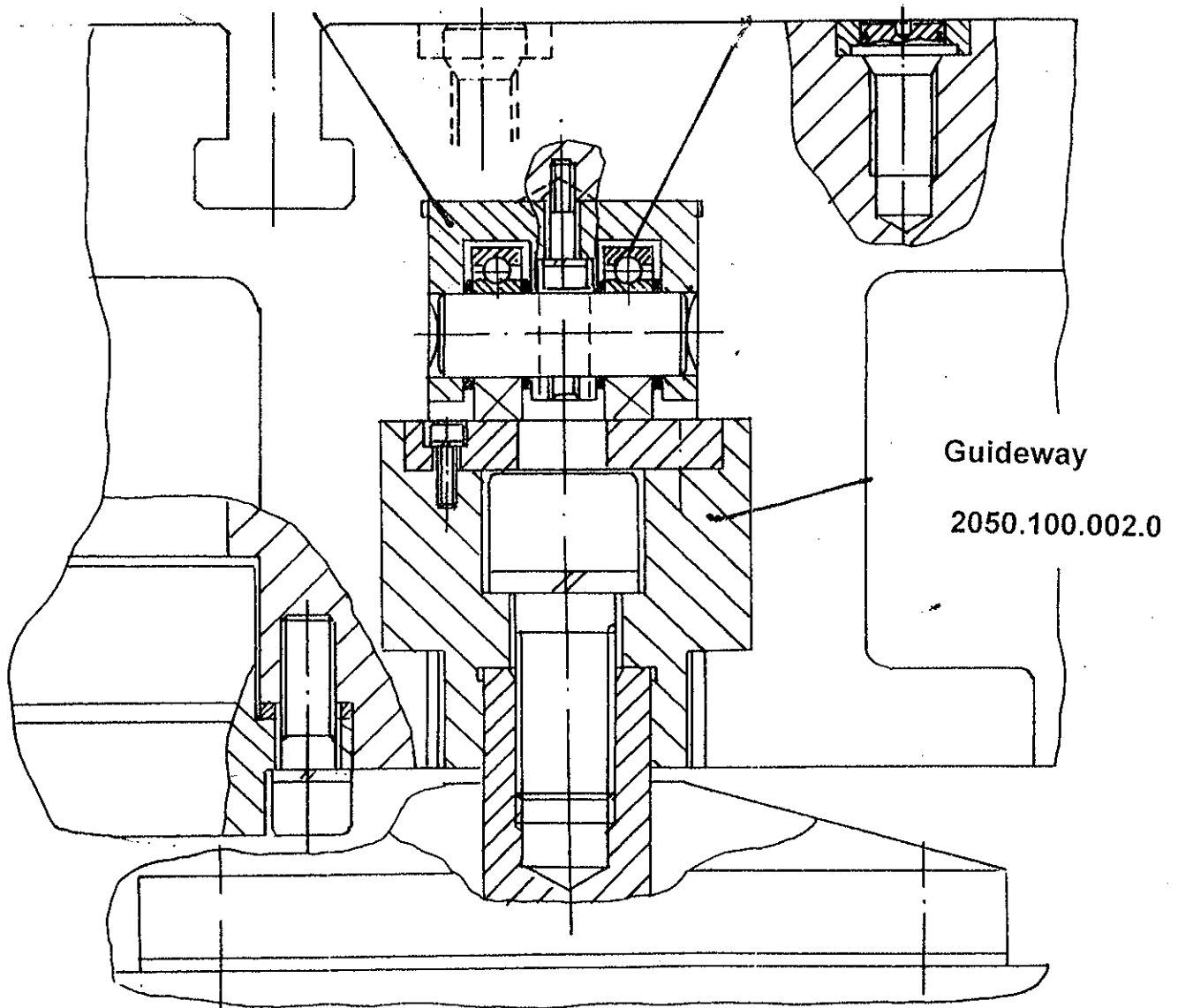
Bushing

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D - D

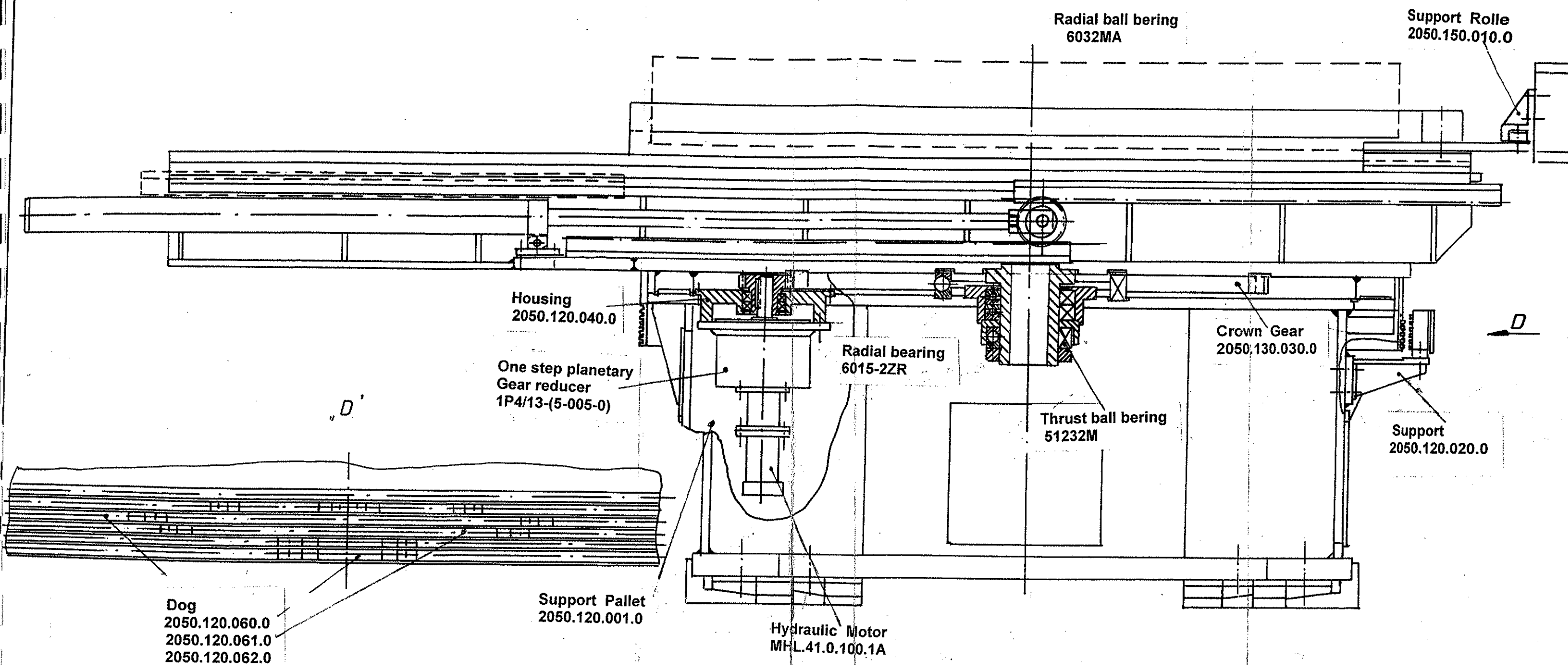
Ball bearings

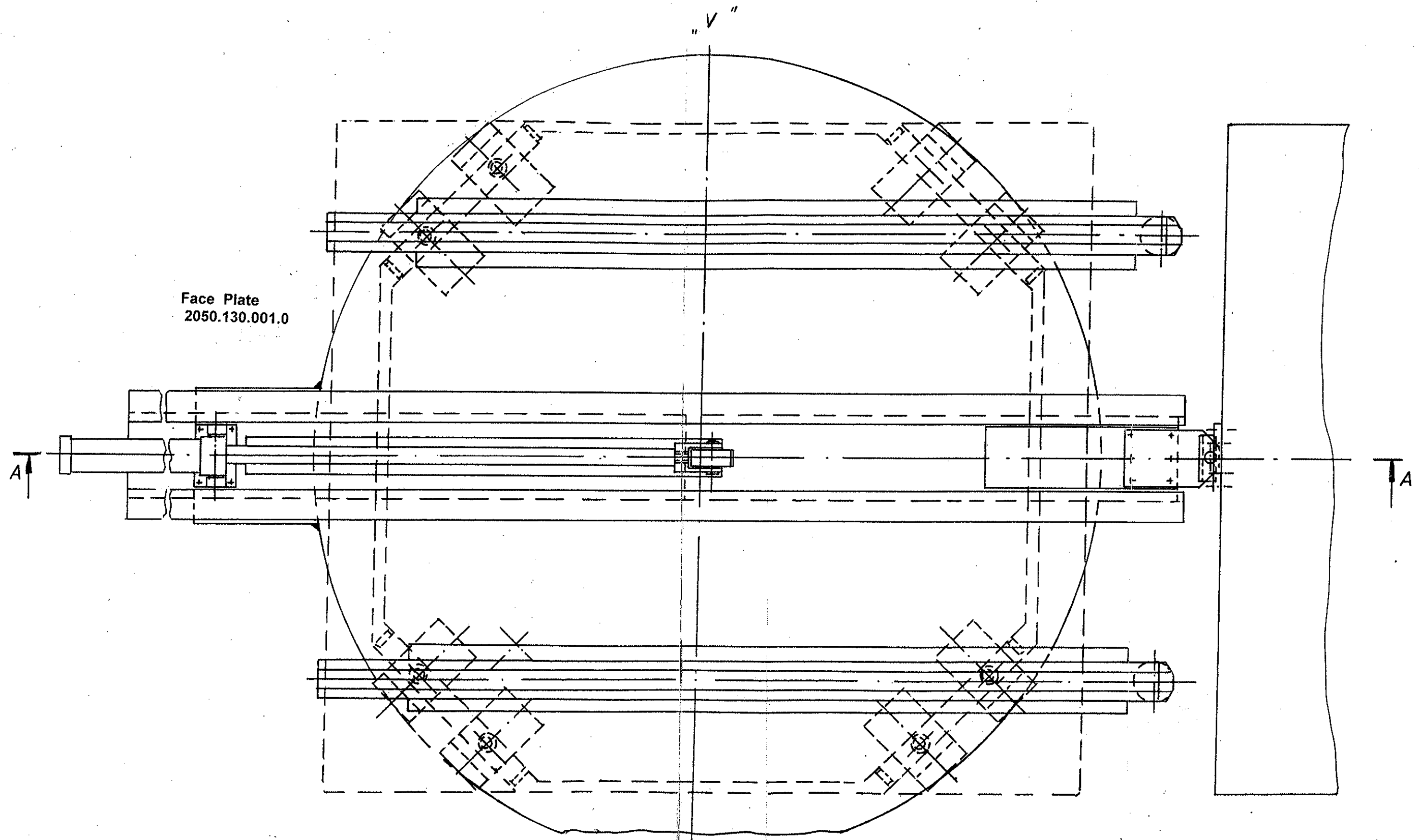
6205-2RSR

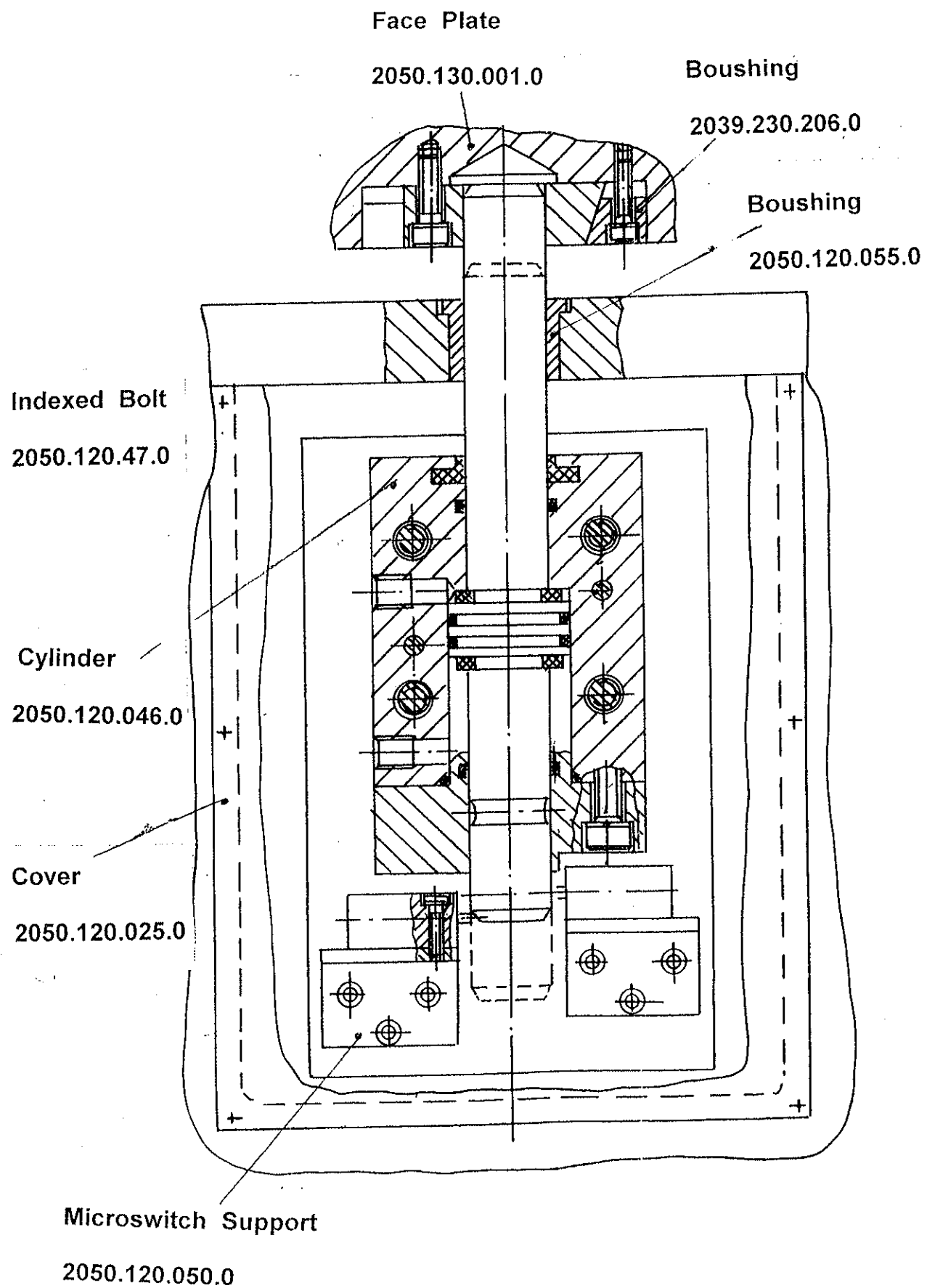


Guideway

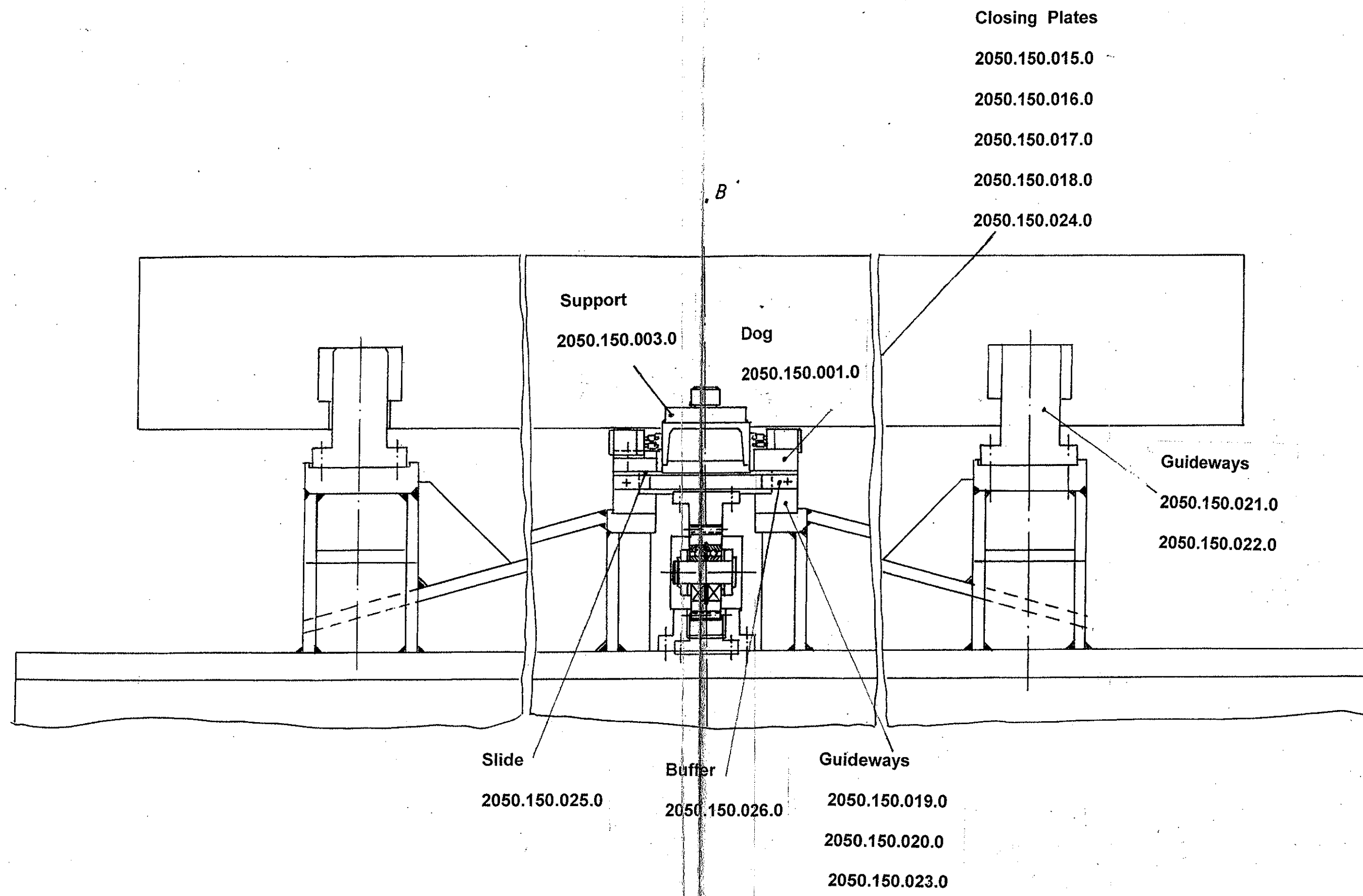
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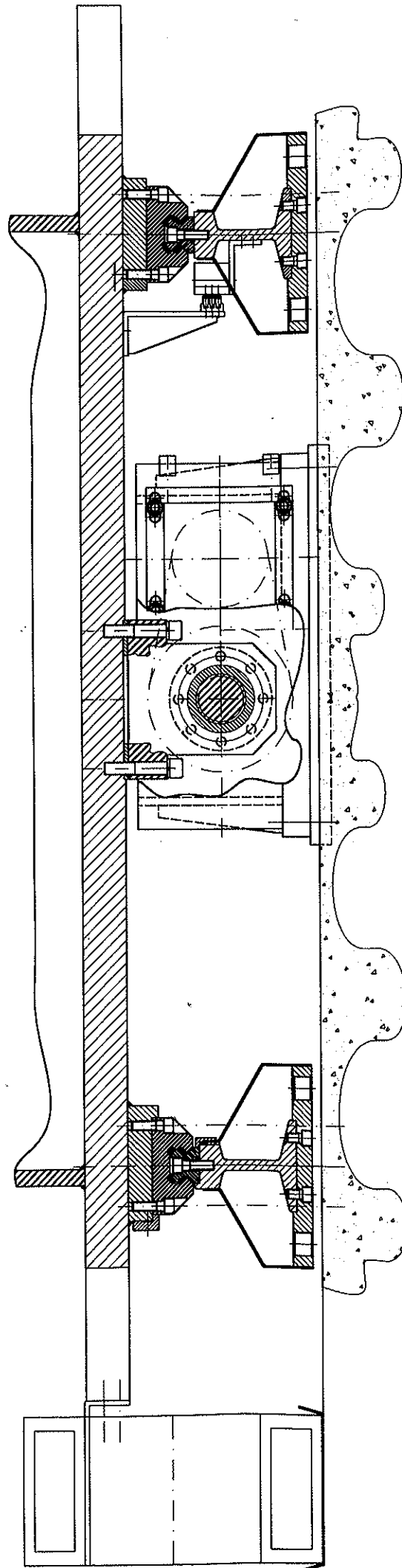




