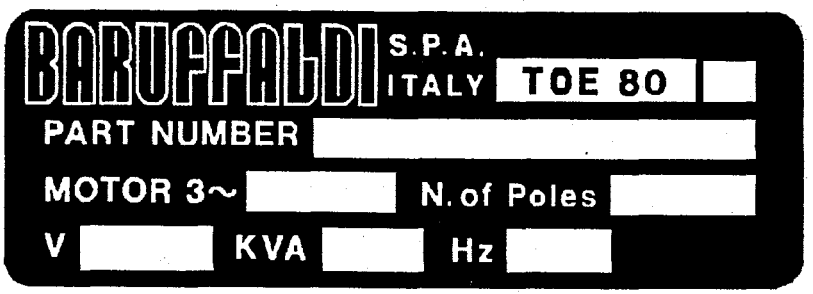
TOE 80
TURRET

USE AND MAIN TECHNICAL GUIDE

INDEX



Turret type and size

Part number

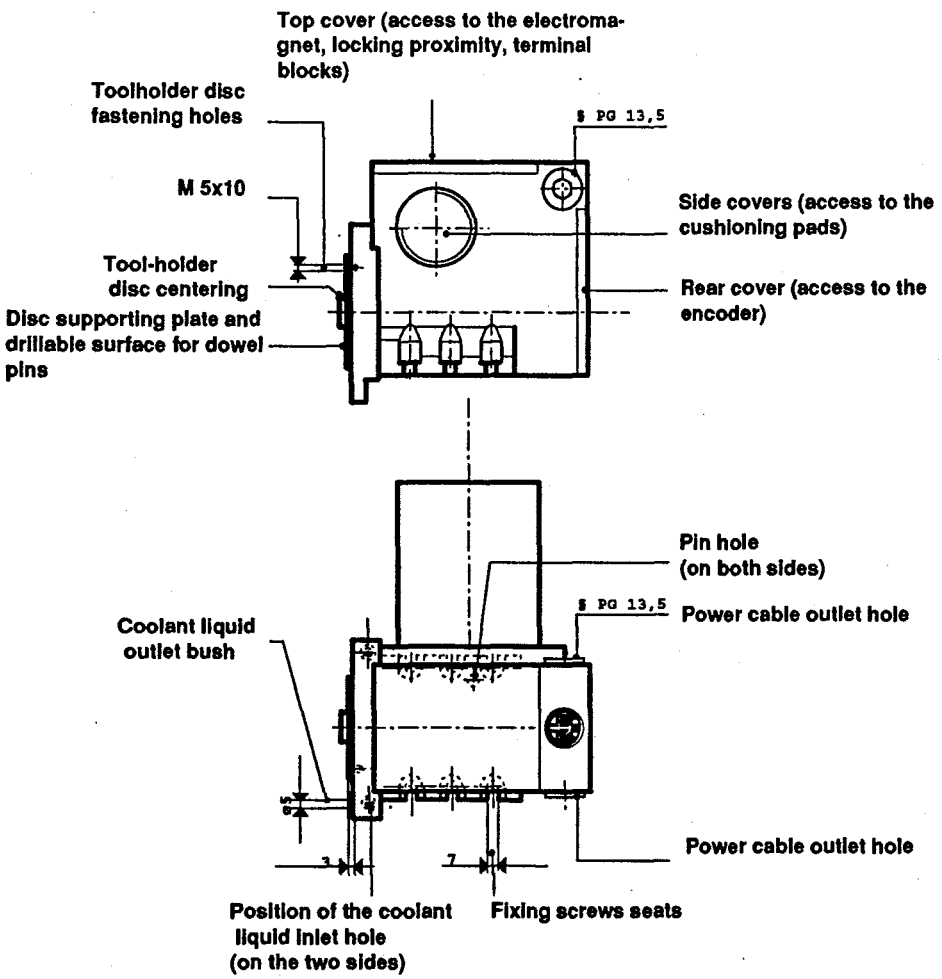
Motor Pole number

Motor Voltage

Motor Power

Motor - Frequency

The turret consists of a fixed part (casing) containing all the elements for indexing, and a moving part where the toolholder disc is installed and an electric motor assembly that is mounted onto either right face or left face (version "A" or version "B"). The disc rotation axis is parallel to the casing mounting face. Turrets series TOE 80, generally provided with 6 or 8 positions, change from a position to the following one, rotating both in counterclockwise and clockwise direction.



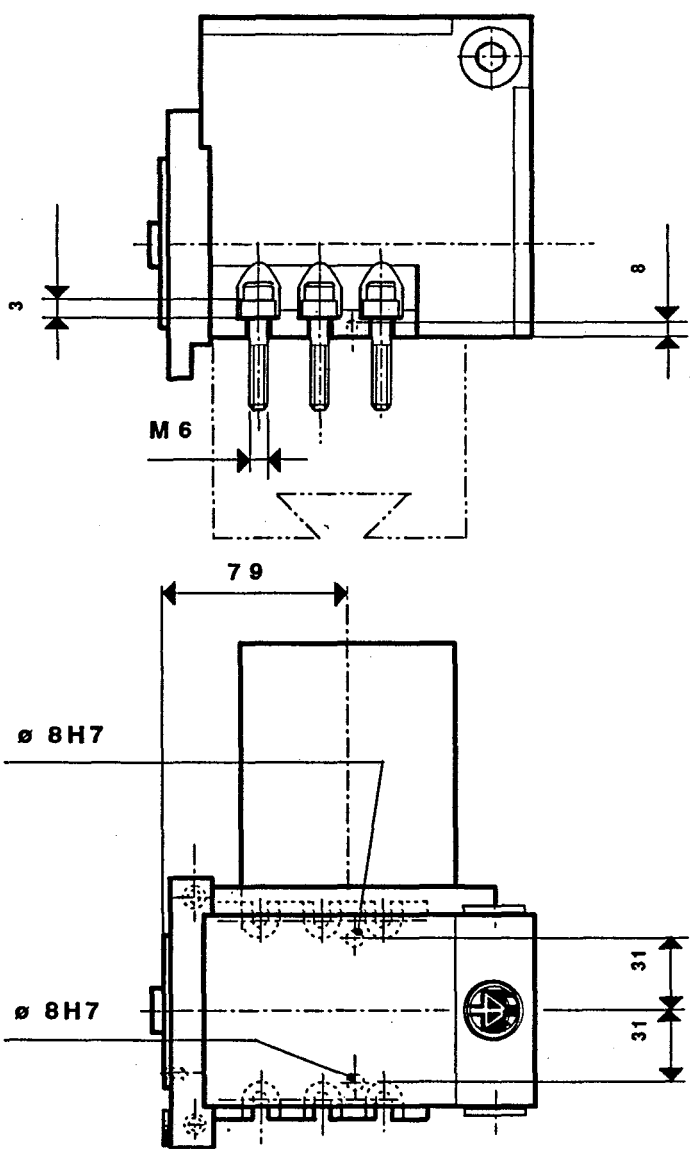
The picture represents the motor position (version A), it is possible to have the motor in the opposite position (version B).

Diameter cable outlet holes
PG 13,5

The mounting surface where the turret has to be installed must be clean and not damaged, its flatness error must be within 0.01/100 mm. If necessary adapt the height by inserting a packing plate under the base of the turret.
Pre-dowel the pin on the machine slide where the dowel seat in the turret base is placed.
By using fixing screws almost fully tightened, line up the turret, or rather the toolholder disc with the spindle axis, then tighten the screws. It is even possible not to install the dowel in order to allow the turret to slip with respect to the slide (if there is an impact). Then the dowel can be lined up again.

IMPORTANT NOTE

Whenever checking the lining up and the center height of the turret or of the toolholder on it, the turret must be in a locked condition. If this rule is not followed, problems in the setting up will arise.



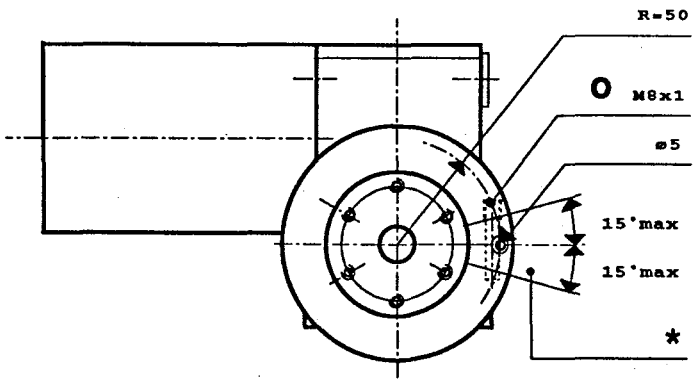
On the turret side there is a hole for the coolant liquid inlet; placed just at the opposite part of the motor (version A or version B); connect the coolant liquid feed pipe with the inlet hole through aleakproof connector.

The perforated bush (033) has to be installed as shown in the picture. The 033 bush rubs against the rear plate of the toolholder disk where the interception hole is placed.

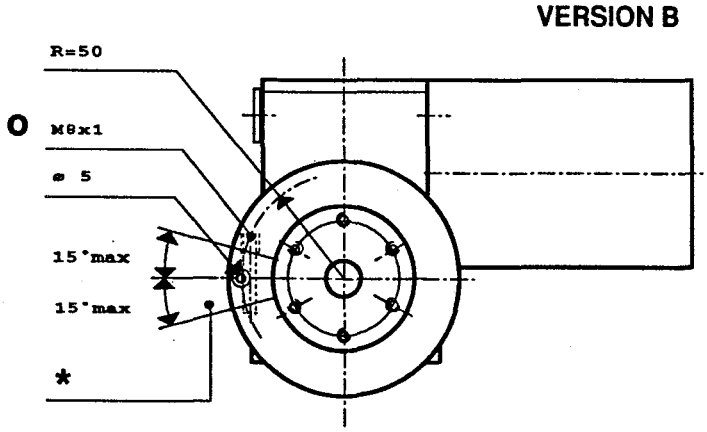
O Coolant liquid inlet hole position

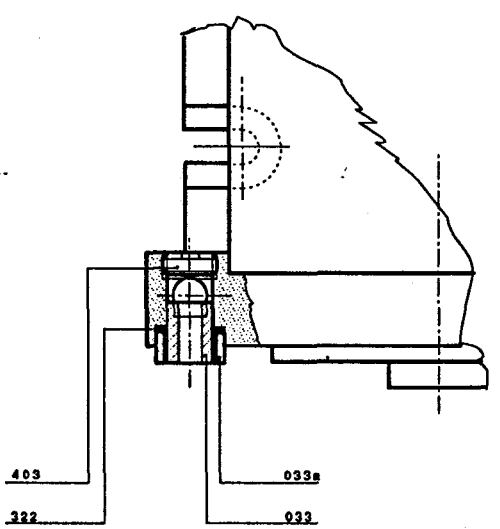
***** Area in which it is possible to position the hole for interception of the coolant liquid in "model A" or in "model B" on the 6 or 8 position faceplate.