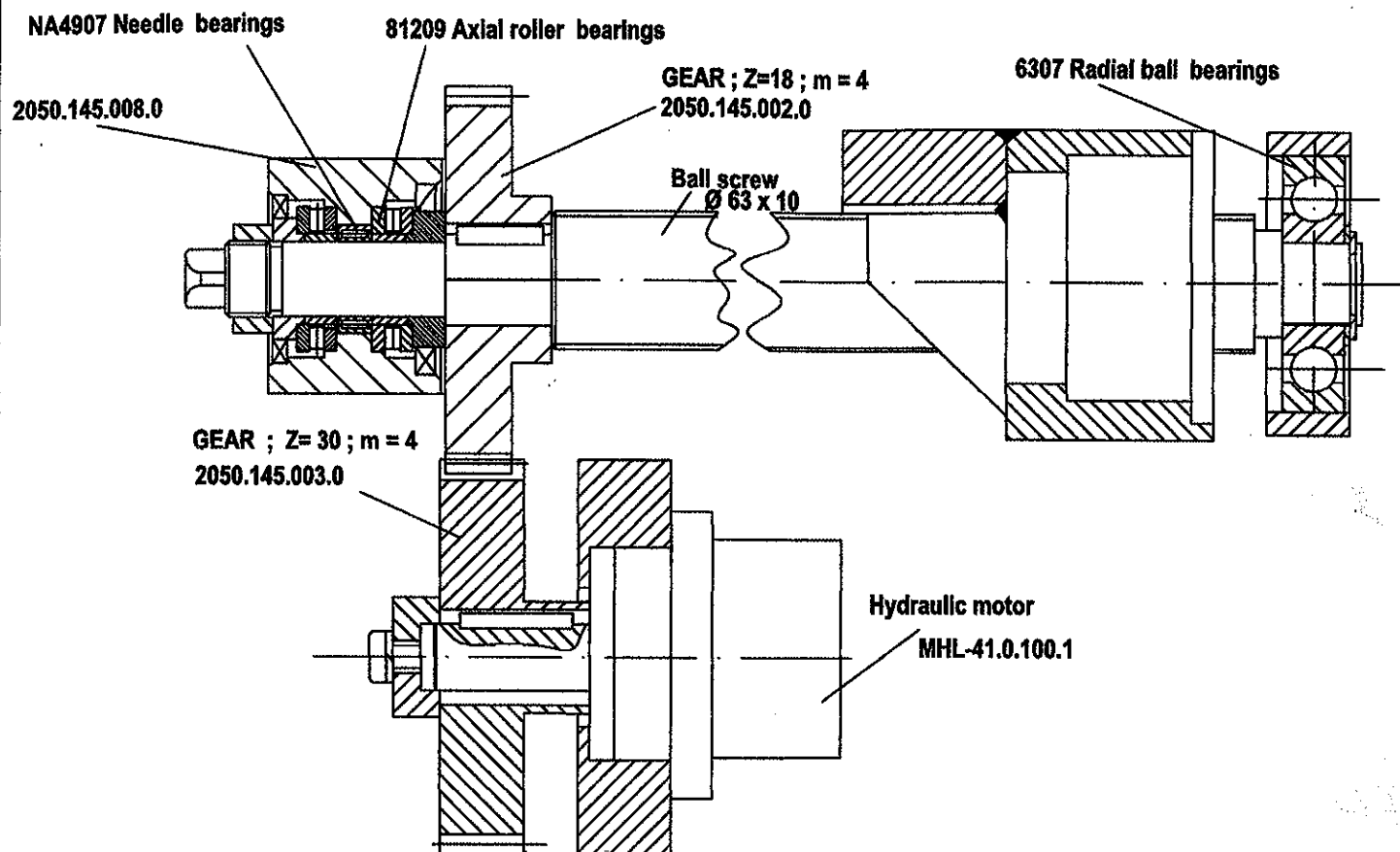


PALLET SUPPORT 3/4

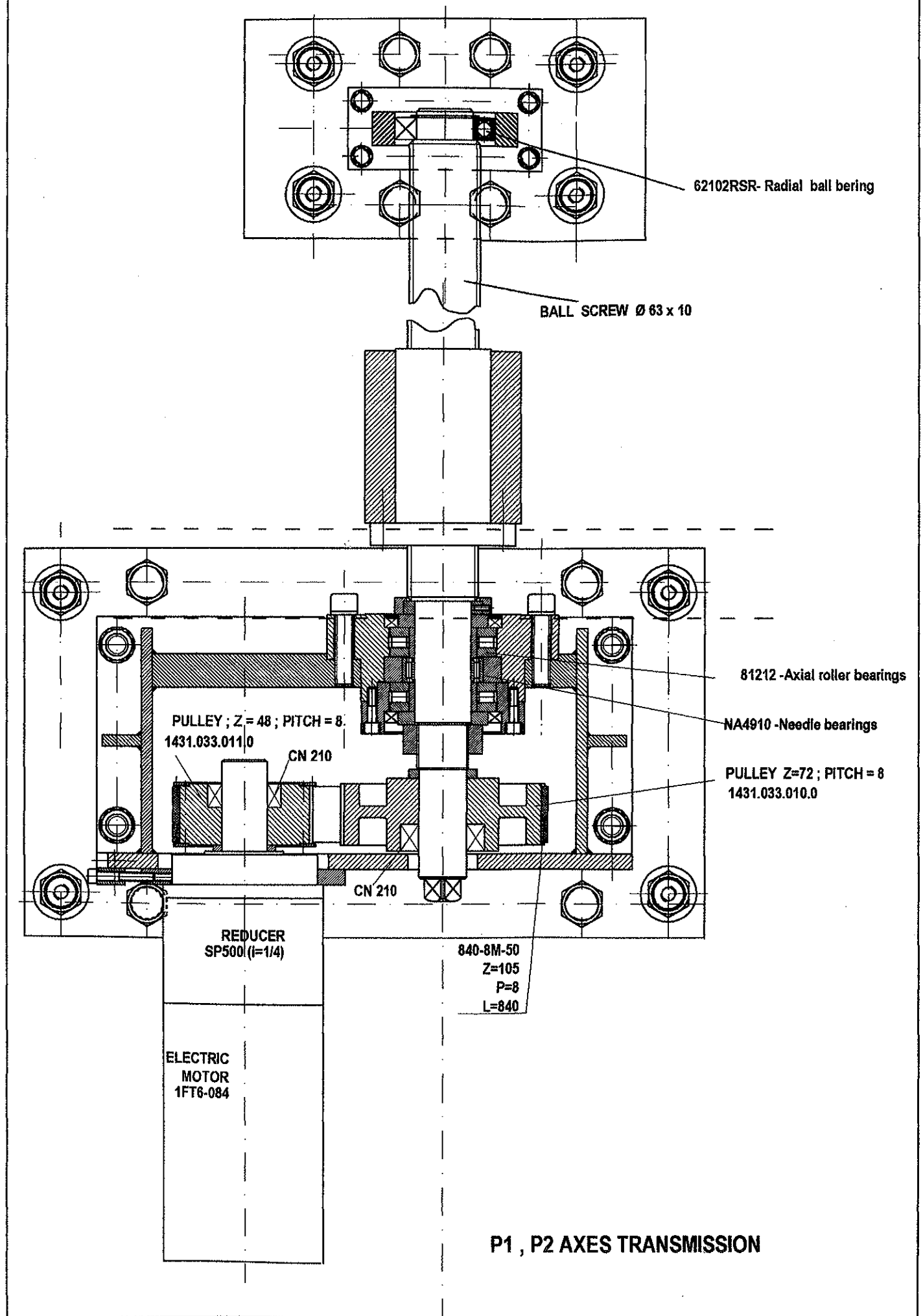




P1,P2 AXES TRANSMISSION



M1,M2 AXES TRANSMISSION



WORKING CYCLE AFT 130-P (PALLET SYSTEM)

No.	WORK SEQUENCE DENOMINATION	WORKING ELEMENT	ACTUATING CHARACTERISTICS				ACTUATING MECANISM	FORCE	TORQUE	MOVING DIRECTION (plane)	FLOW	WORKING PRESSURE	TIME		REMARKS
			STROKE		SPEED								CALCU- LATED	REAL	
			mm	degree	mm/min	rpm									
1	TABLE ROTATION IN PALLET CHANGING POSITION	TABLE		Max 180		2	FEED DRIVE BOX		1000	HORIZONTAL			60	65	
2	TABLE BLOKING	TABLE BLOKING PLATE	-	-	-	-	HYDRAULIC PISTONS		2500	VERTICAL		80	2	3	
3	PALLET DISPLACEMENT TO NEARER STATION	TABLE SLIDE	2000		8000		MOTOR, REDUCER, BELT, BALL SCREW	6500		HORIZONTAL LEFT OR RIGHT			15	20	
4	PALLET SUPPORT ROTATIO TURRET	TURRET		90		1,9	HYDRAULIC MOTOR, REDUCTOR, CILINDRICAL GEAR		700	HORIZONTAL	25	90	8	10	
5	TURRET INDEXING	INDEXING PIN	30		900		DOUBLE ACTION HYDRAULIC CYLINDER	265		UPWARDS VERTICAL		30	2	3	
6	TABLE DISCHARGING OF PALLET	TABLE GUIDEWAYS	25		260		DOUBLE ACTION HYDRAULIC CYLINDER (6pcs.)	27000		UPWARDS VERTICAL	15	60	6	8	
7	PALLET TRANSFER FROM THE MACHINE TABLE TO SUPPORT TURRET	TURRET CLAMPING SLIDE	2650		5000		HYDRAULIC MOTOR, CILINDRICAL GEAR, BALL SCREW	1950			30	40	32	35	

8	TURRET UNINDEXING	INDEXING PIN	30		900		DOUBLE ACTION HYDRAULIC CYLINDER	265		DOWNARDS VERTICAL		30	2	3	
9	TURRET ROTATION IN WAITING POSITION	LOADING STATION TURRET		90		1,5	HYDRAULIC MOTOR, REDUCTOR, CILINDRICAL GEAR		700	HORIZONTAL	25	90	8	10	
10	PALLET SUPPORT TRANSLATION	SUPPORT PALLET	1210		3000		MOTOR, REDUCER, BELT, BALL SCREW	3000		HORIZONTAL			24	30	
11	TABLE DISPLACEMENT TO THE SECOND STATION	TABLE SLIDE	4000		8000		MOTOR, REDUCER, BELT, BALL SCREW	6500		HORIZONTAL			30	35	
12	PALLET SUPPORT TURRET UNINDEXING	INDEXING PIN	30		900		DOUBLE ACTION HYDRAULIC CYLINDER	265		DOWNARDW VERTICAL	15	30	2	3	
13	PALLET SUPPORT TURRET ROTATION	TURRET		90		1,9	HYDRAULIC MOTOR, REDUCTOR, CILINDRICAL GEAR		750	HORIZONTAL	25	90	8	10	
14	PALLET SUPPORT TURRET INDEXING	INDEXING PIN	30		900		DOUBLE ACTION HYDRAULIC CYLINDER	265		UPWARDS VERTICAL		30	2	3	
15	PALLET TRANSFER FROM PALLET SUPPORT TO MACHINE TABLE	TURRET CLAMPING SLIDE	2650		5000		HYDRAULIC MOTOR, REDUCTOR, CILINDRICAL GEAR, BALL SCREW	2500		HORIZONTAL	30	40	32	35	
16	PALLET BLOKING TO MACHINE TABLE	TABLE GUIDEWAYS	25		300		DOUBLE ACTION HYDRAULIC CYLINDER			DOWNARDS VERTICAL	15	60	5	7	

17	PALLET SUPPORT TURRET UNINDEXING	INDEXING PIN	30		900		DOUBLE ACTION HYDRAULIC CYLINDER	265		DOWNARDS VERTICAL	30		2	3	
18	PALLET SUPPORT TURRET ROTATION	TURRET		90		1,9	HYDRAULIC MOTOR, REDUCTOR, CILINDRICAL GEAR		700	HORIZONTAL	25	90	8	10	

TOTAL PALLET CHANGING TIME:

$$T = T_{12} + T_4 + T_5 + T_6 + T_7 + T_8 + T_9 + T_{10} + T_{11} + T_{12} + T_{13} + T_{14} + T_{15} + T_{16} + T_{17} + T_{18} = 3 + 10 + 3 + 8 + 40 + 3 + 10 + 35 + 3 + 10 + 3 + 40 + 6 + 3 + 10 = 3 \text{ minute}$$

T_{12} = unindexing time

T_4 = pallet rotation time

T_5 = pallet indexing time

T_6 = table discharging of pallet time

T_7 = pallet transfer time

T_8 = turret unindexing time

T_9 = turret rotation time

T_{10} = support translation time

T_{11} = table translation time

T_{13} = rotation turret time

T_{14} = turret indexing time

T_{15} = pallet transfer time

T_{16} = pallet blocking time

T_{17} = turret unindexing time

T_{18} = turret rotation time

6.9.5 The ball screw

The ball screw assembly provides the displacement backlash free of the saddle (due to the preloaded ball screw nuts). The mechanism transform the movement transmitted from the saddle displacement feed box to linear movement of the saddle.

The ball screw is supported in three points with radial and thrust bearings (two main supports and the third as secondary one). The nuts housing is fitted on the bottom side of the saddle.

6.10 Feeds Mechanisms

The feed movements on X, Y, W, Z, B, P1, P2, axes are achieved by means of teeth belts with reduction ratio, actuated by electrical motors with continuous variation of the speed, independent on each axis, with great ranges of feed between 5 - 3500 RPM. The rotation speed of the table is of 1.5 RPM.

- The feed mechanism for cross travel of the table (X axis), ensuring a 4000 mm travel in placed on the longitudinal slide, at its rear end. It consist of on ZF reducer with transmission ratio of 1/4 actuated by an electrical motor of 16,2 Nm couple with continuous variation of the speed which by means of a teeth belt of 960-8M50 type (length = 960 mm; step = 8mm width = 50 mm), transmits the movement to the driving ball-screw ($\phi 80$, pitch = 10), by means of a coupling with elastic lamellas.

The driving ball screw of X axis is double-axially and radial sustained at both ends, having both the possibility for axial pre-loading of the bearings and the possibility for screw pre-loading. The ball-screw is also provided with an electromagnetic brake.

The ball-screw nut pre-loading was performed by its manufacturer.

- The feed mechanism for headstock vertical moving (Y axis), ensuring a 2500 mm travel is placed at the superior level of the column near the headstock balancing rolls. It is achieved by a ZF reducer with the transmission ratio of 1/4 actuated by an electrical motor of 16,2 Nm with continuous variation of the speed which by means of a 1120 8M50 (width = 50 mm; Z=140 ; p=8 mm) teeth belt transmission, transmits the movement to the driving ball-screw ($\phi 63$, pitch= 10).

The Y axis ball-screw is axially and radial double-sustained, having the possibility for pre-loading both of the ball bearings in each bearing and the screw. for screw revolution locking by missing the electric current at the superior side on the screw it is mounted an electro-magnetic brake with friction with pressure springs of FEA 5 (Mn = 50 Nm) type.

- The feed mechanism for column saddle longitudinal displacement (W axis) ensuring a 1500 mm travel is placed inside of a cave in the column bed. It consist in a ZF reducer with transmission ratio of 1/4 actuated by a electrical motor of 16,2 Nm couple with continuos variation of the speed which by means a 800-8M50 : (L =

800mm, step = 8 mm, b = 50 mm) teeth belt transmission, transmits the movement to the driving ball-screw ($\phi 80$, pitch = 10).

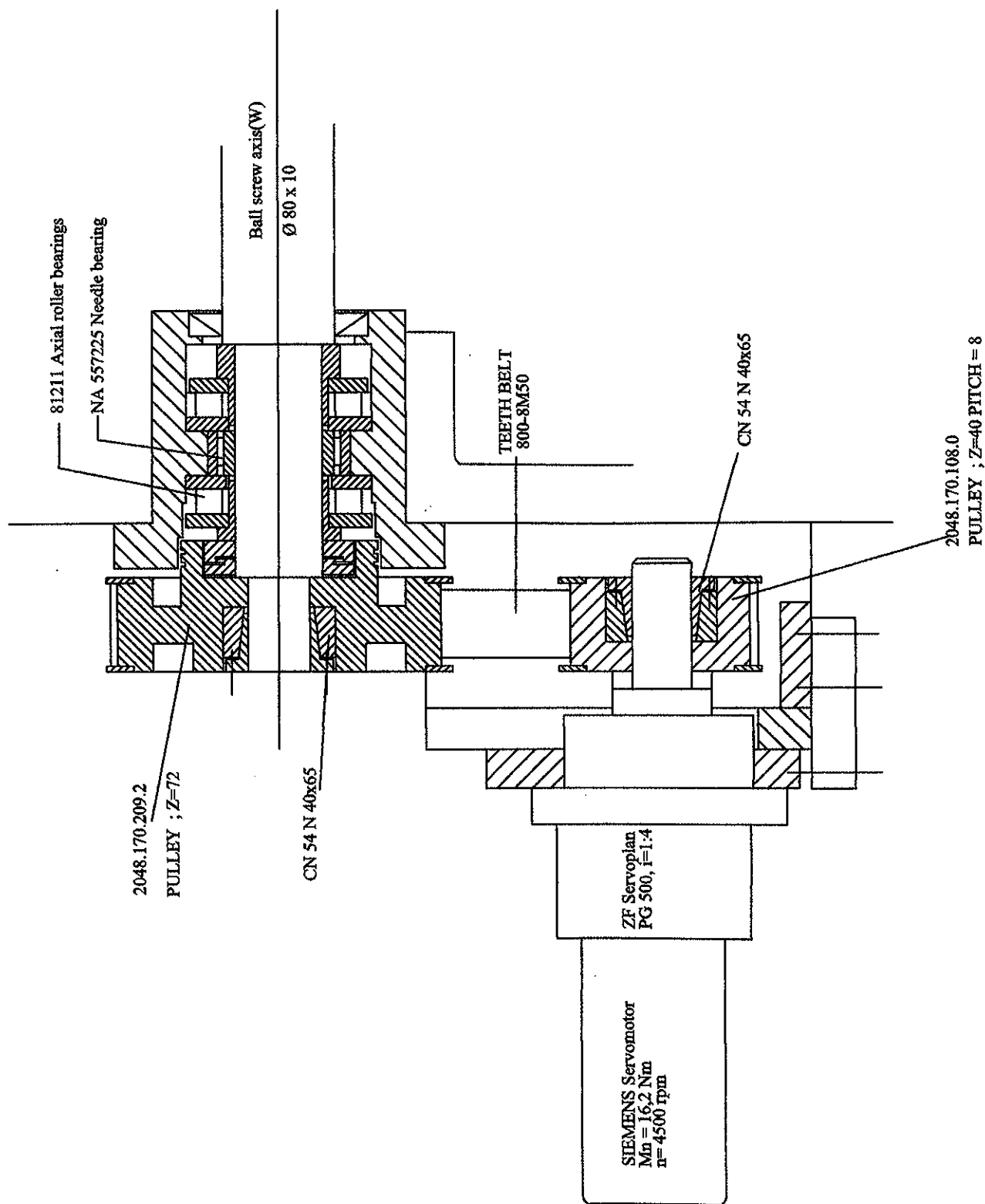
The Z axis ball-screw is double axially and radial sustained at both ends having the possibility both for axial pre-loading of the ball-bearing at both ends and for screw pre-loading.

- The feed mechanism for boring spindle displacement (Z axis) is coupled on the rear side of the arm at its end. It consist in a ZF reducer with the transmission of 1/4 actuated by an electrical motor of 10,4 Nm with continuos variation of the speed which by means of a 1200-8M50 (L 1200 mm; step = 50 mm, B = 50;) teeth belt transmission transmits the movement to a ball-screw ($\phi 63$, pitch= 10), which is double axially and radial sustained at both ends having the possibility both for axially pre-tensioning of the ball-bearings at both ends and the screw pre-tensioning possibility.

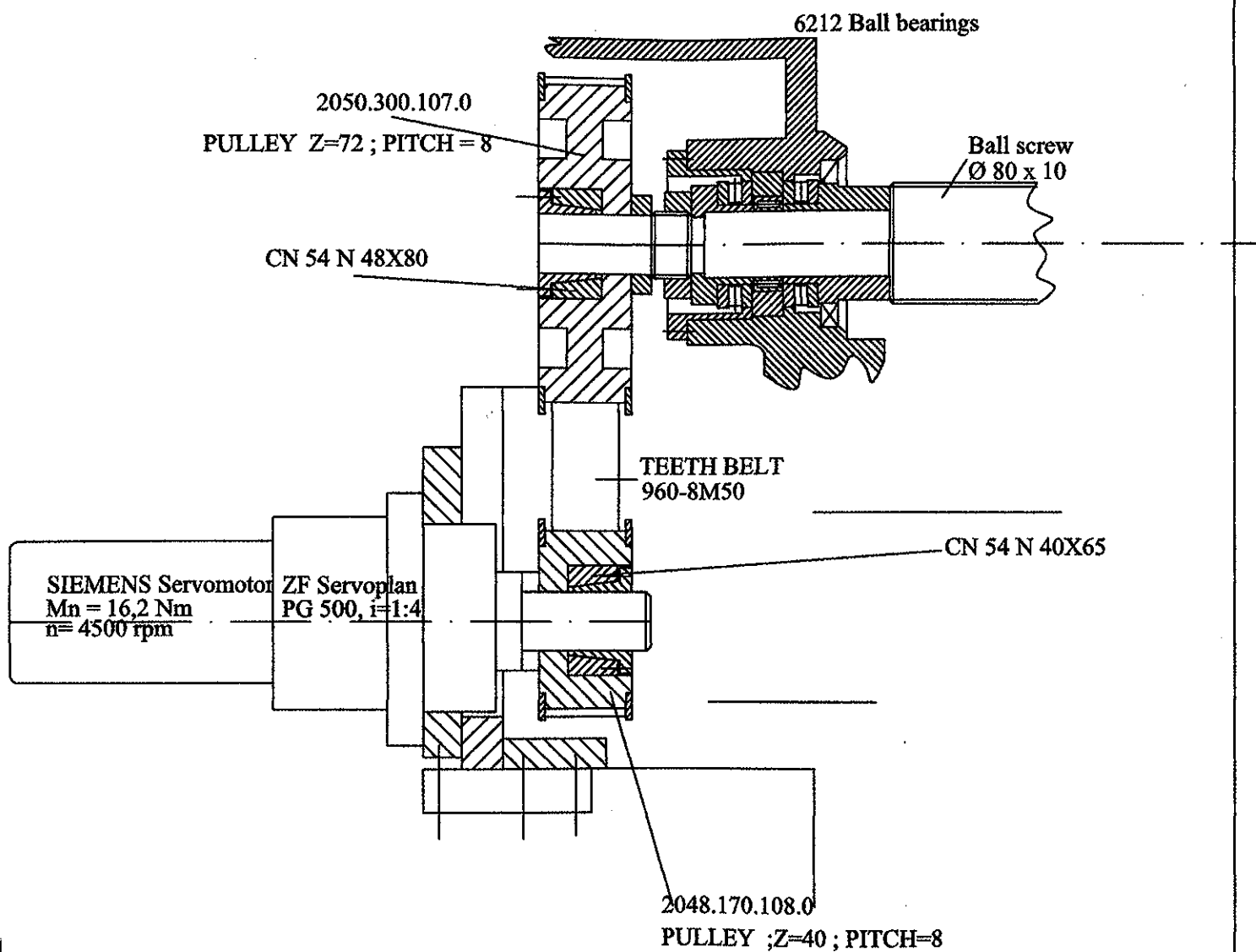
- The feed mechanism for each pallet (P1, P2) consists in: variable speed motor (Nm = 16.2Nm), planetary gear reducer ($i=1/4$), belt transmission 840-8M-50(L=840,pitch=8, B=50), ball-screw($\phi 63$,pitch=10). Ball-screw bearing are as follows: 2 roller thrust bearings and one radial neadle bearing on one end and one radial ball bearing at the other end.