VERSION A



VERSION B

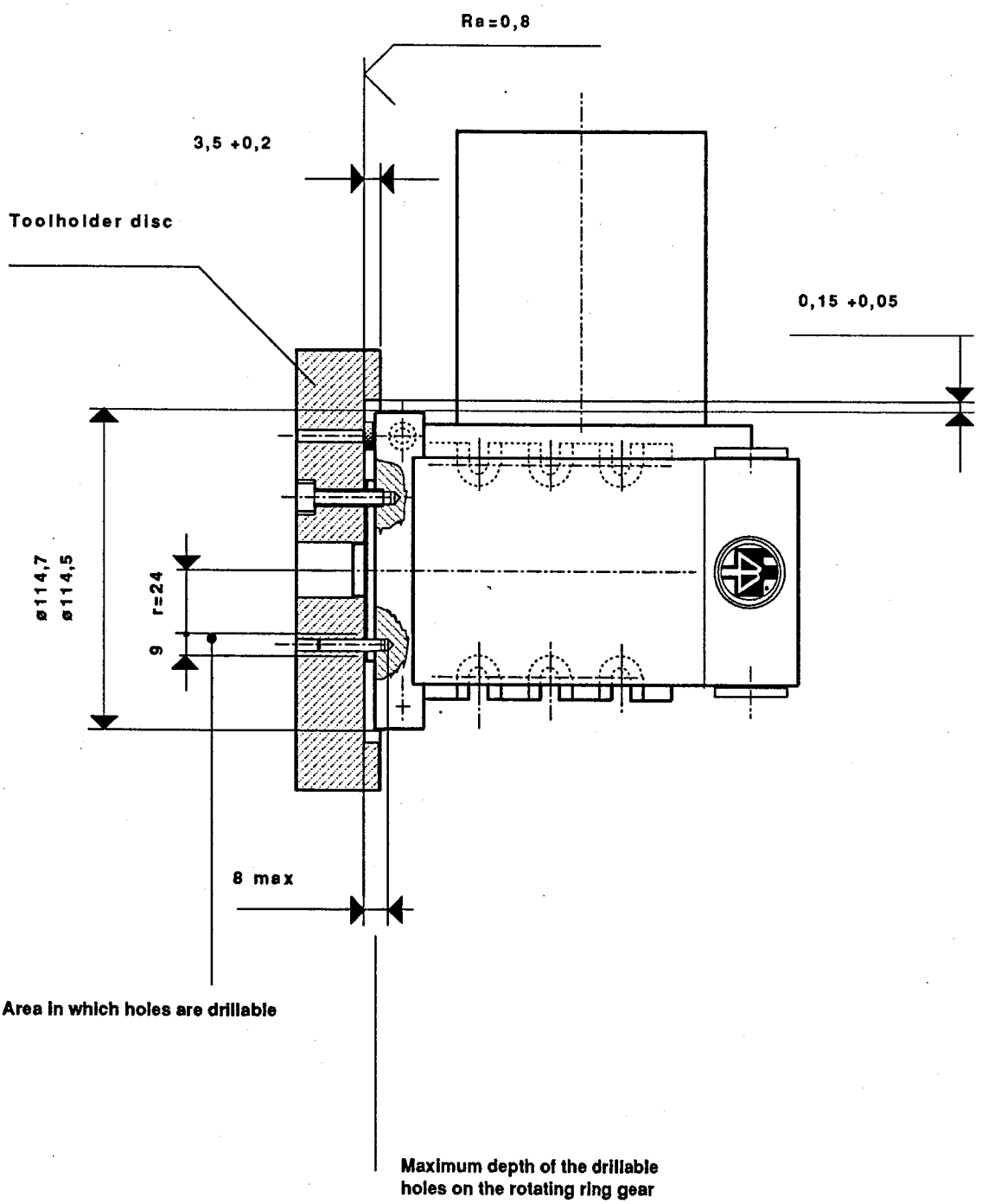




The toolholder disc is installed and fixed on the turret with screws, while its orientation is determined by suitable drilling and pinning.
It is even possible not to install the dowels in order to allow the toolholder disc to slip with respect to the rotating ring gear (if there is an impact). Then the dowels can be lined up again.
The picture represents the maximum alowable depth of holes; on the rotating ring gear, and the areas where they can be made.

The tool-holder disk must be designed with an empty space to create a labyrinth in order to protect the bush from swarf (respect the values shown in the picture).