- The feed mechanism for table revolution (B axis) is placed on the rear side of the table bed. It consist in a gear reducer actuated by an electrical motor of 22.4 Nm with continuos variation of the speed which by means of a (L = 1040mm; pitch = 8 mm, B = 50;) teeth belt transmission transmits the movement to the crown gear and pinion mechanism.

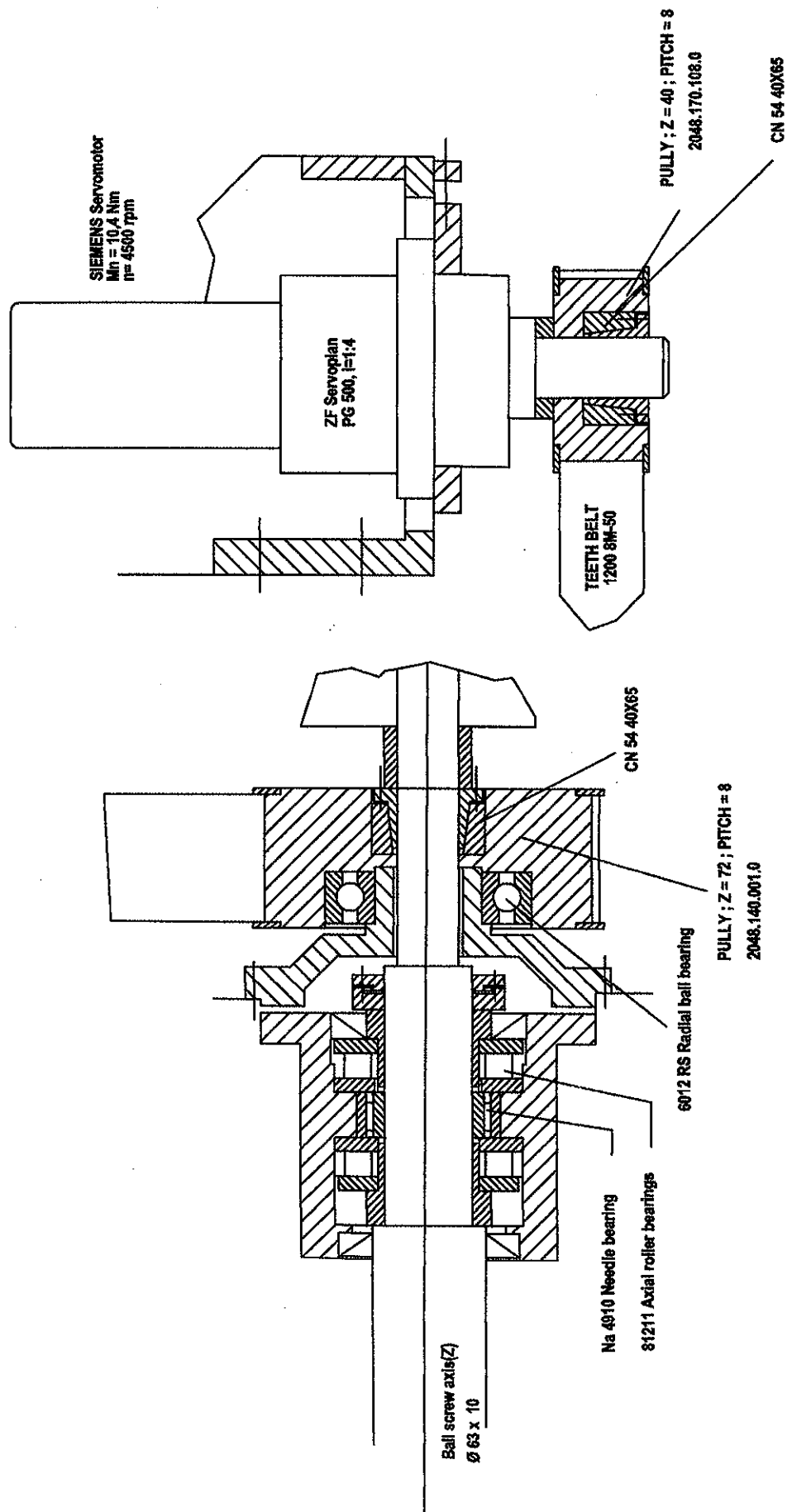
- The feed mechanism for pallet changing stroke (M1, M2) is made of :one variable speed hydraulical motor ; one cylindrical gear and one ball-screw $\phi 63$, pitch=10 (ball screw nut is actuating the pallet clamping device).



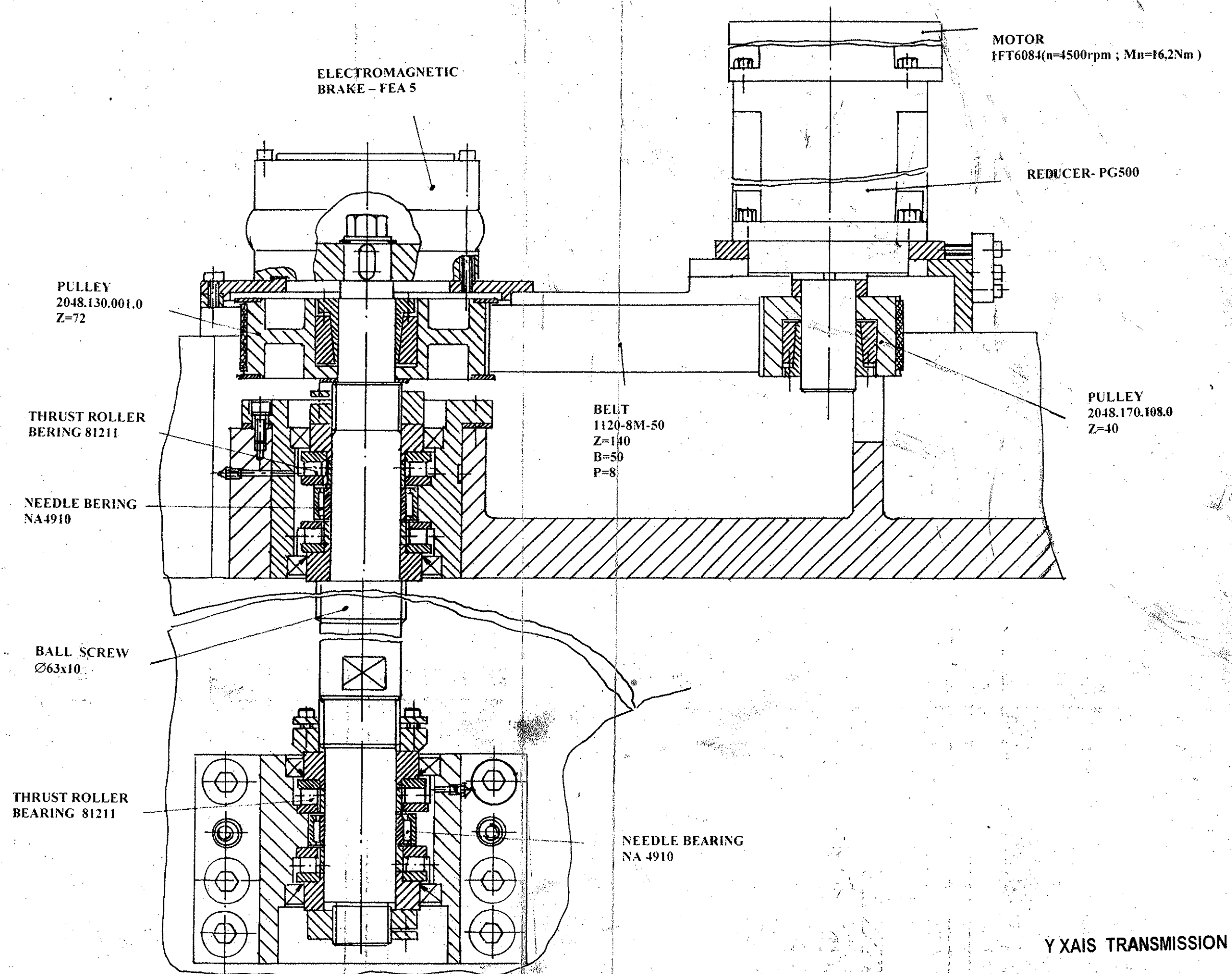
W AXIS TRANSMISSION



X AXIS TRANSMISSION



Z AXIS TRANSMISSION



6.11 Balancing Mechanism

Both the headstock and the arm are sliding along the guide-ways of the column. So, this sub-assembly needs to be poised by a hydraulic cylinder located inside the column. The link between the headstock and the balancing piston is ensured by a Fleyer chain, which moves over two rollers. These rollers are mounted on the roller support, which is fixed on the upper side of the column.

6.12 Z axis blocking

Hydraulic pistons mounted into the rear side bearing ensure Z-axis blocking. Pressure for hydraulic blocking is 80 bar. Besides the hydraulic locking an electromagnetic brake is mounted on ball-screw end.

6.13 Measuring Systems

For displacements on X, Y, W, Z and B axes measuring the machine is endowed with the following measuring systems:

- or X, Y, W, Z axes: - linear transducers (or rotary encoders
- for B and C axes: - rotary transducers;

6.14 Pendant Control Panel

The control panel is floor mounted next to the headstock. It includes all machine controls, as well as the numerical control and the operator panel.

6.15 Mechanisms Lubrication

The machine is endowed with two lubrication units Willy Vogel type, one which is lubricating the column bed and column guide-ways; W,Y,Z,P1,P2,M1,M2 axis ball screws nuts, and a second one which is lubricating table slide and also X axis ball screw nut , the pinions and crown transmission for table rotation.

The main spindle bearings are lubricated with oil mist .

The worm gear transmission from the table rotation feed mechanism is lubricated in oil bath. The gears from table drive box are grease lubricated.

Grease lubricated are also the X, Y, P1, P2, and Z-axis ball screw bearings and the rear side bearings of W axis ball screw .

Oil equivalents list is presented in the hydraulic machine bock –Table no. 1.

6.16 Mechanical hand

Mechanical arm travels along on the rolling way, which is fixed on the column, and performs the change and carrying of tools between the tools-magazine and the machine spindle.

Mechanical arm consist of a levers mechanism for gripping the tools, an arm taking of and inserting the tools in the spindle taper or in the holder-post in the magazine. The unit is completed with a 180° swiveling mechanism of the arm body supporting the tool grippers.

The 180° swiveling are achieved by means of a pinion-rak mechanism hydraulically driven by a hydraulic linear motor.

The axial motion in and out (180 mm travel) is achieved by means of linear hydraulic cylinder, placed inside the mechanical arm body.

On the upper and lower sides of the mechanical arm lousing, there are attached the rolls to provide the movement along the rolling guide ways. Rolls are fixed by means of brackets supporting a free swiveling fork, so that the triangle profile roll follows the guide way track.

Displacement of the mechanical arm on the rolling - way, between the magazine and the machine spindle, is achieved by means of rotating hydraulic motor (MHL, $Q = 100 \text{ cm}^3/\text{rot}$). Chain and pinion mechanism is moving the arm along it's guide way.

All movements are hydraulic, by means of linear and rotary motors, and confirmed by inductive proximity switches, mechanically limited.

Mechanical Arm Operating Cycle

0. "O" automatic cycle start position
1. hydraulic cylinder actuating for the tool unclamping (magazine side)
2. movement to the 1 position and tool clamping over from the magazine
3. tool clamping (magazine side)
4. tool clamping off the magazine, position 2
5. mechanical arm travel to position 3 and arm withdraw, position 4 (poss.)
6. mechanical arm movement towards machine spindle with end of travel speed decreasing, and hydraulic cylinder actuating for the tool unclamping (spindle side) pos.5
7. machine spindle tool clamping
8. hydraulic cylinder actuating for tool clamping
9. tool tacking off the machine spindle, pos. 6
10. 180° swivel, pos.7
11. new-tool inserting into the machine spindle, pos.8
12. hydraulic cylinder actuating for tool unclamping (machine spindle side)
13. movement towards the tools magazine, pos. 9, and mechanical arm coming out and end of travel speed decrease, pos.10

- 14.tool inserting in the magazine, pos. 11
- 15.hydraulic cylinder unblocking towards magazine side
- 16.withdraw to "O" position
- 17.mechanical arm coming out, pos. 13
- 18.180° swivel to initial position, pos.13
- 19.mechanical arm withdraw, pos.14

Rolling guide way

Subassembly consists of 3 parts:

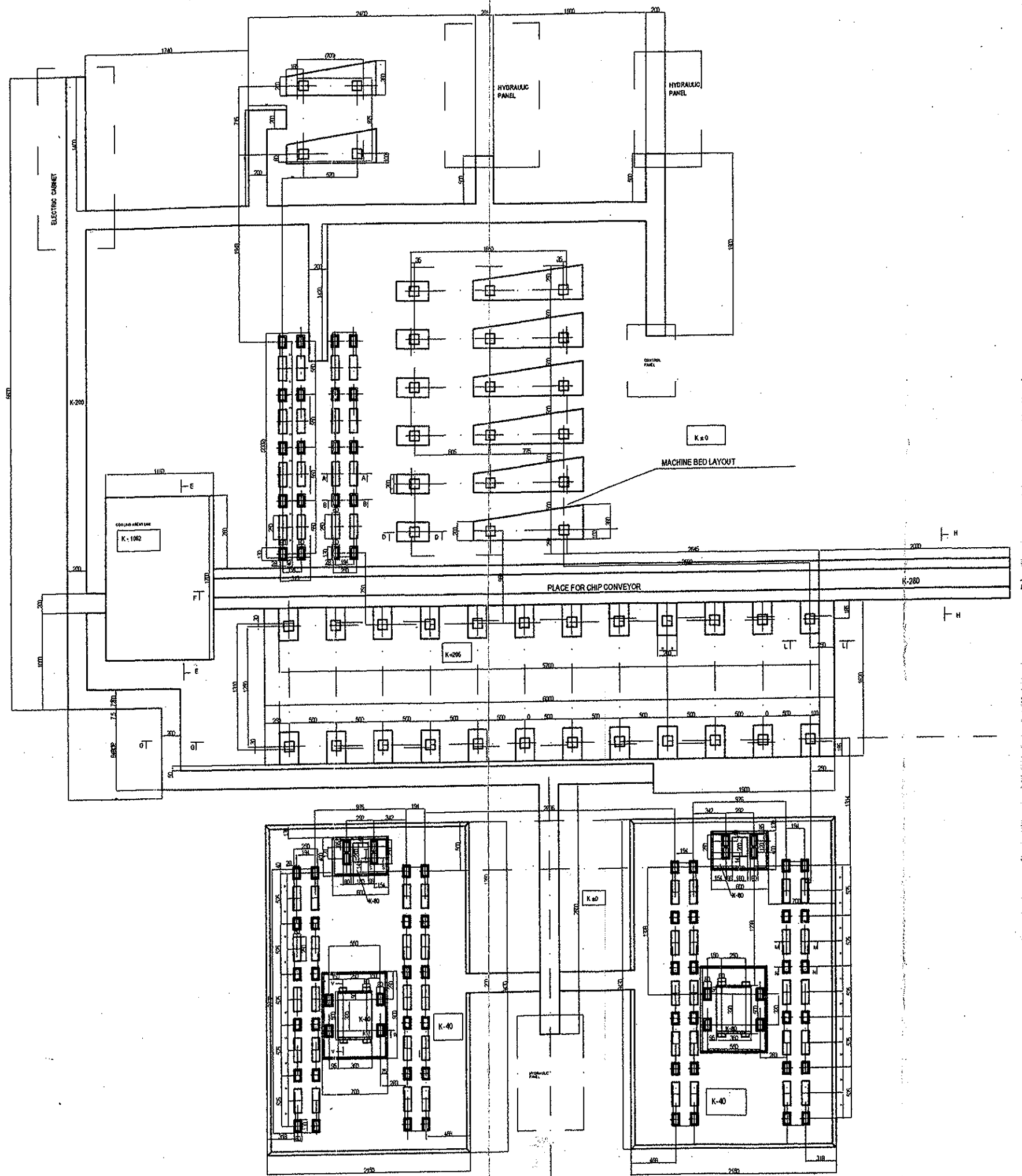
- 2 straight parts (front and rear)
- 1 -90°curved part, connecting the two 2 straight parts

Each part consist of two triangle profile guide ways (upper and lower) and the chain support -.Parts are attached to one another with screws and pins, achieving a compact and rigid guide way.

The rolling guide way is attached to the column by two brackets. At the ends of the guide ways there are stop buffers to limit the mechanical arm travel.

On the guide ways there are also mounted proximity switches to slow, stop and bring to "O" position.