The slipping surface of the bush must have a roughness of Ra = 0.8

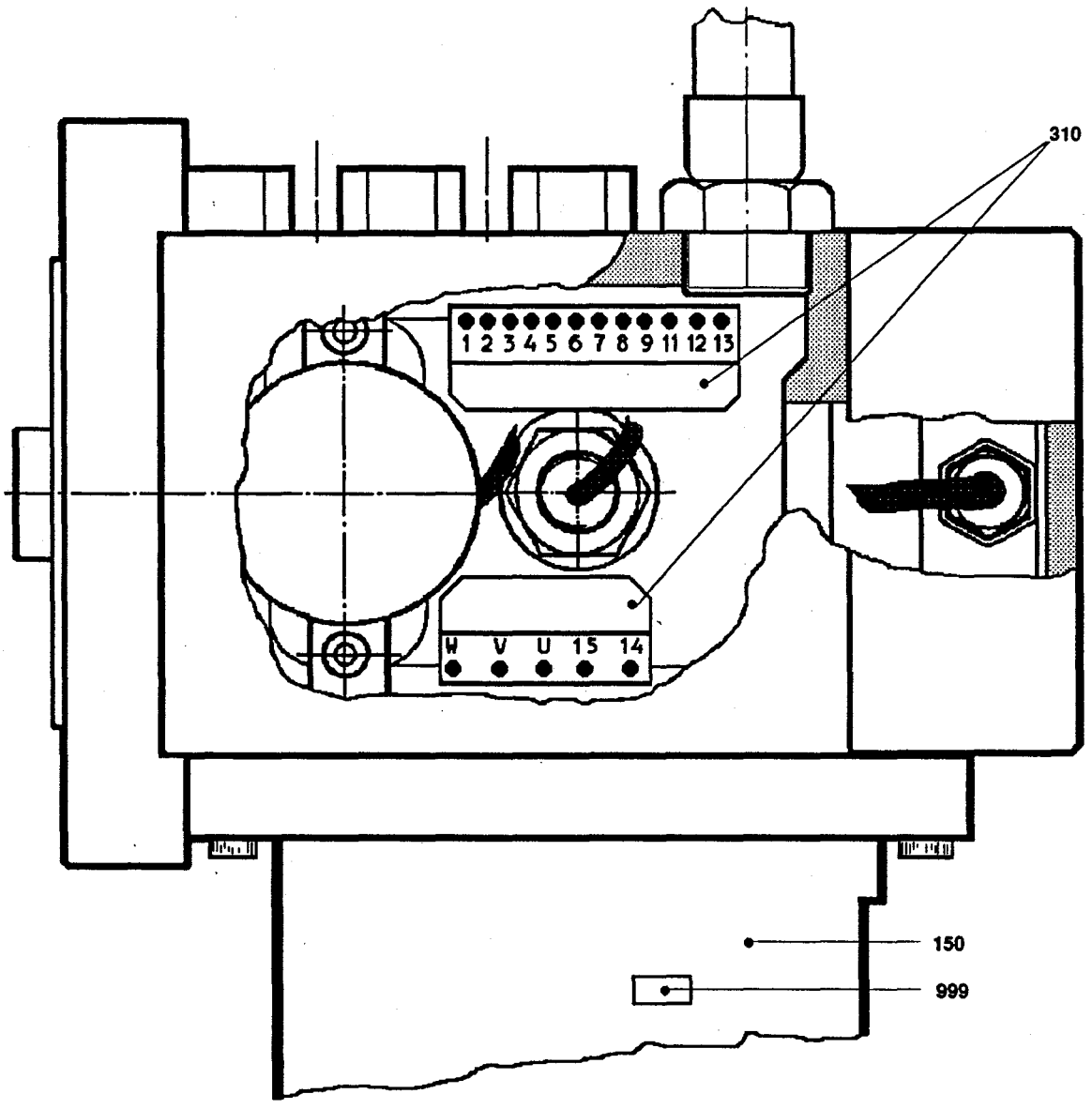


The wire assembly inside the turret has to be made according to the electrical chart (see page 8).

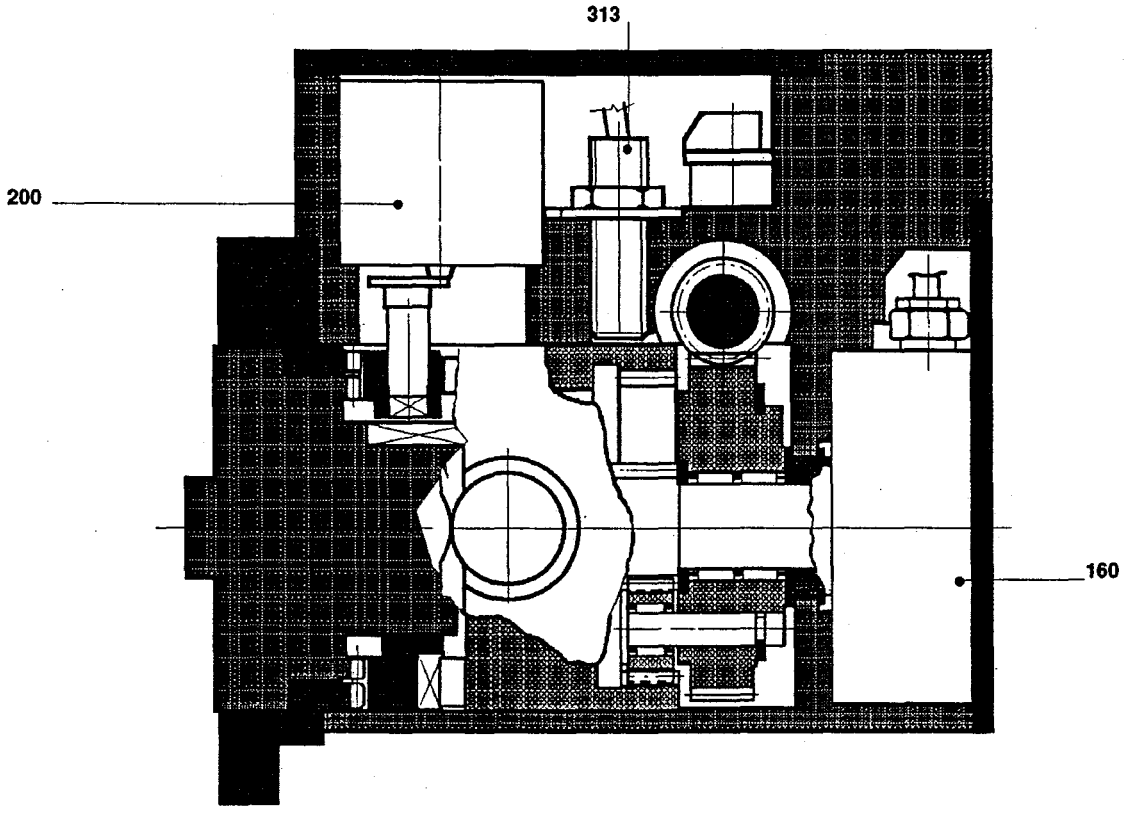
The cables must be arranged so as to prevent them from being squashed when the top cover 044 is installed. The cables have to be kept tight; any slacckness has to be tucked away in a non dangerous area.