7.LOCATION AND INSTALLATION



FUNDAMENT
AFT 130-P FOUNDATION

B-B
N-N
R-R
S-S

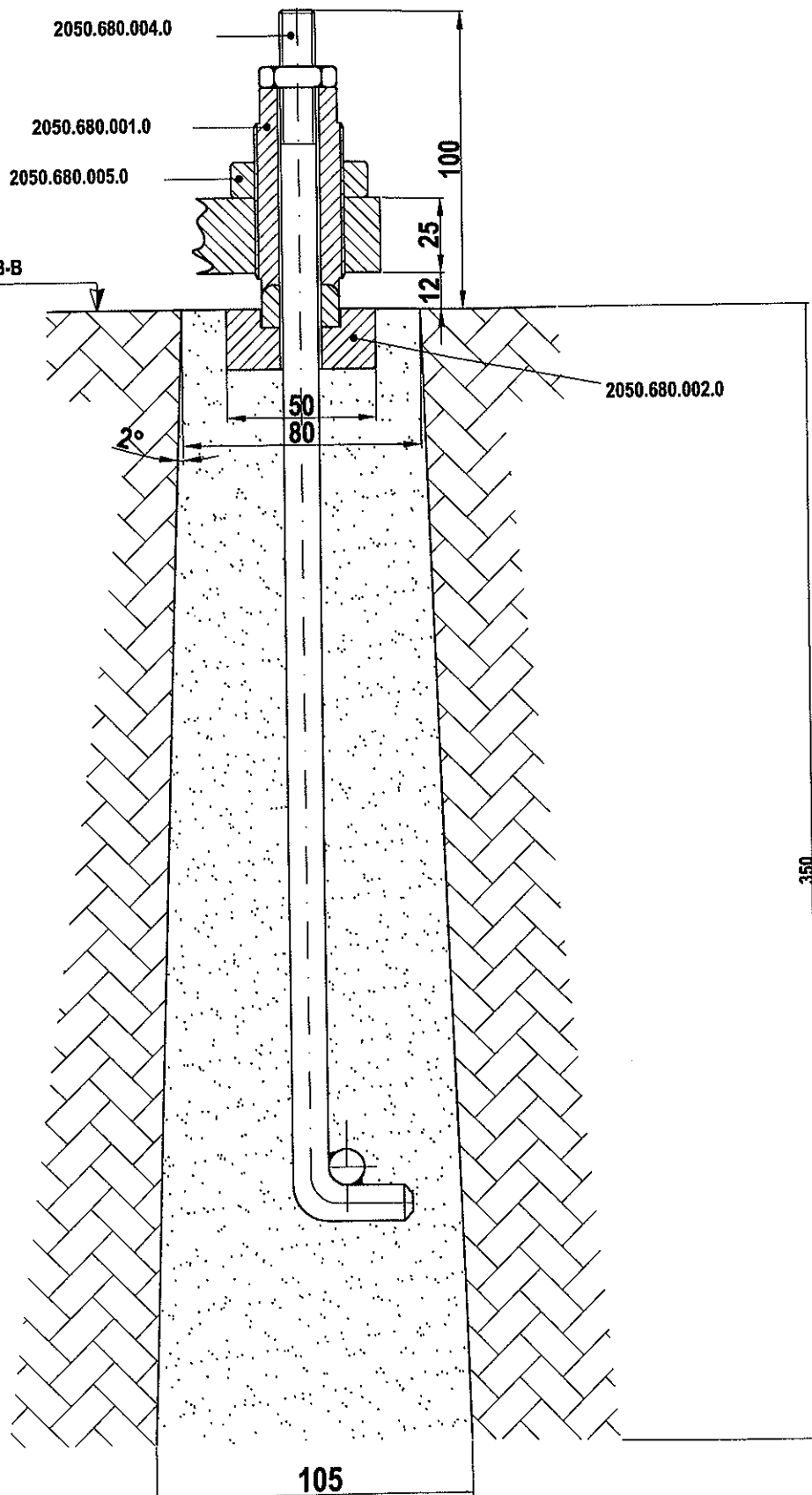
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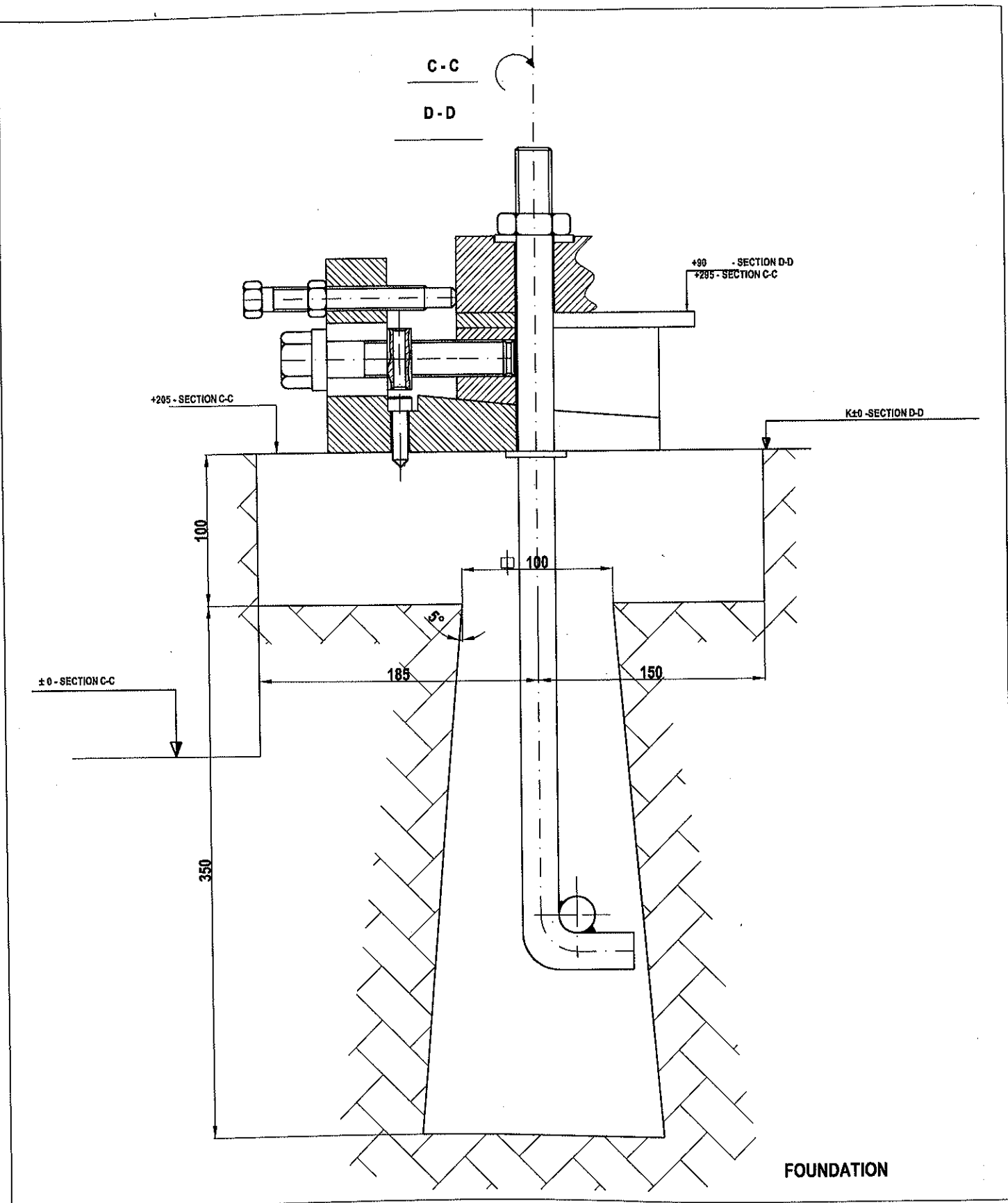
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K ± 0 - SECTION B-B

-40 - SECTION N-N
-80 - SECTION R-R
-80 - SECTION S-S



FOUNDATION



E-E

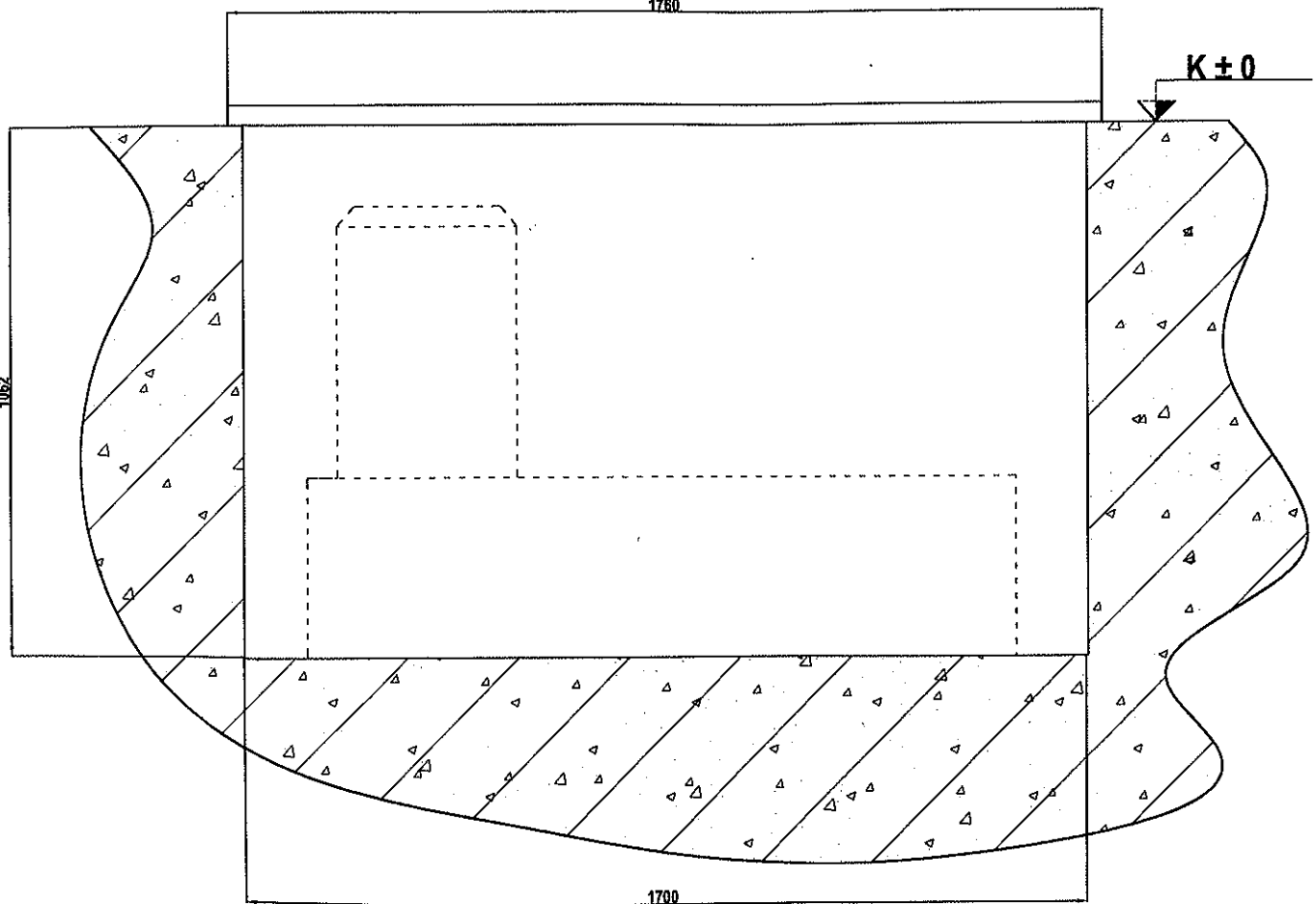
1760

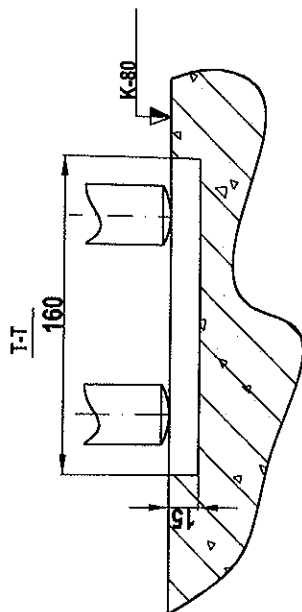
K±0

1052

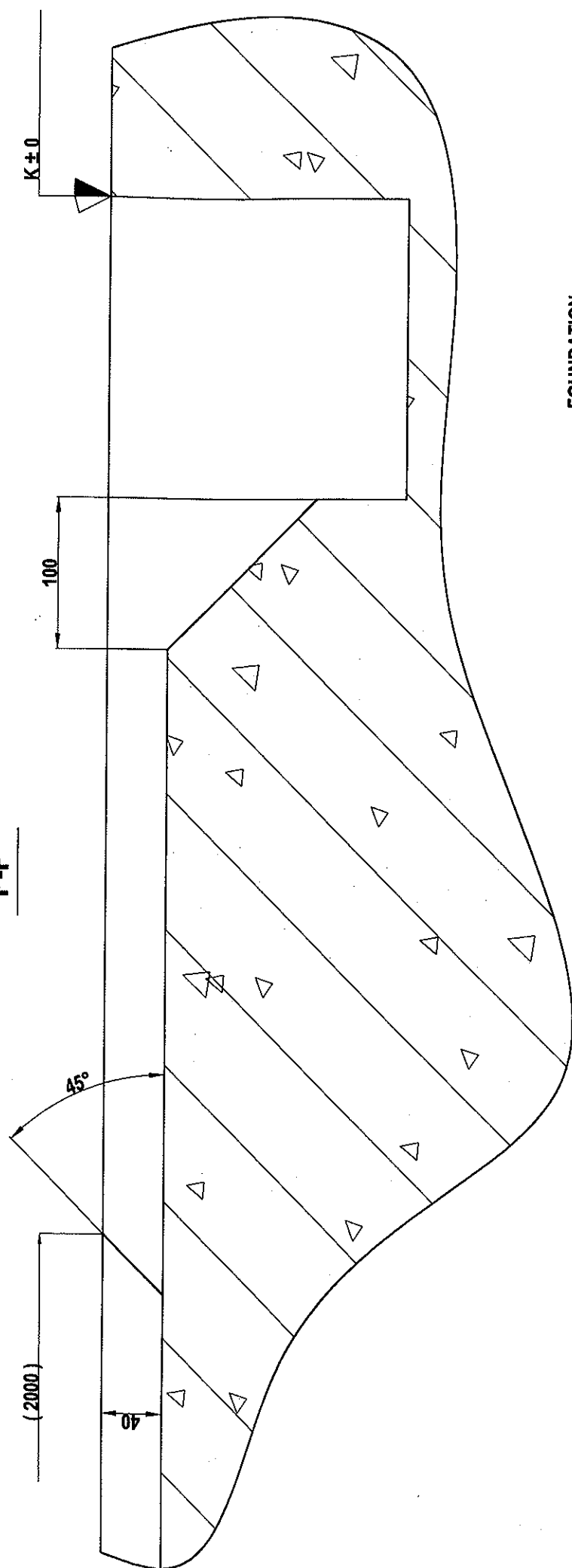
1700

FOUNDATION



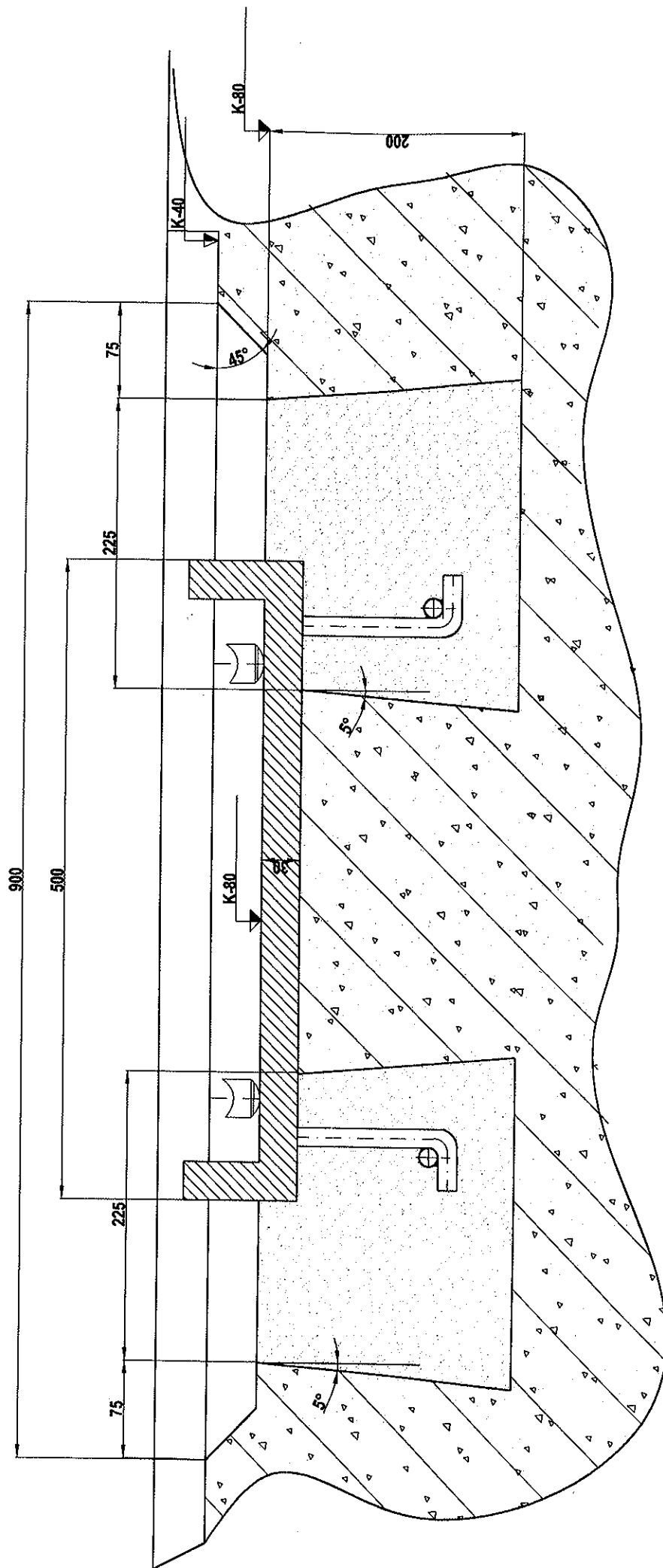


P-P



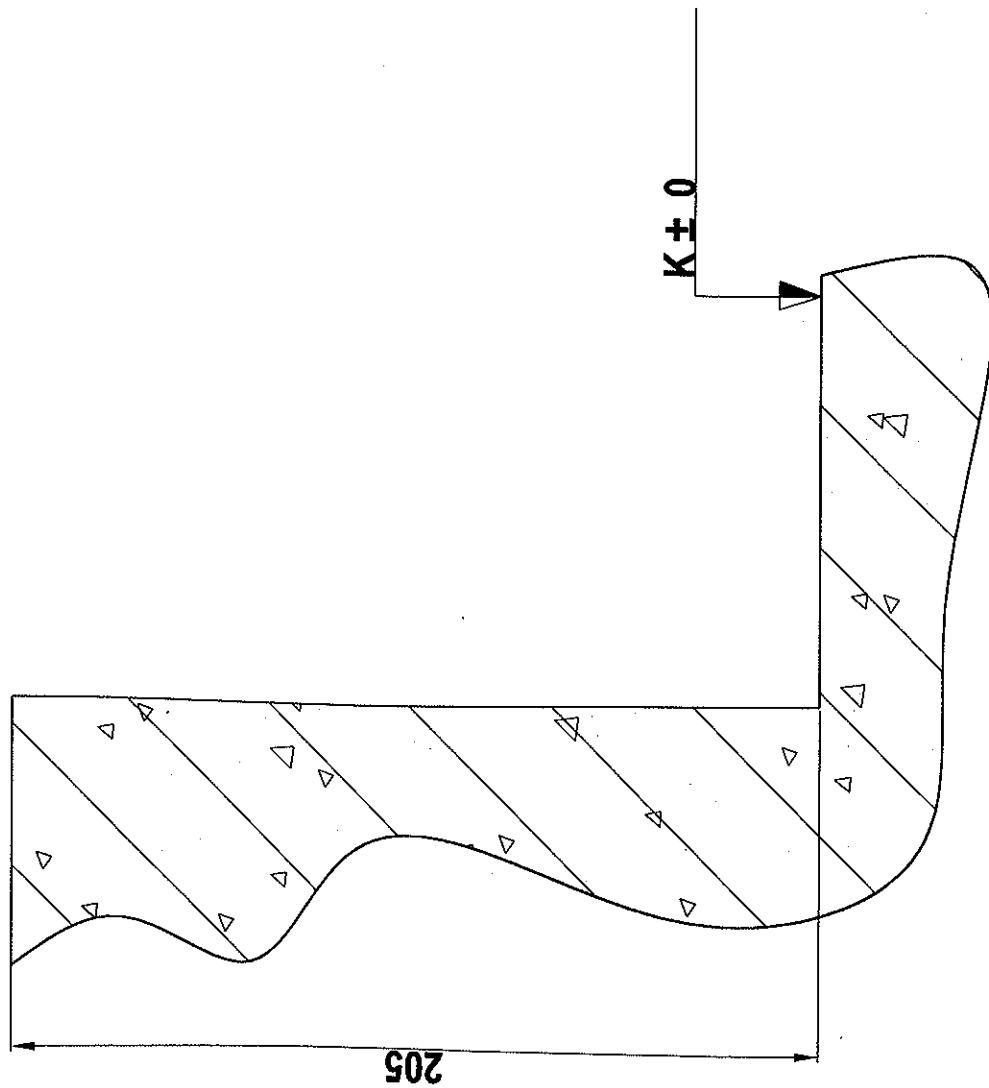
FOUNDATION

V-V

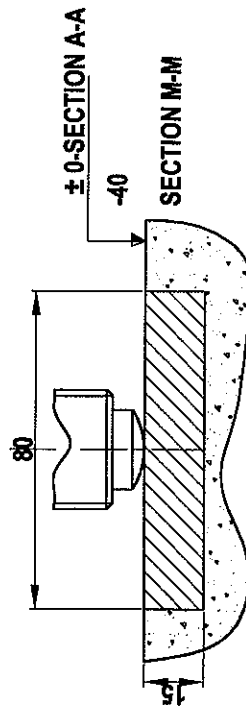


FOUNDATION

L-L



M-M
A-A



FOUNDATION

K+205

H-H

400

K±0

200

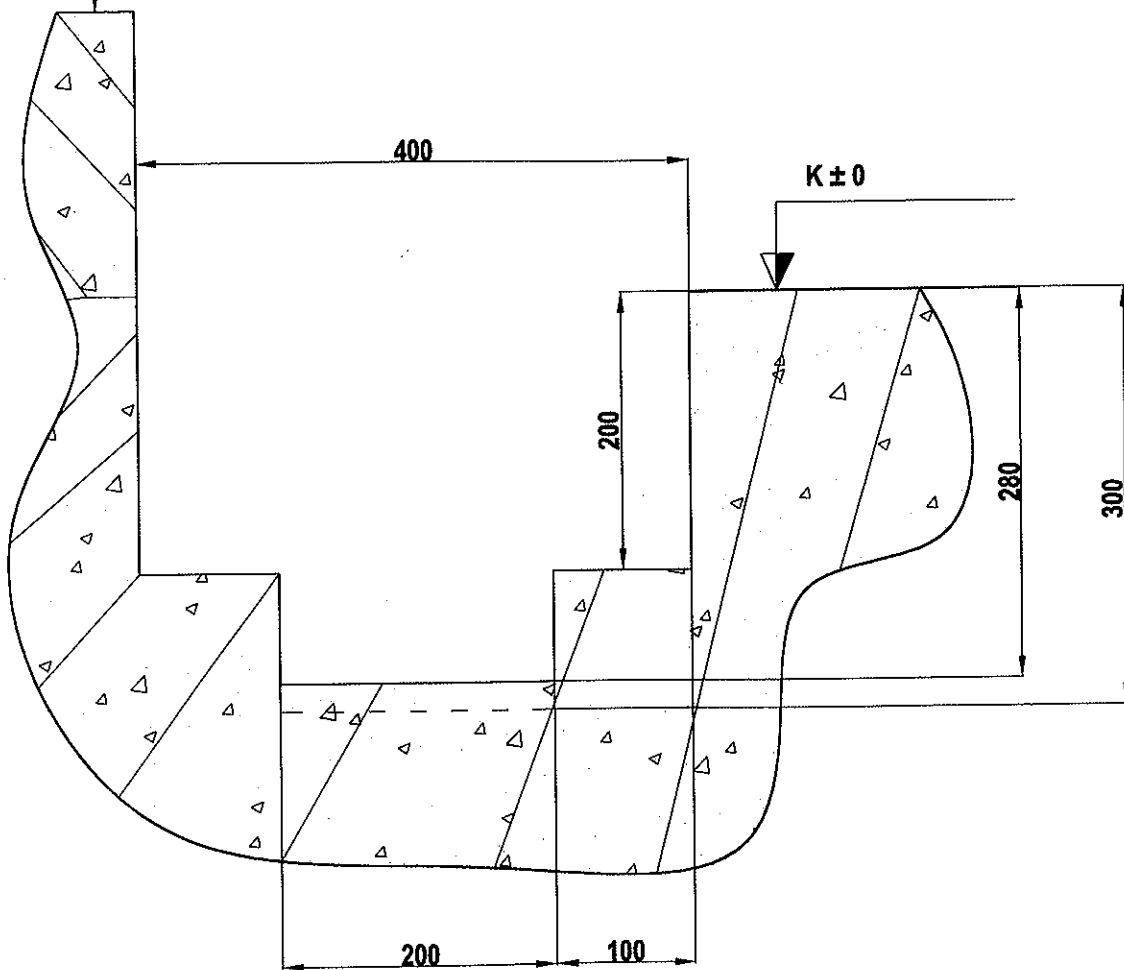
280

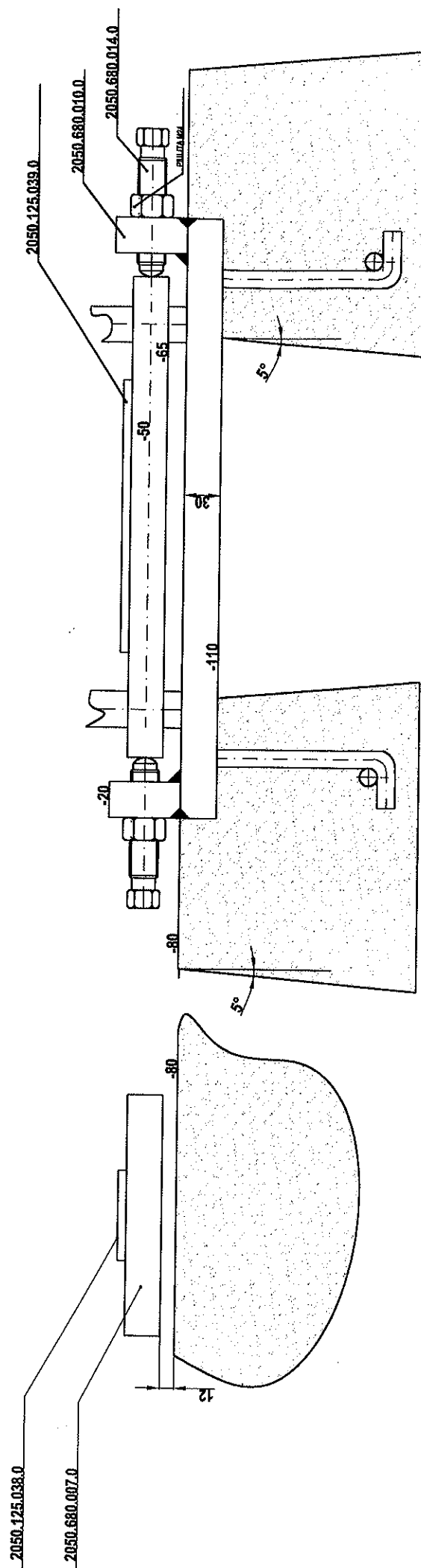
300

200

100

FOUNDATION





FOUNDATION

7.1 Base

In order to maintain its machining accuracy, the machine should be installed in the customer's shop onto a concrete base, whose execution shall comply with the drawing append.

The base thickness will be set according to the ground nature and to the vibration sources around, as well.

Base dimensioning and armament shall be done by the shop designer, taking into account both the fixed and mobile loads, as indicated on the base drawing, appended.

The permitted bent of the base should not be more than 50% of the rectilinearity deviation value, i. e. 0,010 mm/m, and respectively 0,04 mm throughout its length.

Concrete casting shall be performed at least four weeks prior to the machine installation onto the base, for the concrete not to yield subsequently.

The location of the electric conductors input shall be set according to the customer's local possibilities, while building the base. It is recommended that both the machine installation onto the base and the assembly installation and adjustment to be performed by the supplier.

Under the influence of moving loads the rectilinearity deviation shall not be more than $\pm 0,02$ mm/m and the verticality deviation shall not be more than the absolute value of 0,020 mm/m.

Cement mortar composition for device fastening into the base:

- 1 measure Portland 750 cement
- 1 measure 0,3 cm granulation sand
- 2 measures 0,7 cm granulation sand.

The water addition has to be choose in order that the mixture for dwellings to be paste (to pour).

The base body surfaces in contact with cement-mortar for devices fastening, shall be well-cleaned and moistened during two days before mortar pouring by vibrations.

The walls and the bottom of the decanter hole and of the hole for cooling unit tank and also the channels for cooling liquid draining shall be polished and isolated against cooling liquid infiltration.

Under the influence of moving loads the rectilinearity deviation shall not be more than $\pm 0,02$ mm/m and the verticality deviation shall not be more than the absolute value of 0,02 mm/m; a,b - directions for devices placing onto the base.

All the devices will be adjusted at media quote of 110 mm.

At the a and b devices the respective extensions shall be mounted.

The devices shall be mounted in the foundation screws holes and the extensions shall be correctly oriented.

The bed, in this way prepared will be placed onto the base on two lateral rows of metallic auxiliary adjusting wedges so that the devices foundation screws and the extensions to be perfectly in the designed hole in the concrete body and filled up to 3/4 with soft cement mortar.

Immediately the bed vertical and horizontal alignment will be performed and then the holes will be filled with cement mortar from lateral sides. After 6 hours the foundation screws nuts shall be loosen in order to avoid the concrete tearing from the device sole the bed being sustained by the wedges.

After 14 days, the bed will be aligned once again by means of the device and the wedges shall be removed.

After that the nuts shall be firmly tightened the beds shall be relieved with tightened nuts.

Finally the device adjustment screws shall be locked.

7.2 Machine Installation and Alignment onto the Base

For the machine to be installed the base drawings will be studied and the following mounting sequence will be kept:

- The beds shall be placed on two bearings. Each slot within the bed, plate shall be provided with a double-effect device for horizontality adjustment. The screws which are mounted within the end plate must be provided with plates and nuts, such as the upper side of the screw to be approx. 10 mm over the nut.

- The bed will be lowered onto the base by means of the horizontality adjustment devices, close to the base slots. The bed shall be supported by two steel plates, located at half distance between two adjoining screws, in order to allow a first leveling and base holes filling with cement water. The plates will be supplied by the customer.

- Cement water will be poured into the base holes. At least 48 hours after filling, the following operations should be achieved:

- The devices shall be handled such as the bed to be sustained by them; afterwards, the positioning screws of the devices onto the base shall be slowly screwed and the steel plates shall be removed.

- The beds guide ways shall be well cleaned by means of a duster imbibed with oil and the bed shall be positioned both transversally and longitudinally by means of a level and leveling devices.

- The screw nuts of the bed plate will be screwed.

- Bed horizontality shall be checked and corrected.

- The slide assemblies shall be mounted as such:

- The beds guide ways shall be well cleaned with a duster imbibed in oil. The slide assembly shall be lifted by means of cables and its surfaces of contact with the bed shall be cleaned.

- The slide assemblies shall be placed onto the bed after an abundant greasing of the bed guide ways.

- The ball screw nut of the slides shall be fixed by screws against the slide-sustaining surface.
- The beds guide ways closing plates shall be mounted.
- The column shall be lifted by means of cables.
- The contact surfaces shall be cleaned and lubricated with a thin layer of oil; subsequently the column shall be placed onto the column saddle.
- The column fixing screws shall be screwed.
- The headstock shall be lifted by means of cables, its guide ways shall be carefully cleaned, afterwards it is put in contact with the column guide ways, previously cleaned and greased with a thin layer of oil. In this case the headstock must be sustained by two wooden logs.
- The procedure continues by fixing the ball screw nut against the headstock sustaining surface.
- The cables between the headstock hydraulic balancing cylinder and the headstock is mounted by manual actuation of the headstock ball screw, then the sustaining bar of the counterweight shall be removed. Ball screw actuation shall be achieved by a wrench.
- The guide ways guards shall be mounted; previously the supports of the travel measuring transducers must be mounted.
- The procedure will continue by mounting the other elements: the hydraulic installation, the electric equipment, and after filling the oil tanks, the adjustments and the tests of the machine- tool will be done.

7.3 Accurate Adjustment of the Machine Horizontality

1. The machine horizontality is adjusted by using levels, such as to keep the following tolerances:

- rectilinearity deviation of bed cross guide ways: 0,020/1000mm
- rectilinearity deviation of bed longitudinal guide ways: 0,020/1000 mm
- perpendicularity deviation of the column guide ways towards the bed guide ways, longitudinally = max 0,030/1000 mm (inside only)
- parallelism deviation of the boring spindle towards the longitudinal displacement of the table (measured both in horizontal and vertical planes) = 0,020/500 mm.

For adjusting the machine horizontality, the adjustment parts shall be used by making sure that all parts are equally under the load.

2. The protection parts shall be mounted onto the machine.
3. The oil tanks shall be filled.

7.4 Transportation

The machine shall be transported from manufacturer to the customer dismantled into subassemblies, being packed in accordance with the transport conditions and duration.

The manufacturer such as the machine to reach the customer in good conditions establishes the necessary packing for transportation.

After unpacking the subassemblies shall be transported by crane. The following rules shall be complied with:

- The cables shall be suitable to the load to be lifted, with no defects and long enough.

- The sensitive parts of the machine shall be protected with wood pieces and for avoiding paint scratching, rag shall be placed where necessary.

- The subassemblies shall hang perfect horizontally or vertically (i.e. the column) in order to avoid upsetting while starting or stopping the crane.

- Using two bars, which are passed through the bed holes specially provided, and two cables of equal length shall horizontally suspend the rotary table.

It is recommended the subassemblies to be lifted by crane as indicated in the pictures appended.

The transportation capacity of the crane shall be big enough for there subassemblies to be lifted.

For this reason the approximate weight of each main subassembly shall be indicated:

• <u>table</u>	- 3500 daN
• <u>saddle</u>	- 3000 daN
• <u>column</u>	- 8000 daN
• <u>headstock.</u>	- 3200 daN
• <u>table bed</u>	- 7000 daN
• <u>column saddle + column bed</u>	- 9000 daN
• <u>mechanical hand</u>	- 300 daN
• <u>tools magazine</u>	- 1800 daN
• <u>pallet</u>	- 3000 daN
• <u>table slide</u>	- 3000 daN

7.5 Unpacking

Assemblies featuring the component elements in state of functioning pack the machine tool. After the machine reception by the customer, the machine may be unpacked and checked unless damages occurred during the transportation.

If any damages occurred while transporting, both the transporting company and the manufacturer should be immediately advised.

It shall also be checked that the case contains all the accessories mentioned on the inventory list.

ATTENTION : LIFTING HOLES TO BE USED ONLY FOR INDIVIDUAL HANDLING OF EACH PART.

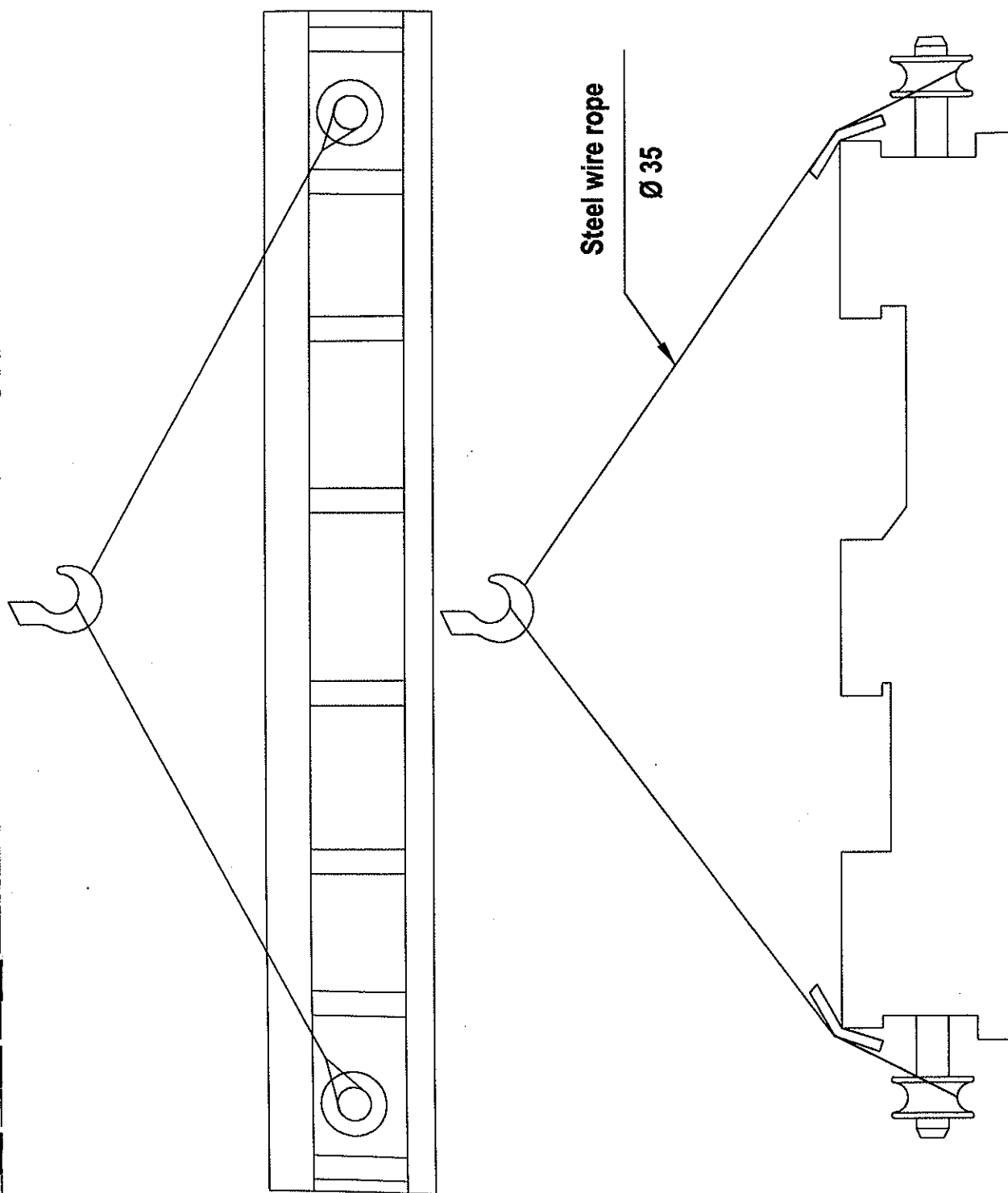


TABLE BED RAISING MODE
7000 daN

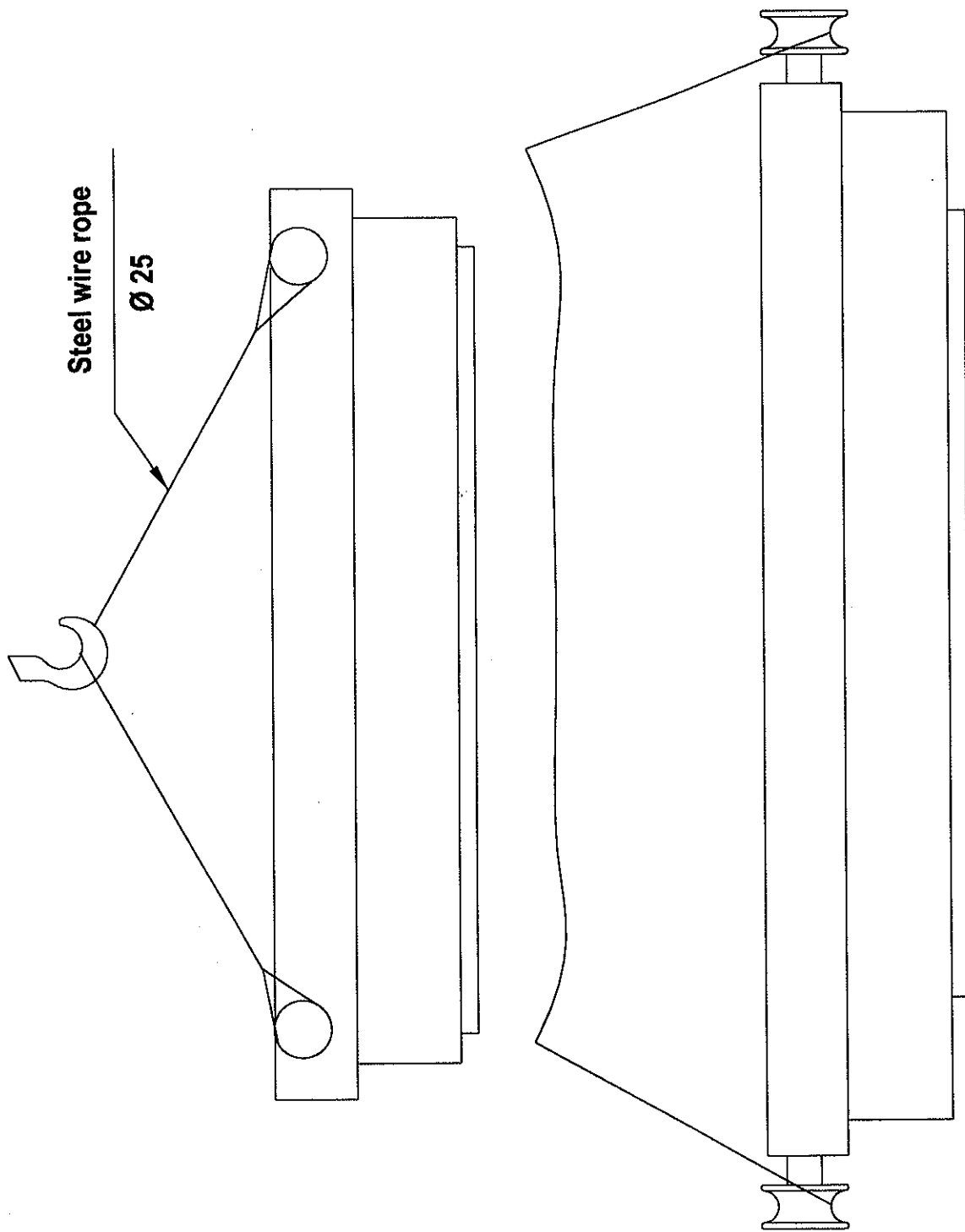
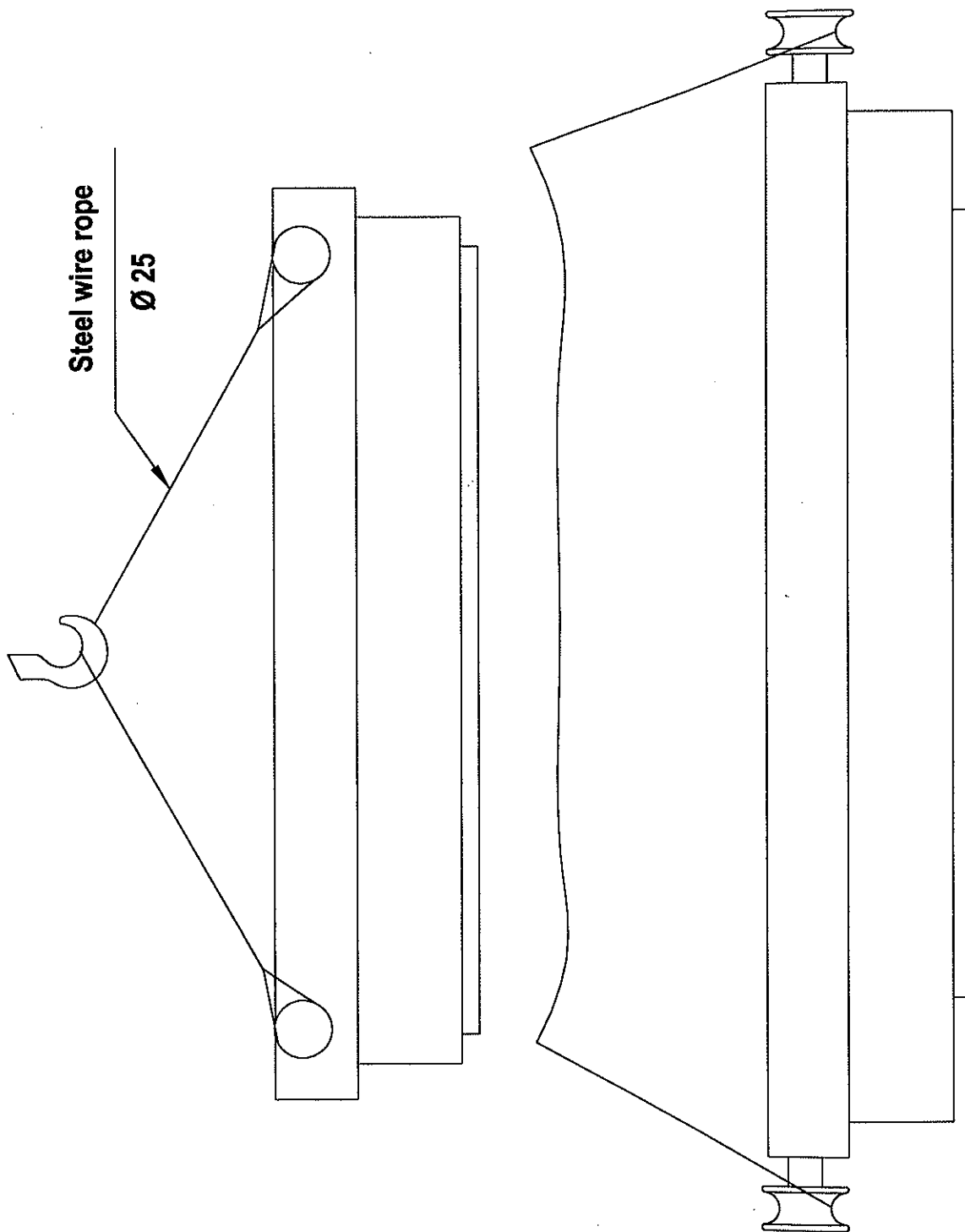
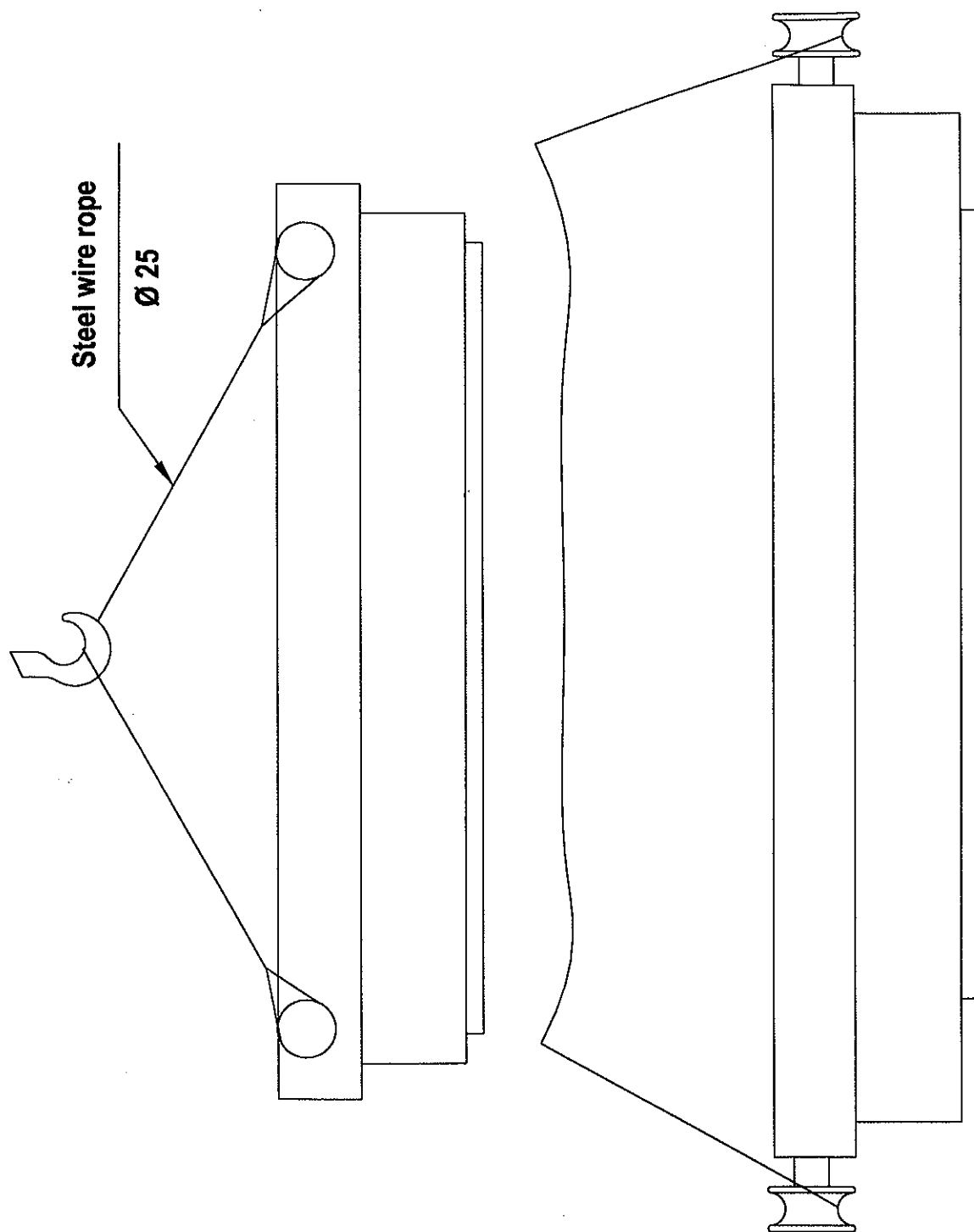