A PG 13,5 threaded hole for the supply cable outlet is provided on the turret sides.
The connector, the over braided water tight cable, the application and the set up must prevent the coolant liquid from leaking into the turret.

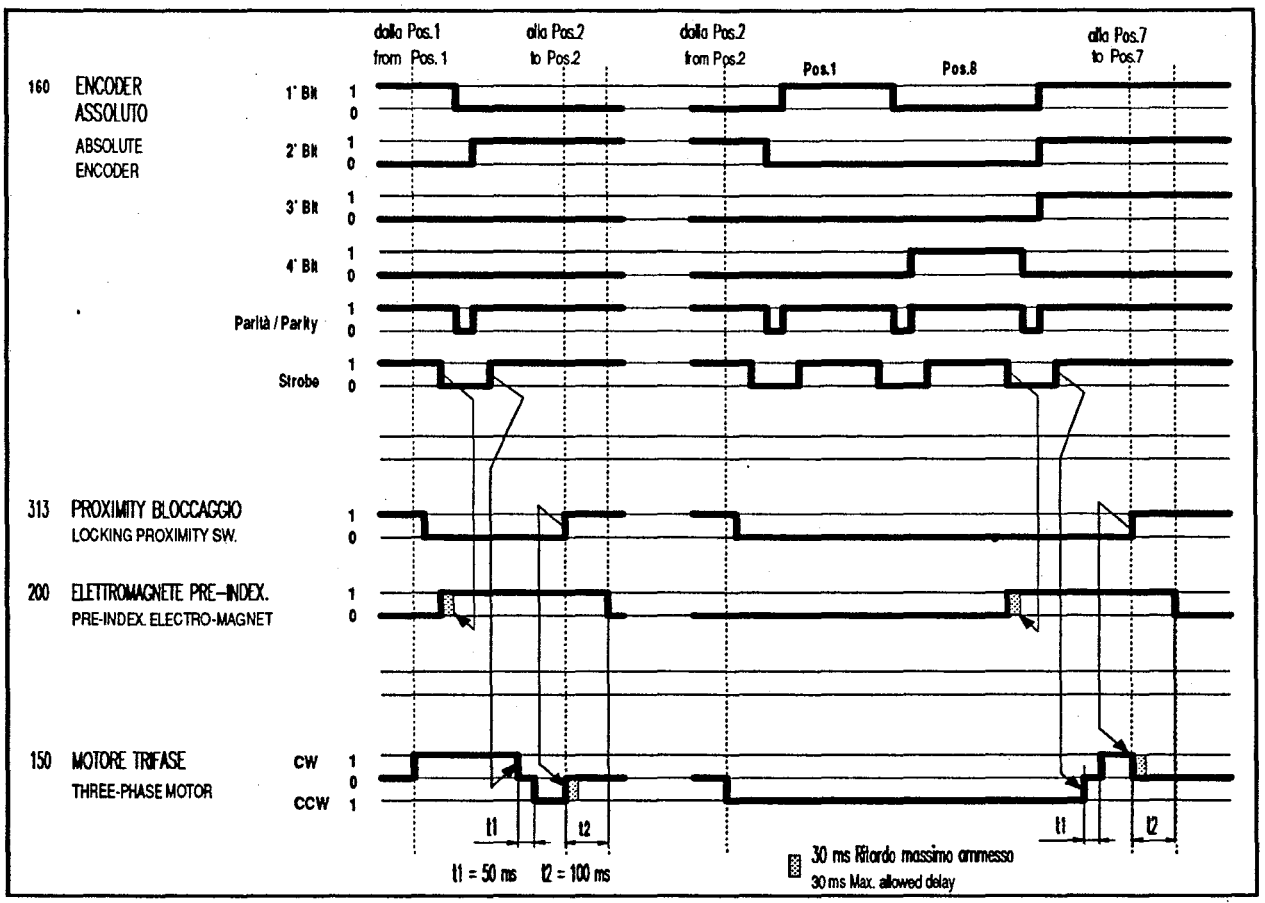
▲ The hole not used for the outlet of the power cables must remain hermetically sealed.



The picture represents the version B (motor placed on the right side). In the version A (motor placed on the left side) the wire assembly is specular.



Ref.	Component - Specification	Colours/Connections	Type/Notes
160	ABSOLUT ENCODER BINARY code 1° BIT 2° BIT 3° BIT 4° BIT PARITY STROBE + 24 Volt 0 Volt Screen	White 1 Yellow 2 Green 3 Violet 4 Red 5 Black 6 Brown 7 Blue 8 Yellow/Green 9	Encoder type 60
301	LOCKING PROXIMITY SWITCH + 24 Volt 0 Volt Output	Brown 7 Blue 8 Black 11	Diam. 12 mm L= 45 mm Ripple 10 % Output PNP-NO max. 300 mA Short circuit protection
200	PRE-INDEX. ELECTROMAGNET 24 Volt DC	Orange 12 Orange 13	24 Volt 60 Watt 50 % ED
999	THERMOSTATIC SWITCH	Gray 14 Gray 15	Normally closed type contact (until 120°C)
150	THREE PHASE MOTOR	Black X Y Z Red U Red V Red W Yellow / Green	110 Volt 50/60 Hz 220/380 Volt 50/60 Hz Ground
310	TERMINAL BLOCK		



CYCLE DESCRIPTION

• The above operation diagram shows the sequence to be followed in order to move from position 1 into 2 in a clockwise direction (with the turret tool-holder disk in front), and from position 2 into 7 in a counterclockwise rotation.

• As first operation the motor is fed for rotation in the direction selected. Wait for the falling wavefront of the STROBE signal for the previous station is arrived at, the pre-indexing electromagnet is energised as quickly as possible (within the maximum permitted delay time).

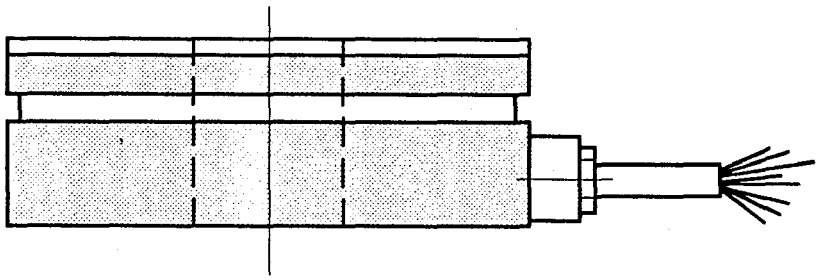
• With the electromagnet energised, the raising wavefront of the STROBE signal of the required position is awaited; upon reception of this signal the motor is immediately halted and the rotation direction is reversed after 50 ms pause.

• Wait for the locking proximity signal then halt the motor as quick as possible (maximum delay permitted: 30 ms).

• At this point a safety check of the position can be carried out, and consent for machining can be given, followed by electromagnet de-energizing after 100 ms pause.

NOTE: The maximum care should be taken regarding the permitted delays, particulary their repeatibility. (delays should be measured directly on the turret component devices).

TYPE 60
(TOE 80 — 100)



A (1° BIT)	WHITE
B (2° BIT)	YELLOW
C (3° BIT)	GREEN
D (4° BIT)	VIOLET
PARITY	RED
STROBE	BLACK
+ 24 VOLT	BROWN
0 VOLT	BLUE

Screen YELLOW - GREEN

ENCODER CODE TABLE

POSITION	A	B	C	D	PARITY	STROBE
1	●				●	●
2		●			●	●
3	●	●				●
4			●		●	●
5	●		●			●
6		●	●			●
7	●	●	●		●	●
8				●	●	●
9	●			●		●
10		●		●		●
11	●	●		●	●	●
12			●	●		●