TABLE SLIDE RAISING MODE
3000 daN



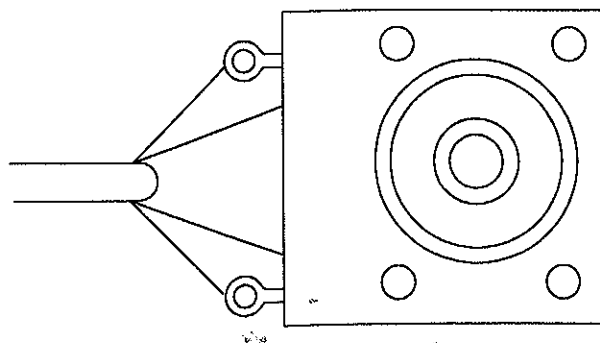
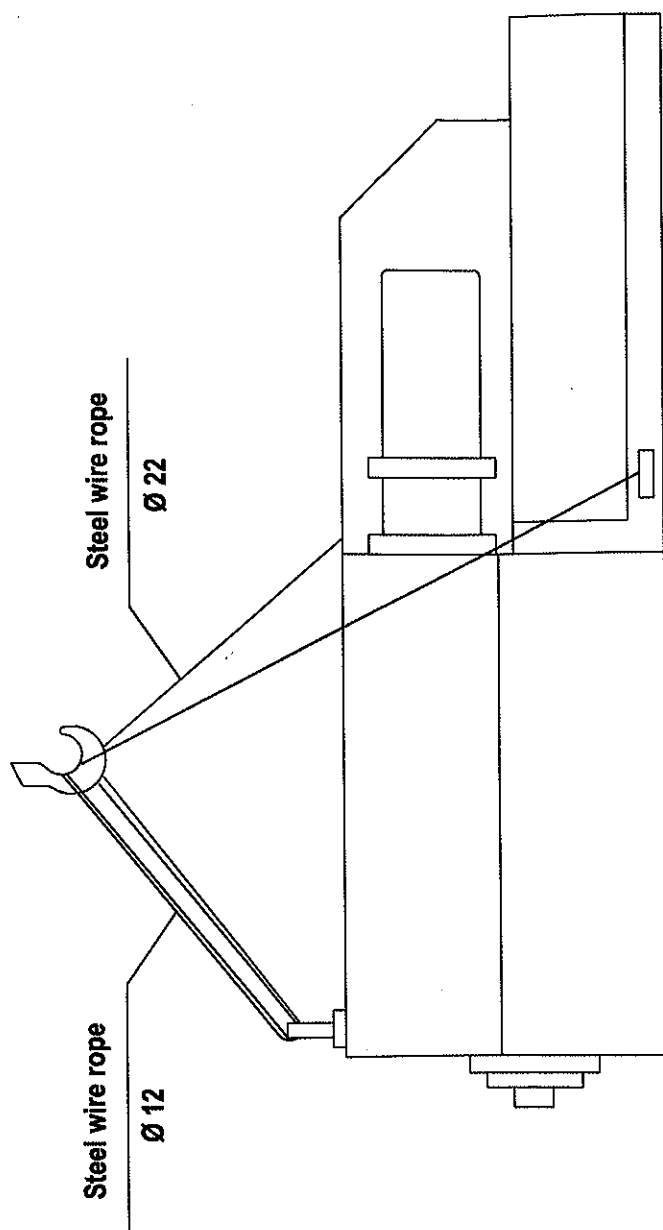
PALLET RAISING MODE

3000 daN

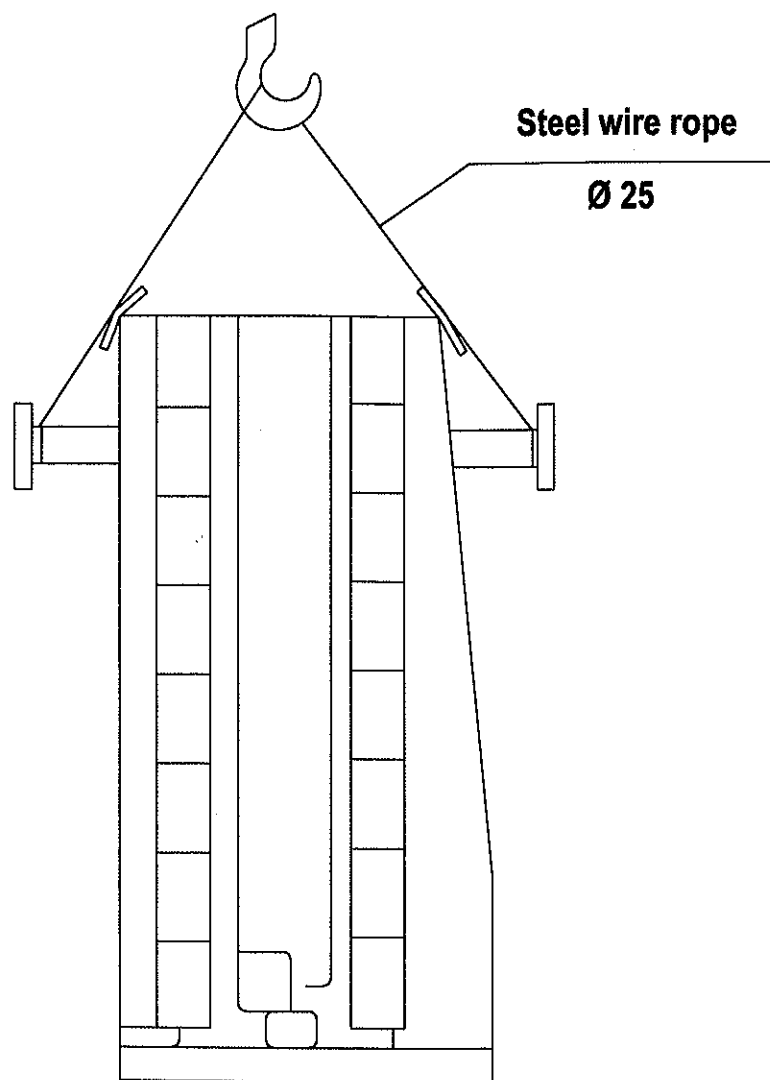


CAUTION:
WILL BE BALANCED WHEN
LIFTING AND TRANSPORT

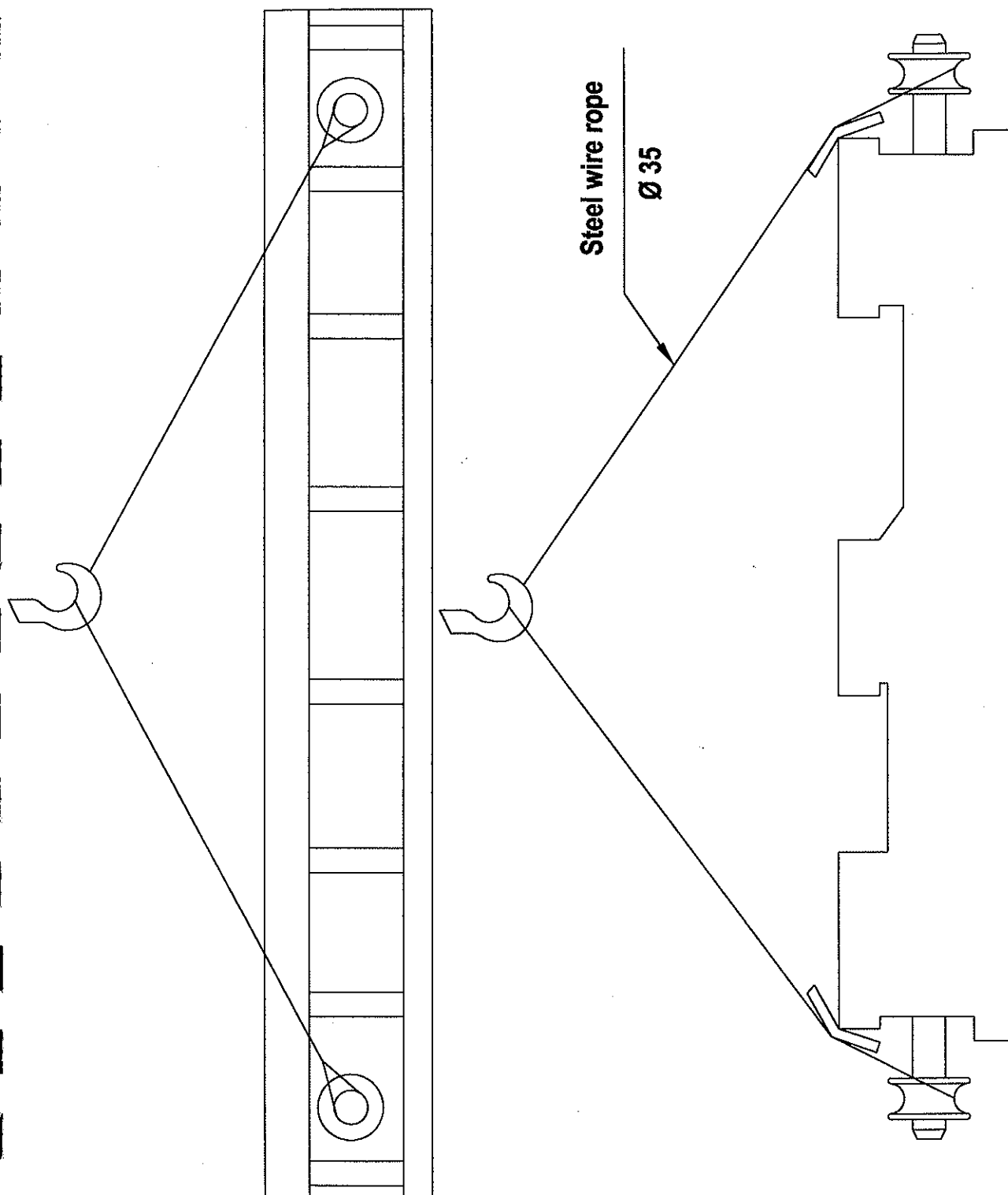
TABLE RAISING MODE
3500 daN



HEADSTOCK RAISING MODE
3200 daN



COLUMN RAISING MODE
8000 daN



BED COLUMN RAISING MODE
5500 daN

7.5.1 Cleaning

The manufacturer greases the guide-ways surfaces, unpainted surfaces, service elements and labels with grease. The grease shall be wiped out and then cleaned by means of dusters imbibed in oil.

Wire brushes, metallic blades and other objects or materials, which would damage the protected surfaces, shall not be used.

The surfaces of contact between subassemblies shall be checked.

These shouldn't feature shock traces or foreign impurities.

7.6 Instructions/Rules for Installation and Location

After unpacking and cleaning, the installation of the machine subassemblies may begin. The mounting sequence of the machine subassemblies is as follows:

- column bed + column saddle
- column
- headstock, counterweight
- table bed
- slide of the table
- rotary table
- pendant panel support, pendant panel
- cooling installation
- electric and hydraulic equipment connection.

The mounting of these assemblies shall be achieved through a close interdependence, in order to ensure both the machining accuracy and the necessary functioning, according to the technical documentation of the machine manufacturing.

When mounting the machine to the customer, as well as when mounting it to the manufacturer, the following rules shall be kept:

- the joining of the subassemblies which both the rigidity and accuracy of the machine are depending on, shall be achieved such as between the respective subassemblies, a 0,02 mm caliper gauge may not reach a 3 ÷ 5 mm depth;
- the contact surfaces shall not feature scratches or shock traces;
- those parts of the subassemblies which are to be joined to other subassemblies shall be cleaned and blown with compressed air;
- when mounting the moving subassemblies (such as slide, boring spindle), the parallelism of the subassemblies moving direction to the axle of the actuating element (ball screw) shall be checked;
- the pipes of the lubricating installations shall not feature sharp holding angles deformations or bending on their rectilinear portions, and shall be rigidly mounted;
- the use of cotton dusters or other materials which might, leave fiber for cleaning the hydraulic elements is forbidden.

The machine is recommended to be installed inside closed halls, with no direct solar radiation action onto the machine-tool components (mechanical, hydraulic, electric) and far from thermal and vibration sources, as well.

7.7 Instructions/Rules for Connecting the Electric and Hydraulic Equipment

The connection of the boring and milling machine AFT 130 P CNC type to the electric and hydraulic equipment will be performed keeping the following rules:

- before connecting to the power electric circuit it shall be checked that the functioning voltage and frequency of the machine are according to the mains voltage and frequency;
- it shall be checked that the earth connection is well done;
- it shall make sure that the electric motors direction of rotation are as shown onto the main control board;
- the protection switches shall be checked, after a careful study of the “Machine Handbook - the electric section.”
- This checking shall be related to several periods of functioning, as well as after each intervention to the electric installation when it is compulsory.
- The correct functioning of all travel-end limiters and brakes shall be ensured.
- All parts which need lubrication shall be lubricated; the oil tanks shall be filled only with the oil type as shown in documentation, up to the preset level on the level indicator.(The oil level shall indicate the maximum oil quantity within the tank)
- The lubrication pumps shall be checked such as to have the suitable direction of rotation.

7.8 Reception of the Machine Delivery Documents

The reception of the boring and milling machine of AFT 130 P CNC type shall be done either by the customer to the manufacturer, or by agreement, directly to the customer's firm after the tests and checking with a view to homologation, by following up the strict accordance with the provisions of the machine handbook.

The documents to be provided with the machine delivery are:

- 1 -Machine Handbook
- 2 -Quality certificate
- 3 -The measuring charts, which acknowledge the good functioning of the product, its accuracy and geometry, according to DIN German standards.
- 4 -Specification of the main components of the machine completed with the special endowments, as per the contract.

8. COMMISSIONING AND EXPLOTATION RULES

8.1 Kinematic Diagram

The main motion of processing is achieved by a D.C. motor 1PH7-167-SIEMENS type ($P = 37\text{kW}$; $n_{\text{max.}} = 6000\text{ RPM}$).

The feed motion on X, Y, Z, W, B are achieved by teeth belt reducers, actuated by electrical motors by means of ZF reducers, with speed continuous variation independent on each axis, with large range of feeds.

On all the four linear axes, there are hardened and ground ball-screw.

8.2 Prescription for Putting into Operation

After fixing onto the base, the following stages shall be attended for machine putting into operation:

- the functioning voltage and frequency of the machine shall be checked to fit to the mains voltage and frequency;
- the grounding shall be checked to be correctly done;
- the electric motors and lubricating pumps senses of rotation shall be checked to be as shown on the main control board;
- the protection switches shall be checked after studying the "Machine Handbook-Electric Section";
- the correct functioning of all the travel-end micro-switches, couplings and electromagnetic brakes shall be checked;
- all the elements that need lubrication shall be lubricated.

The oil tanks shall be filled only with the type of oil as indicated such as the oil levels to show the maximum value.

- the correct switching of the spindle speed range shall be checked, as well as the correct table locking-unlocking function;
- by using various speed rates, the correct mounting and functioning of the guide ways guards and of the guide ways wipers as well, shall be checked;
- all manual and automatic commands shall be checked.

8.3 Guaranties, Period between Repairs

The manufacturer guarantees the proper functioning of the machine-tool 12 month since its putting into operation, but no longer than 18 months from delivery (unless otherwise stipulated by the delivery contracts), in accordance with the current norms and laws, by complying with the instructions for use as provided in this machine hand-book.

The guaranty term refers to attachments, as well.

The guaranty consists of remedying the deficiencies free of charge and, possibly, the replacement of the defective parts, in case when the deficiencies occurred under normal running and maintenance conditions, being caused by several constructive or material hidden defects.

8.4 Regime and Condition for Adjustment and Functioning

AFT 130 P CNC boring and milling machine can operate either in automatic regime or in manual regime with commands from the operator.

For both ways of machining, the regimes are identical.

Before putting into operation, the following adjustments are necessary:

- spindle bearings adjustment;
- adjustment of shanks and of the disk-springs set compression force for a odd tool clamping within the spindle taper;
- adjustment of ball screw bearings pre-stressing;
- adjustment of both main sub-assemblies position (i.e. table and column with headstock);
- table bearing adjustment;
- wedges adjustment
- travel adjustment of the moving elements (such as slides, boring spindle, headstock) as well as of electric command and confirmation elements (such as detectors, micro-switches, etc);
- check of protection disconnections, both for each subassembly apart and for the whole machine;
- check of lubricating unit functioning oil level checking inside the oil tanks of the hydraulic and lubrication units.

After applying these adjustments as well as being aware of the provisions referred to at "Rules for connecting the electric and hydraulic equipments" the machine-tool may be put into operation.

8.4.1 Spindle Bearings Adjustment

The axial backlash adjustment of the spindle bearings shall be performed only if an axial backlash over the preset values is measured, by means of a caliper gauge onto the spindle front flange.

For backlash adjustment of the four front side bearings, the procedure consists of:

- the front cover of the headstock shall be removed The bearings take-nuts shall be released by unscrewing their locking screws with the help of a hexagonal rod.
- A hexagonal rod shall be entered into one of the radial holes of the take-nut in order to avoid its rotation with the milling spindle.
- The milling spindle shall be rotated with the necessary angle for backlash taking-over, and the desired screwing or releasing of the take-nut will be obtained.
- This operation shall be repeated until the caliper gauge that is touching the spindle flange will show the maximum allowed backlash value.
- The take-nut shall be locked onto the set up position through the threaded bolt; afterwards, the headstock cover will be mounted back.
- The same procedure shall be used for rear side bearings.