SPECIFICATIONS

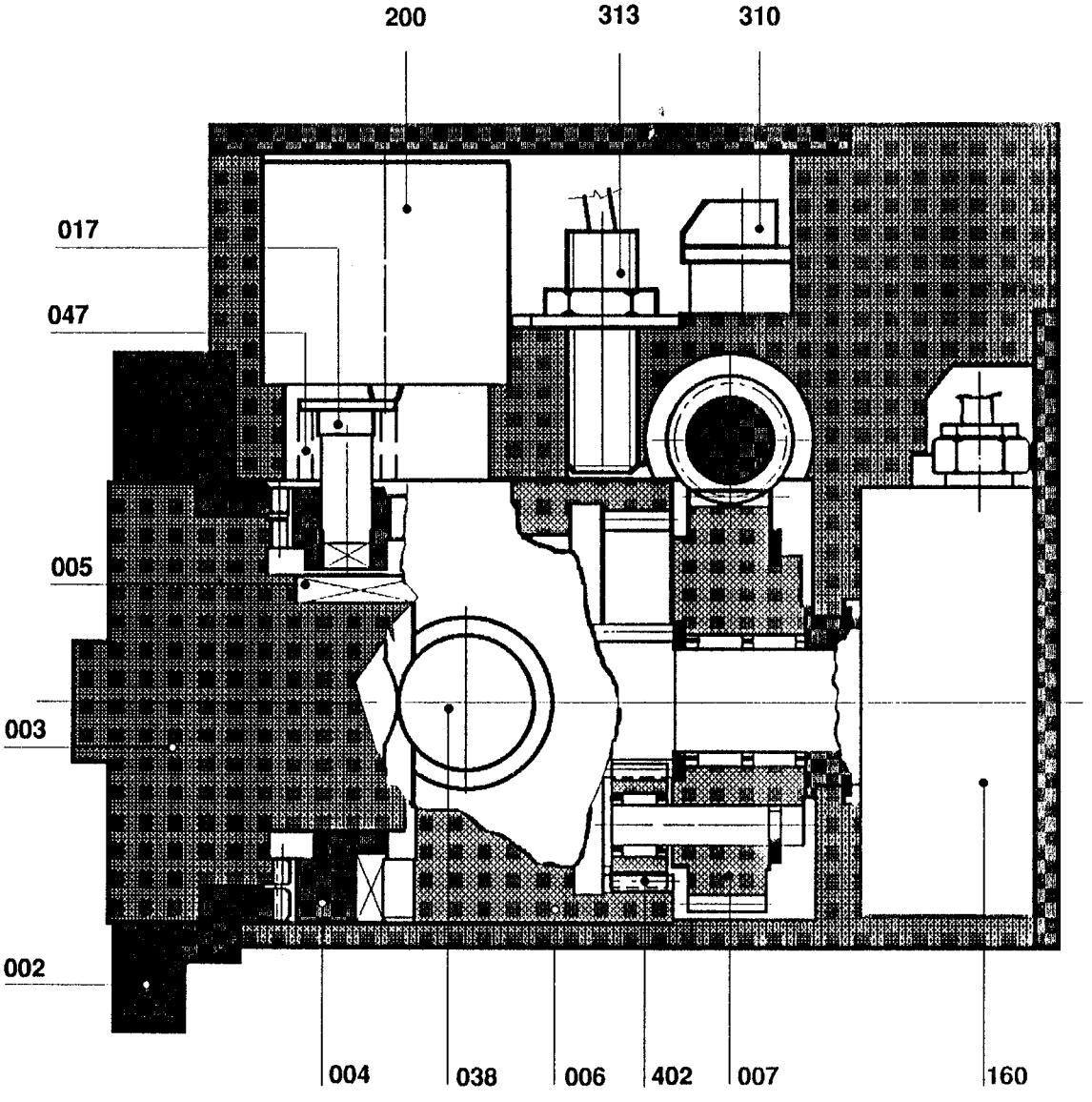
- Power supply DC 24 Volt +/- 10% RIPPLE 10%
- PNP outputs (max. load 50 mA) in BINARY code
- PARITY Check and STROBE signal
- Reverse polarity protected
- Output short-circuit protected
- Connection to be made with 8-pole screened cable

STARTING CONDITIONS

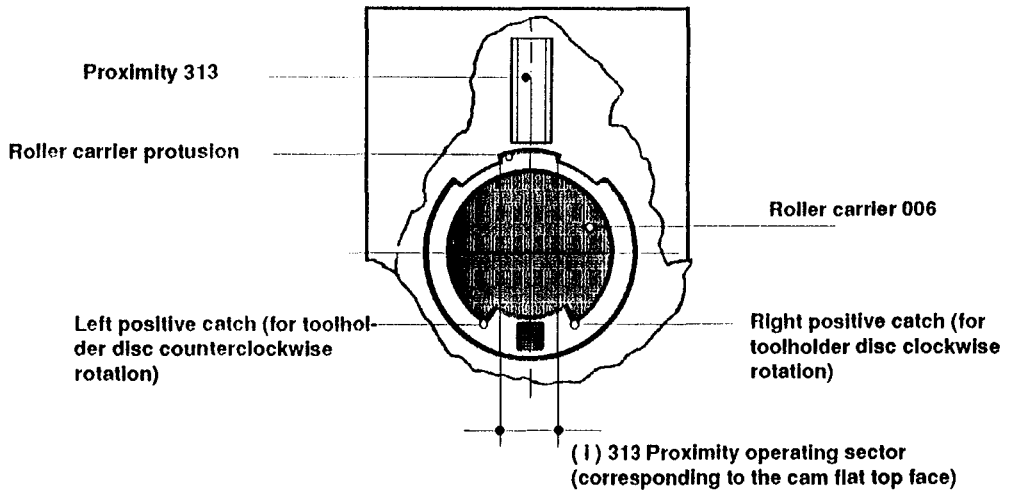
- turret closed
- de-energised motor
- de-energised electromagnet 200
- the mobile ring gear 003 is engaged with stationary toothed ring gear 002 and the short-circuiting gear 004.

NEW POSITION RESEARCH

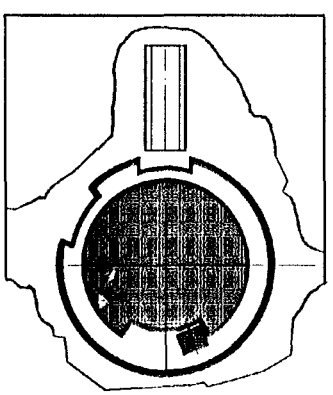
Energize the motor which through the reduction stages starts the rotation of the 006 roller carrier crown gear whose movement is stopped against a positive catch after an established angle. During this stage the 034 central spring pushes the short circuiting ring gear back, causing the cam top sides to descend from the rollers 038. Thus the mobile ring gear whose rotation is started by the planitary gears 402 is released.
Near the arrival station (upon reception of the signal of the 160 angular encoder) the 200 electromagnet is energised. This pushes the 017 lock into the proper pre-positioning hole of the 005 indexing head thus causing the ring gear and its toolholder disk to stop rotating.
The consequent impact is cushoned by the 032 pads. The motor rotation is reversed. The motor starts the satellite and the 007 roller guide crown gear rotation in the opposite direction compared tothe previous one.
Therefore, the rollers by climbimg the cam top sides push the short circuiting ring gear forward so meshing Hirth teeth. The nose of the outside (I) of the 006 roller carrier activates the locking proximity indicating that the turret is locked. That is to say that the rollers are on the cam top side.
Upon receipt of this signal the motor is de - energized. Soon afterwards the electromagnet is de - energized; therefore the lock pushed by the 047 spring comes out of the hole in the 005 indexing head.