The spindle axial backlash adjustment shall be performed at by the manufacturer and, by this reason, it is not necessary any intervention.

8.4.2 Table Bearing Adjustment

This operation will be done only in case when deviations beyond the prescribed value of the Acceptance chart have been found during one of the machine checking. For bringing these deviations within the prescribed limits, the stressing nut of tensions the bearing shall be adjusted up to the radial run out of bearing is 0,008-0,01 mm.

There will be no need for the rotary table to be dismantled.

8.5 Running In Period

The period of running in tests shall consist of 72 hours of functioning. It is recommended that during this test the machine being used in two shifts.

During the running in tests, the record of the machined work pieces, machining regimes, machining accuracies and of other various remarks regarding the machine behavior meantime, shall be held.

It is recommended the machine exploitation to be progressively done, as such:

- the first stage shall last about 16 hours; during this period such machining regimes shall be applied, as the consumption power not to exceed 30% of the main motors rated power.

- The second stage shall last about 40 hours, when the chosen machining regimes shall not require more than 60% of the rated power consumption of the main motors.

- The third stage shall last about 16 hours; meanwhile the main motors power consumption shall be 80% of the rated power, with machining regimes established for maximum sized work pieces, made of various materials.

After finishing the running in period, the oil from the lubrication unit tank shall be changed.

Then the machine might be exploited at its all installed power.

The manufacturer guarantees the manufacture precision degree unless shocks or damages occurred during the transportation to the customer and if the machine is mounted onto a suitable base.

Dismantling the machine sub-assemblies or their component parts by the customer whilst the guaranty period without the manufacturer's agreement cancels the manufacturer's obligations.

Both the repairing cycle and periods between repairs are settled by the norms related to the technical maintenance and repairing of the machines and installation for machine construction and metal machining.

In order to ensure a correct machine functioning, the checking of the main sub-assemblies, shall be done at the following periods of time:

HORIZONTAL BORING AND MILLING MACHINE AFT 130 P CNC

Page 113

No.	Sub-assembly or parts to be checked	Nature of checking	Checking period
0	1	2	3
1.	The mechanical elements that ensure the machine structure	positioning geometrical precision of bed guide-ways, according to the repairs chard	2 months since the mounting onto the base
2.	The whole machine -tool	geometrical precision, according to the acceptance chard	each 12 months after reception
3.	Feed mechanism of boring spindle headstock, table	state of gearings on Y and W axes	each 6 months after reception
	Headstock	behavior of tightening parts	each 6 months
		pinions and bearings wear	each 18 months
		state of the mechanism for	each 3 months
4.	Travel limits on all axes	correct functioning of all micro-switches	each 6 months
5.	Electric equipments	Parameters and converters as per the working characteristics	each 6 months
		time relays adjustment	each 6 months
6.	Hydraulic equipments	- the pressure of the mobile gear driving circuit axes and table locking, by the pressure gauges; -lubrication pumps flow; -electro valves functioning; - checking and adjusting the valves for maintaining the adjusted pressure of the hydraulic circuits , mobile-gears axes locking-unblocking	each 3 months since a deficiency has occurred each 6 months each 6 months each 3 months
7.	Chain for headstock balancing	To be changed	after 20000 hours of running

REMARKS:

The time periods for the items 3 to 7 are specified for a machine running in two work shifts and are considered by the reception date.

Regarding the repairing cycles and other elements related to these, the following recommendations are done:

No.	Sort of repair	Running period till the repair	Repairing duration(days)
0	1	2	3
1.	Technical revision	After each 1000 hours	3
2.	Current repair 1-st degree	After each 2500 hours	7
3.	Current repair 2-nd degree	After each 10000 hours	15
4.	Capital repair	After each 30000 hours	30

•The machine command elements are placed in accessible positions for the operator and there is no risk for any command to be initiated by mistake.

•While machine running or adjustment the operator doesn't need any work or protection equipment different from the normal equipments.

•The machine operators shall attend a detailed induction training on the technological process of the work-pieces to be machined, on the commands, and of the sub-assemblies and machine general functioning, as well.

At the same time, the operators should be firstly and detailed instructed about the work protection rules specific to this machine; the machine using without these regulations acknowledge being forbidden.

At the work start, the machine general state will be checked and the beginning of the work will not be admitted in the case when deviation of the control, lubrication, tool damages etc. occurrence is noticed.

During machining and after the lubrication and the oil level of all the subassemblies will be checked.

Interlocking between rapid and working feeds ensures all the control commends and travels.

During mounting using and maintenance of the electric equipment the rules of work protection at electric equipment should be observed.

The chips' removing by hands or non-suitable tools is not allowed.

In order to protect the personnel against the dangerous voltages, all the metallic parts able to be accidentally under voltage connections, will be connected at the electrical general panel null of the shop and at the internal belt of earth connection.

It is forbidden the handling of main switch during the work.

This handling can be done after machine stops.

The working piece will be firmly fixed on the machine table by means of special devices, or directly on the pallet by means of screws.

When placing the working piece on the table:

•the table should be cleaned with chips brushes, brooms or hooks. In the case when the chips are removed by blowing with compressed air, protection spectacles should be worn and near personnel will be protected. Do not remove chips by blowing

blowing with compressed air, protection spectacles should be worn and near personnel will be protected. Do not remove chips by blowing with the mouth. Pallet cleaning will be performed after machine stops, tools removal and all the objects from the table were removed;

- the fastening of the piece on the pallet has to be done in two points at least, so that to balance the machining forces effects;

- the fasteners have to be close enough to the piece. A special attention will be granted for the pieces pile up and theirs handling by crane. It is forbidden the damaged tools using.

- If during the machining strong vibrations occur, the machine will be turned off immediately, doing all necessary to avoid vibrations.

- In the case when high rotation milling is performed using tools with plates of metallic carbides, protection screens should be used in order to avoid chips projection against the near persons.

- At milling (boring) the feed selection, will be made after milling spindle starts, and feed turning off will be performed before milling spindle stops.

- It is forbidden the chips cleaning pieces measuring and checking during machine functioning.

- It is forbidden to climb and to stand on the guide-ways, guards etc.

- Around the machine a free space has to be previewed for the workers access.

Besides these prescriptions the machine will satisfy all the work protection rules in accordance with current norms and standards.

Safety Devices Against Wrong Handlings

In the electrical scheme inter-locking for safety were installed excluding wrong handlings or the possibility to commend simultaneously motions, which can lead for accidents.

Interlocking are the following:

Tool locking and unlocking will be possible only if the boring spindle is stopped, this situation being confirmed by the STOP commend at the panel.

Feed selection (coupling & uncoupling) of one direction will be accompanied by the prior unlocking, respectively by the subsequent locking of the mobile element.

Starting of main motor or feed motor will not be possible only in the situation when the lubrication units for the axis functioning is confirmed.

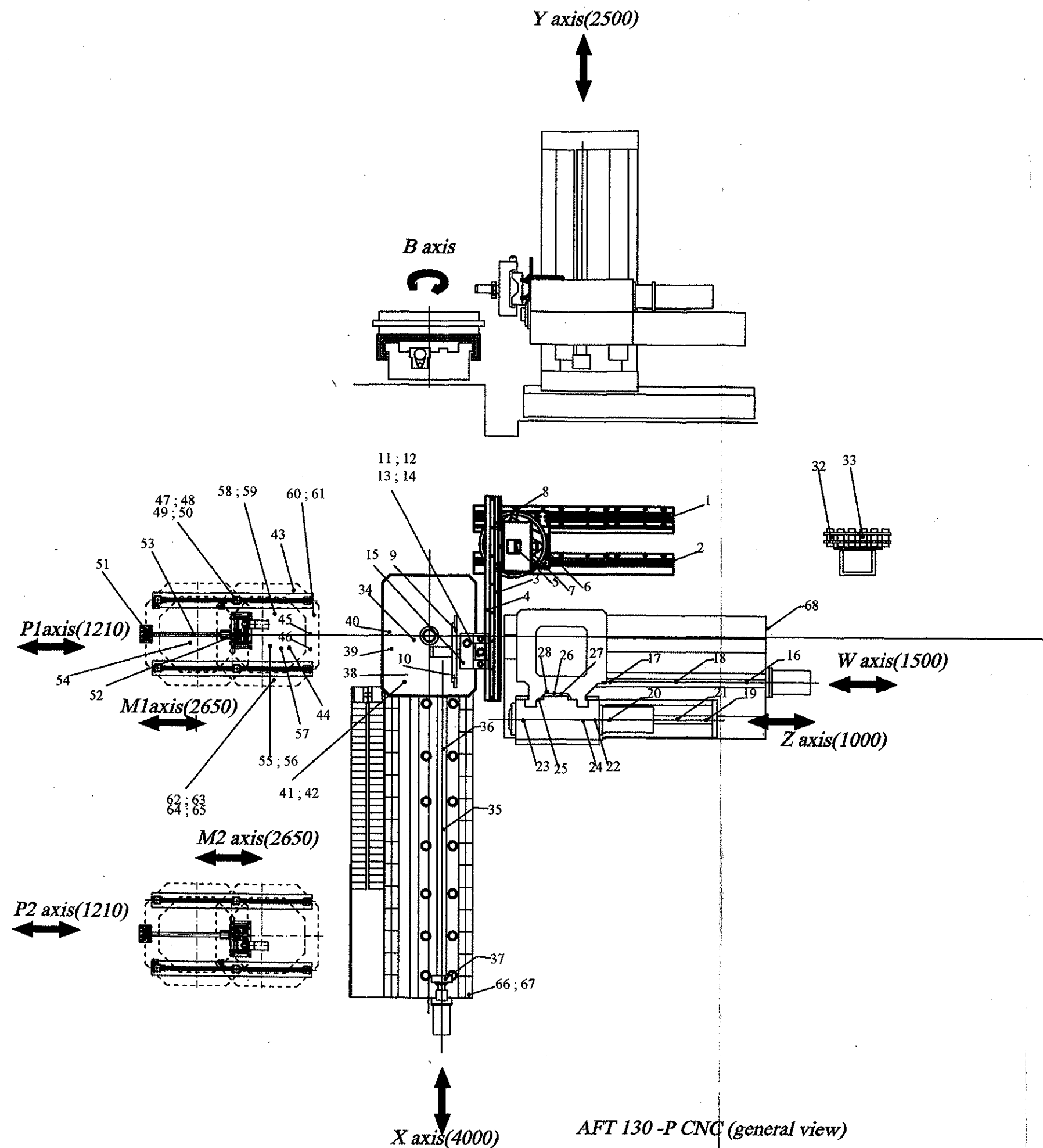
The table rotation is permitted only if the table is unlocked, the table or/and the piece does not strike other subassemblies during rotation.

PAY ATTENTION!

- Keep clean the cone of the bore shaft and the tool cone with a view to ensure the work accuracy of tools.

- Tool clamping operation can be done only if the bore shaft is out of work.

**INSTRUCTIONS ON THE LABELS ATTACHED TO THE MACHINE
SUB-ASSEMBLIES SHALL BE BY ALL MEANS OBSERVED.**



AFT 130 -P CNC (general view)
LUBRICATIONS POINTS

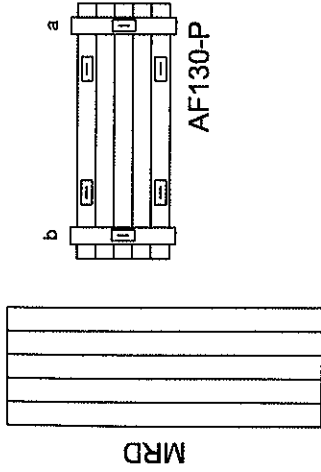
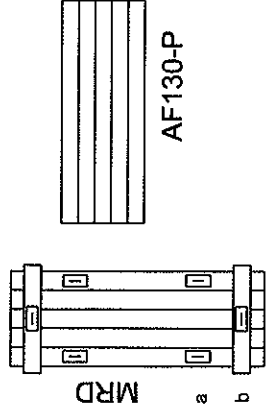
LUBRICATION POINTS LIST

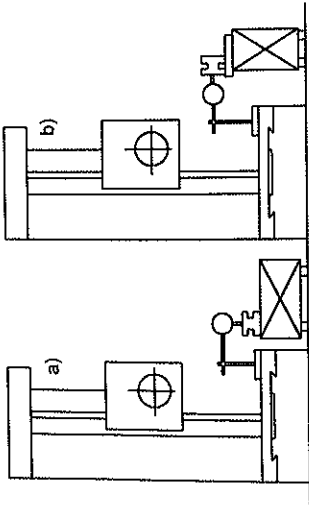
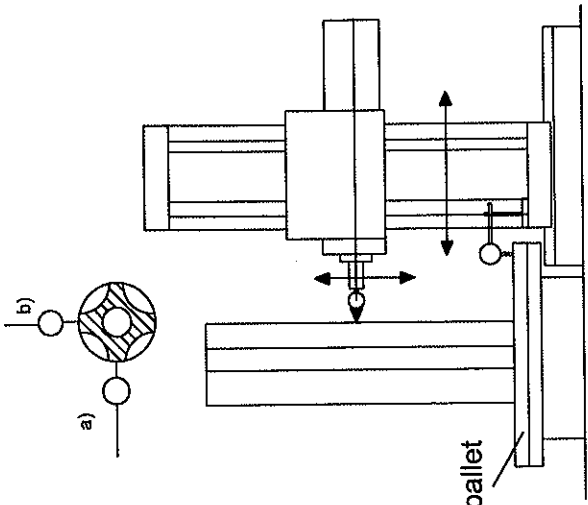
NO.	NUMBER LUBRICATION POINT / SUBASSEMBLY	LUBRICATION POINT DENOMINATION	NUMBER SUBASSEMBLY / MACHINE	LUBRICATION TYPE	LUBRICATION MODE
1.	1 ; 2 ; 3 ; 4 ;	INA Guideways- automatically tool changer	1	Greases	Manually
2.	5 ; 6	Shaft bearings - automatically tool changer	1	Greases	Manually
3.	7	Planetary gear reducer of automatically tool changer	1	Imprisoned	-
4.	8	Pinion rack-piston automatically tool changer	1	Greases	Manually
5.	9 ; 10 ;	Tool clamping levers joint - mechanical hand	1	Greases	Manually
6.	11 ; 12 ; 13 ; 14 ;	Mechanical hand bearings	1	Greases	Manually
7.	15	Rack-pinion - mechanical hand	1	Greases	Manually
8.	16 ; 17 ;	Bearings - axis W	1	Greases	Manually
9.	18	Ball screw nut - axis W	1	Central lubrication	Automatically
10.	19 ; 20 ;	Bearings - axis Z	1	Greases	Manually
11.	21	Ball screw nut - axis Z	1	Central lubrication	Automatically
12.	22	Arm bearing	1	Central lubrication	Automatically
13.	23	Main spindle	1	Oil mist- Equipment VILLY-VOGEL	Automatically

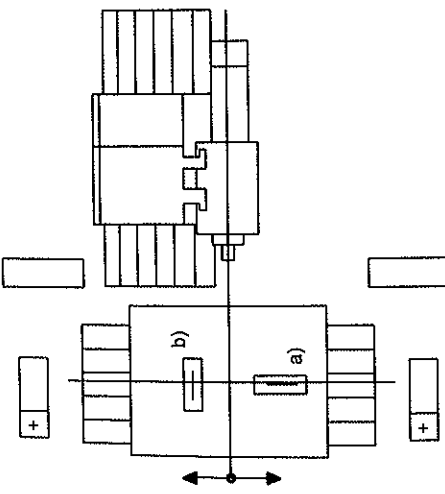
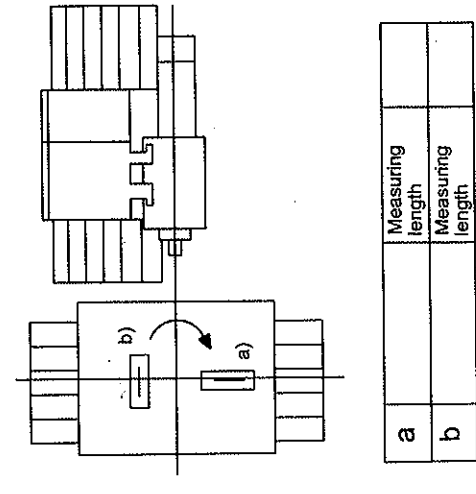
14.	24	Boring spindle bearings	1	Greas	Manually
15.	25	Headstock guideways	1	Central lubrication	Automatically
16.	26 ; 27 ;	Bearings - axis Y	1	Greas	Manually
17.	28	Ball screw nut - axis W	1	Central lubrication	Automatically
18.	29	R.M.H.3000 support	1	Oil mist- Equipment VILLY-VOGEL	Automatically
19.	30	R.M.H.3000 gear	1	Greas	Manually
20.	31	R.M.H.3000 bearings	1	Greas	Manually
21.	32	Tool magazine reducer	1	Greas	Manually
22.	33	Tool magazine bearings	1	Greas	Manually
23.	34	Table slide guideways	1	Central lubrication	Automatically
24.	35	Ball screw nut - X axis	1	Central lubrication	Automatically
25.	36 ; 37 ;	Bearings - X axis	1	Greas	Manually
26.	38	Table mating surface	1	hydrostatic	Automatically
27.	39	Crown gear - pinion -table	1	Central lubrication	Automatically
28.	40	Gears - feed box B axis	1	Greas	Manually
29.	41 ; 42 ,	Table guideways	1	Oil pump	Manually
30.	43	Support pallet guideways	2	Central lubrication	Automatically
31.	44	Support pallet bearings	2	Greas	Manually
32.	45	Support pallet gear	2	Greas	Manually
33.	46	Planetary gear reducer - support pallet	2	Imprisoned	-
34.	47 ; 48 ; 49 ; 50 ;	INA guideways - support pallet	2	Greas	Manually
35.	51 ; 52 ;	Bearings - P1 ; P2 ; axes	2	Greas	Manually
36.	53	Ball screw nut - P1 , P2 axes	2	Greas	Manually
37.	54	Ball screw nut - M1 , M2 axes	2	Greas	Manually
38.	55 ; 56 ;	Bearings - M1 ; M2 ; axes	2	Greas	Manually

40.	57	Gear - M1; M2; axes	2	Greas	Manually
41.	58 ; 59 ;	Turret guideways	2	Oil pump	Manually
42.	60 ; 61 ;	Clamping saddle guideways	2	Oil pump	Manually
43.	62 ; 63 ; 64 ; 65 ;	Support palet - drainage points	2		
44.	66 ; 67 ;	X axis drainage points	1		
45.	68	W axis drainage points	1		

ACCEPTANCE SHEET (according to DIN 8620)

No.	SUBJECT OF CHECKING	FIGURE	DEVIATION (mm)		GAUGES	CHECKING METHODS
			Permitted	Measured		
G1	Longitudinal checking of the bed guideways (AFT 130-P) a) Guideways linearity in vertical plane b) Guideways must be in the same plane	 <p>MRD</p> <p>AF130-P</p>	a) 0.02/1000 Local tolerance 0.006/300 0,01 will be added for each 1000	0,015/1000	- Level - Straight edge	a) Measurements will be performed in different points, equally displaced on the bed length. Note: checking will be done while assemb. b) Level placed in cross position will not indicate, all the bed length, a deviation surpassing the permitted value.
G2	Longitudinal checking of the bed guideways (MRD1700x2000) a) Vertical plane guideways linearity b) Guideways must be in the same plane	 <p>MRD</p> <p>AF130-P</p>	a) 0.02/1000 Local tolerance 0.006/300 0,010 will be added for each 1000mm	0,02/1000	- Level - Straight edge	a) Measurements will be performed in different points, equally displaced on the bed length. Note: checking will be done while assemb. b) Level placed in cross position will not indicate, all the bed length, a deviation surpassing the permitted value.

0	1	2	3	4	5	6
G3	<p>Longitudinal travel linearity of the column on the bed</p> <p>a) Vertical plane</p> <p>b) Horizontal plane</p>		<p>Both a) and b) 0.02/up to 1000 0.03/ over 1000</p> <p>Toleranta locala 0.006/300</p>		<p>-Dial gauge</p> <p>Straight edge or optic apparatus</p>	<p>Dial gauge probe touches the surface of a straight edge positioned parallel to the slide ways in a vertical plane, then horizontally. The rule shall be fixed to an independent fixed part as close as possible to the ways to be checked.</p> <p>Remark: This check up shall be done on a proper foundation. If not available at supplier, this checking shall be done at the customer's site upon his agreement.</p>
G4	<p>Perpendicularity of the headstock vertical motion</p> <p>a) In a plane parallel to the boring spindle axis</p> <p>b) In a plane perpendicular to the boring spindle.</p>		<p>For a) and b) : 0.03/1000</p>		<p>Dial gauge</p> <p>Check plate</p> <p>Check cylinder</p> <p>Optic apparatus</p>	<p>a) A test plate to be located on the rotary table. The plate surface must be parallel to the column longitudinal movement. The square rule shall be put on this plate. The saddle shall be clamped to the bed. While measuring, the headstock to be clamped the dial gauge may be fixed either to the spindle or to the headstock.</p>

0	1	2	3	4	5	6
G5	Horizontal position of the pallet fastened on rotary table; for the X axis travel.	 <p style="text-align: center;">Fig. 5</p>	<p>a) 0,030 mm for up to 1m measuring length. Over 1m tolerance will be added 0,01/m</p> <p>b) 0,03 mm for up to 1m measuring length. Over 1m tolerance will be added 0,01/m</p>		- Electronic levels	Table travels with the levels in a) and b) position, (on the pallet) from middle towards the ends. Measuring length will be mentioned. Deviation values will be noted inside the provided cases, see fig. 5
G6	Pallet horizontal position when traveling along the X axis.	 <p style="text-align: center;">Fig. 6</p>	<p>a) 0,020 mm for up to 1m measuring length. Over 1m tolerance will be added 0,01/m</p> <p>b) 0,02 mm for up to 1 m measuring length. Over 1m tolerance will be added 0,01/m</p> <p>de masurare: se majoreaza toleranta cu 0,010mm/m Lungimea de masurare - oglinda mesei.</p>		- Electronic levels	After having rotated the table 180. Levels will be rotated 180. Deviations values will be noted inside the fig. 6 table .

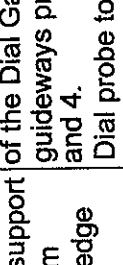
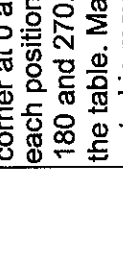
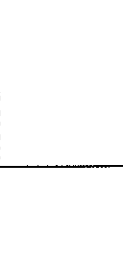
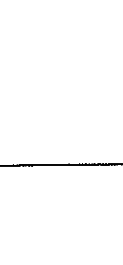
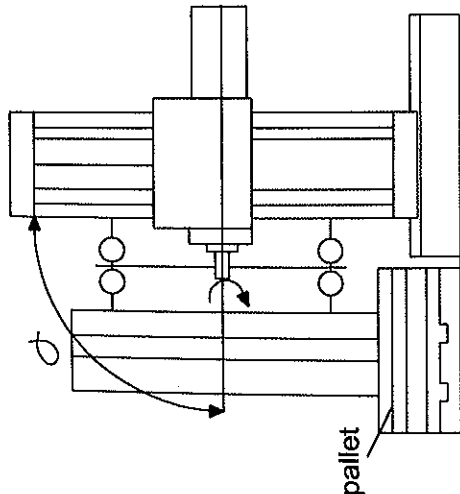
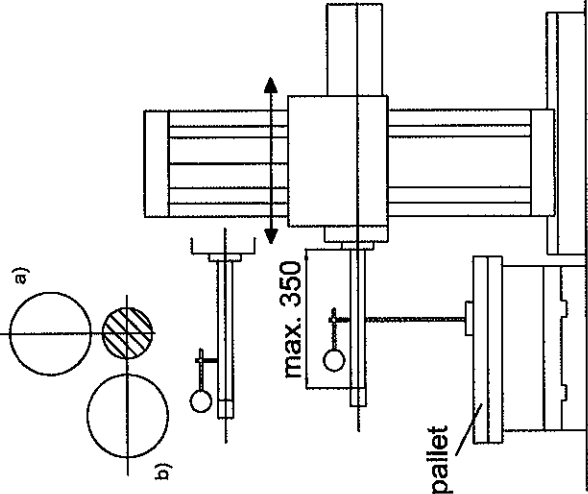
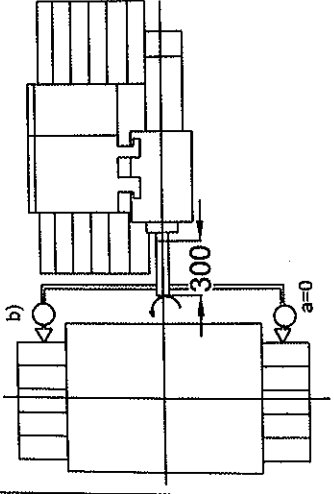
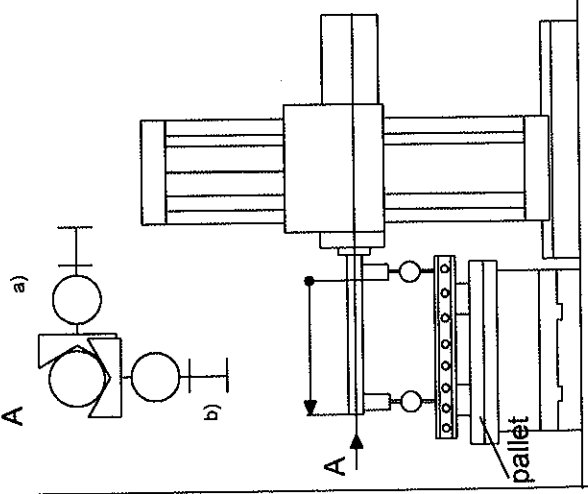
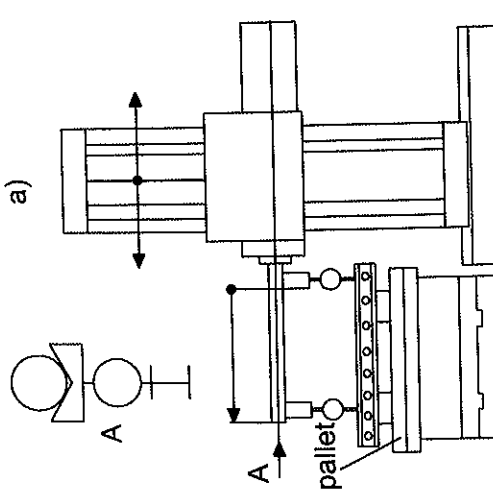
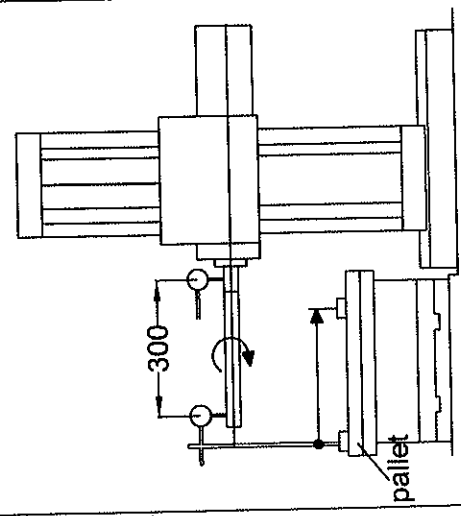
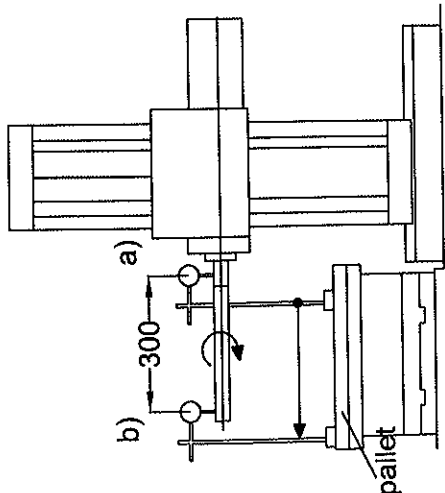
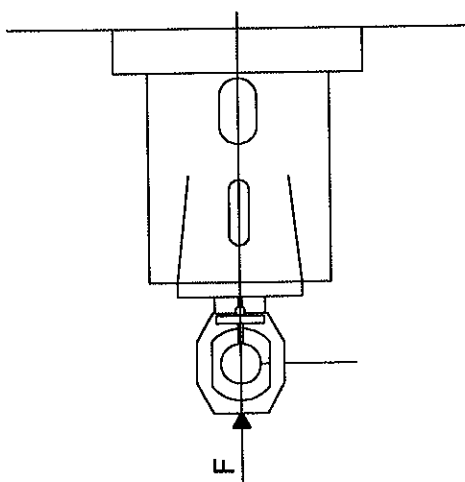
0	1	2	3	4	5	6
	<p>Pallet surface parallelism to the bed guideways</p>  	 	<p>Up to 1m measuring length 0.030mm Over 1m tolerance will be increased with 0,010 mm/m</p>		<p>-0,001 mm accuracy Dial gauge -Gauge support -2800 mm straight edge</p>	<p>Table saddle to be clamped on the bed middle. Straight edge is placed along the diagonal direction (on the pallet). Support of the Dial Gauge will be placed on the guideways progressively in points 1,2,3 and 4. Dial probe touches the edge in pallet corner at 0 adjusted to 0. Pallet is rotated each position of the Dial gauge at 0 , 90 , 180 and 270. Recorded values are noted in the table. Maximum deviation will be noted in max. deviation column.</p>

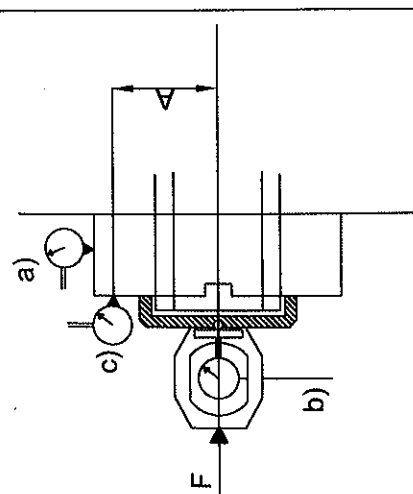
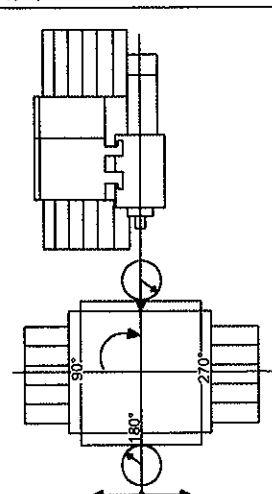
Fig. 7

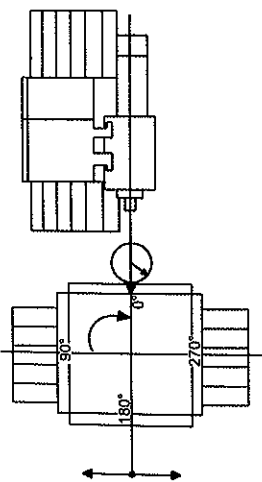
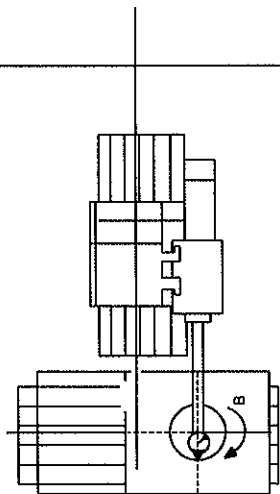
0	1	2	3	4	5	6
G8	Boring spindle axis perpendicularity to the vertical travel direction headstock	 <p>pallet</p>	$0.03/1000$ $\alpha \leq 90^\circ$		-Dial gauge -Stiff support -Straight edge or check cylinder	Headstock must be clamped to the column at half travel. Boring spindle must be withdrawn. Checking can be performed as follows. Support arm in vertical position dial gauge probe touches the check cylinder surface. Headstock travels two arms length and same point is touched with the probe. Recorded difference represents the perpendicularity deviation
G9	Boring spindle axis parallelism to the column longitudinal travel -a) Vertical plane -b) Horizontal plane	 <p>a)</p> <p>b)</p> <p>max. 350</p> <p>pallet</p>	Both a) and b) $0.02/300$		-Dial gauge -Check arbor	Headstock will be clamped half travel. Saddle is clamped half way on the table bed. Dial gauge probe may touch the spindle itself or the check arbor. Note: Test will be performed on proper foundation. When supplier does not have such, test will be performed in the customer's shop, if agreed upon.

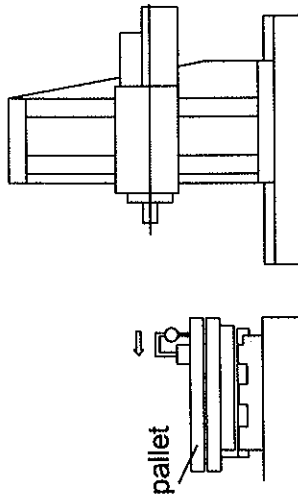
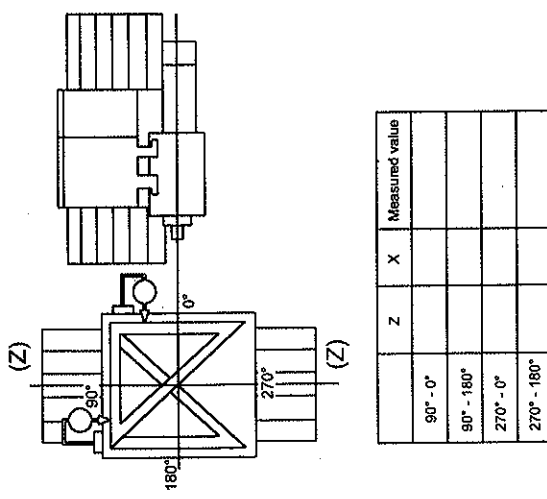
0	1	2	3	4	5	6
G10	Spindle axis perpendicularity to the side way of the table bed		a=0 b) up to 1m : 0.030mm. Up to 2 m : 0.040mm		-Dial gauge -Arm device -Straight edge -Accuracy square rule	Saddle to be clamped at a central position to the bed. Headstock to be clamped to column at the lowest position. Spindle to be withdrawn the arm device with dial gauge to be fixed to the boring spindle, 300mm out. The feeler, bed located at a) and adjusted to 0. Reversal, boring spindle 180 deg. swiveled. To be touched at b) and deviation to be off set in relation to the measure length.
G11	Boring spindle travel linearity: -a) Horizontal plane -b) Vertical plane		a) and b) 0.02/300		-Dial gauge -Straight edge -Parallel blocks	Headstock must be clamped. Straight edge is placed in parallel direction to the spindle and straight edge check surface is touched with dial gauge probe attached to the spindle nose. Test is performed vertically and horizontally.

0	1	2	3	4	5	6
G12	<p>Boring spindle deflection in vertical plane when moving axially.</p> <p>a) When column is traveling along the W axis.</p> <p>-b) When column is traveling along the W axis, in the reference plane parallel to the column traveling plane.</p>	 <p>A</p> <p>pallet</p>	<p>0.015 mm for spindle out = two times spindle diameter.</p> <p>$\pm 0.020\text{mm}$ for spindle out = four times spindle diameter -0.060mm for spindle out = six times spindle diameter.</p>		<p>-Dial gauge</p> <p>-Parallel blocks</p> <p>-Straight edge or cylindri-cal check arbor.</p>	<p>a) Straight edge is placed in parallel position to the column traveling direction.</p>
G13	<p>Boring spindle taper radial runout:</p> <p>-a) Nearby the boring spindle.</p> <p>-b) 300mm from the boring spindle end.</p>	 <p>300</p> <p>pallet</p>	<p>a) 0.015</p> <p>b) 0.030</p>		<p>-Dial gauge</p> <p>-Check arbor</p>	<p>Boring spindle must be in the withdrawn position.</p>

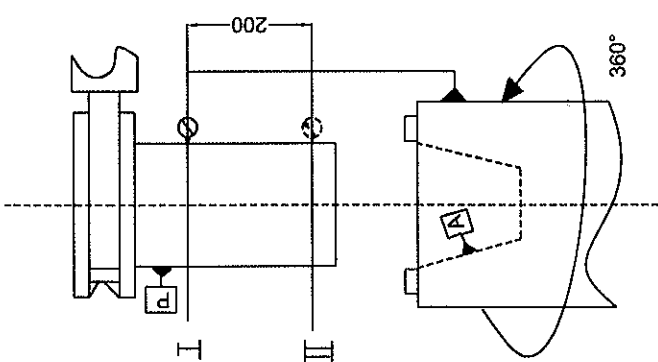
0	1	2	3	4	5	6
	<p>Boring spindle radial run-out</p> <p>a) Boring spindle in withdrawn position b) Boring spindle out 300mm</p> <p>G14</p>		<p>a) 0.015 b) 0.030</p>		Dial gauge	
	<p>Boring spindle axial run-out</p> <p>G15</p>		0.015		Dial gauge	<p>Boring spindle must be in withdrawn position. Manufacturer will specify the presence, value and direction of F-thrust.</p>

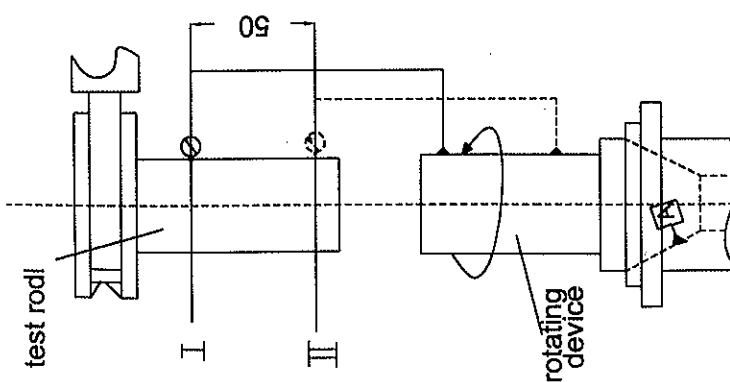
0	1	2	3	4	5	6				
	a)Milling spindle radial run-out b) Milling spindle axial run-ut c) Milling spindle front run-out		a) 0.015 b) 0.015 c) 0.030		Dial gauge	Manufacturer will specify the presence value and direction of the F-thrust. Distance A from the touch probe to the milling spindle axis must be the maximum possible.				
G16										
	Parallelism of the opposites sides of the pallet.	 <table data-bbox="1259 1296 1370 1744"><tr><td>180° - 0°</td><td>Measuring length</td></tr><tr><td>270° - 90°</td><td>Measuring length</td></tr></table>	180° - 0°	Measuring length	270° - 90°	Measuring length	0.030 for up to 1 m measuring length. Tolerance will be added 0.010 mm/m for over 1m measuring length		-Dial gauge -Dial gauge support 0.001mm accuracy	-Table in 0° position . -Table travels along the bed , probing both the pallet long sides (180° and 0°). Test is repeated for the table short sides (90° and 270 °) after having rotated the table 90 ° . Angular tolerances in G18 will be notice and be added to prescribed tolerance. Values will be noted in the table.
180° - 0°	Measuring length									
270° - 90°	Measuring length									
G17										

0	1	2	3	4	5	6																		
G18	Pallet right angle positions when indexing automatically the table 4x90°.	 <table data-bbox="659 1240 802 1733"><tr><th></th><th>0°</th><th>90°</th><th>180°</th><th>270°</th><th>Measuring length</th></tr><tr><td>Unload</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Loaded</td><td></td><td></td><td></td><td></td><td></td></tr></table>		0°	90°	180°	270°	Measuring length	Unload						Loaded						0.030 for up to 1m measuring length. Tolerance will be added 0.010mm/m for over 1m measuring length		-0.001mm accuracy Dial gauge -Dial gauge support	Test will be performed with and without load on the pallet ,by probing all the table sides in the 4x90° positions. Angle deviations of item G17 will be considered. Test workpiece weight will be indicated. Measurement results will be noted into the table. (test workpiece weight = 5000kg)
	0°	90°	180°	270°	Measuring length																			
Unload																								
Loaded																								
G19	Pallet central bore out of run.		0.030mm		-0.001mm; accuracy Finger dial gauge -Dial gauge -Square blocks	Turn the table 360°.																		

0	1	2	3	4	5	6
G20	<p>Pallet clamping surface planity</p>		<p>Concave only</p> <p>To 1 m measuring length: 0,030 mm.</p> <p>Over 1 m measuring length, increase tolerance by 0.01mm/m</p>		<p>Dial gauge 0.001mm precision.</p> <p>Dial gauge support, L=250 mm.</p> <p>Straight edge, L=2800 mm</p>	<p>Table is blocked on the bed.</p> <p>Strait edge is positioned onto the pallet in diagonal directions 1 and 2.</p> <p>Dial gauge support is positioned parallel to strait edge and the dial gauge nose on the strait edge. Moving the gauge along the strait edge and read the value.</p>
G21	<p>Pallet short faces perpendicularity to long faces</p>		<p>To 1 m measuring length: 0.020mm</p> <p>Over 1m measuring length increase tolerance by 0.005mm/m.</p> <p>Note:</p> <p>+ mean over 90° angle,</p> <p>- mean to 90° angle.</p>		<p>Dial gauge 0.001mm precision.</p> <p>Dial gauge support.</p> <p>Square edge.</p>	<p>The square edge is placed on the pallet having the long side paralel to pallet long face.</p> <p>The dial gauge support is sliding on pallet lateral short face and the dial gauge nose on the short square edge face. Repeat the measurement rotating the square edge to the other pallet corners. Write the values on this chart.</p>

0	1	2	3	4	5	6
	<p>Unloaded pallet positioning repeatability</p> <p>a) effective quota (working surface positioning)</p> <p>b) working surface horizontality</p>		<p>To 1 m measuring length; 0.030mm Over 1 m measuring length; increase tolerance by 0.010mm/m</p>		<p>Dial gauge 0.001 mm precision;</p> <p>Level gauge</p>	<p>Pallet changing order follows 1-5 stages shown in sketch. Dial gauge mounted on the boring spindle, is used for a). The boring spindle and headstock are blocked.</p> <p>Level gauge positioned paralel to table edge is used for b).</p> <p>Table (and pallet) is displaced having the level in median position.</p> <p>Measuring length will be indicated. All data will be written on this chart.</p>

0	1	2	3	4	5	6	
G23				max. 0,060 mm		Dial gauge 0.01mm precision, Dial gauge support, Test rod.	The measurement is made in 2 plane, moving the boring spindle 200mm
Test rod and main spindle taper out of run							

0	1	2	3	4	5	6
G24	Test rod and tool holder taper out of run		max. 0,060 mm		<p>Dial gauge 0.01mm precision. Rotating device Dial gauge support. Test rod.</p>	<p>The measurement is made in 2 plane, moving the dial gauge along the rotating device rod 50mm</p>