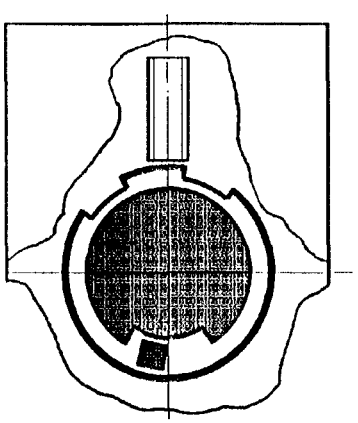
Locked turret (rollers on the cam top central part)



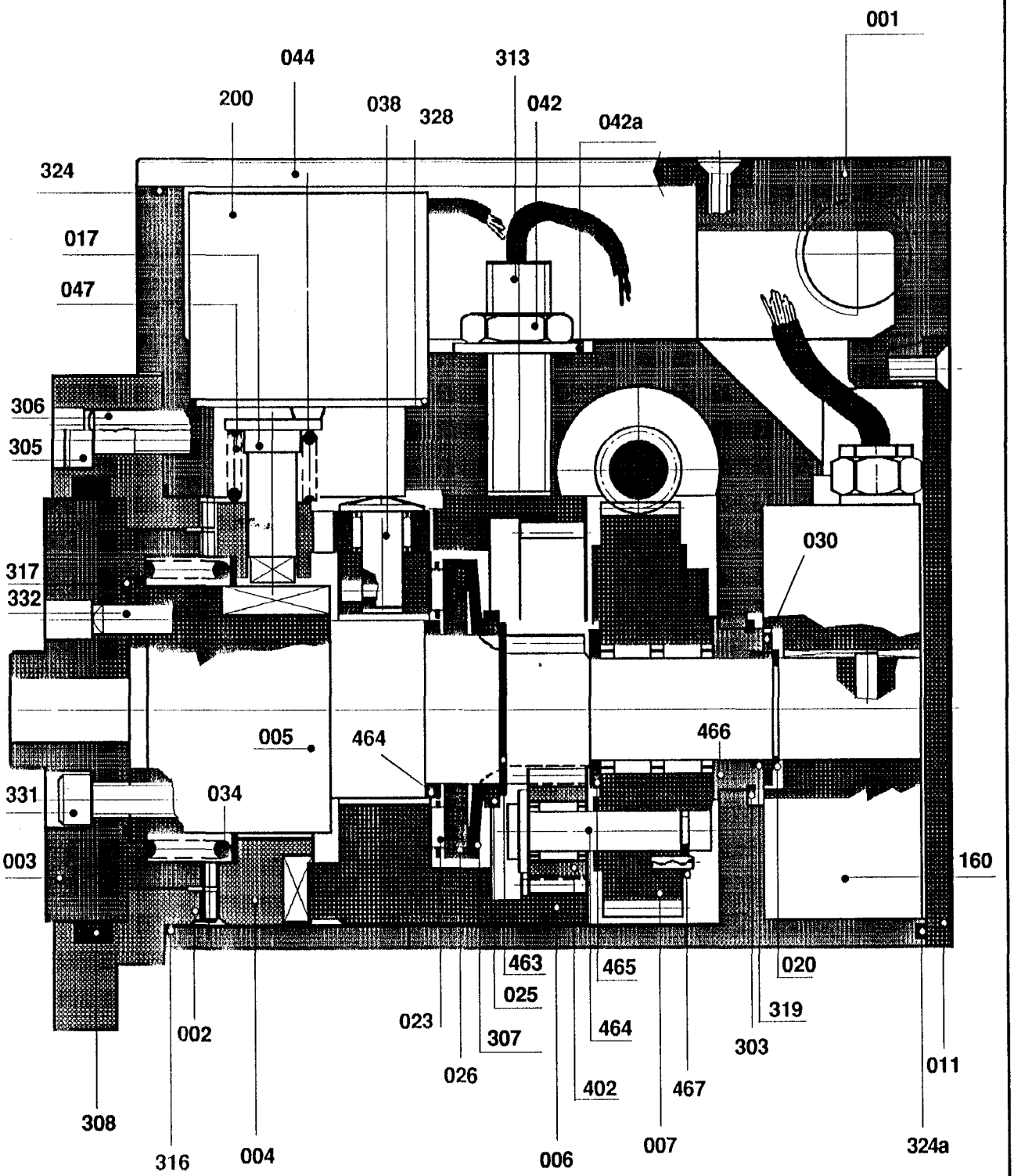
Released turret (the rollers are at the bottom of the cams - the Hirth coupling are released)

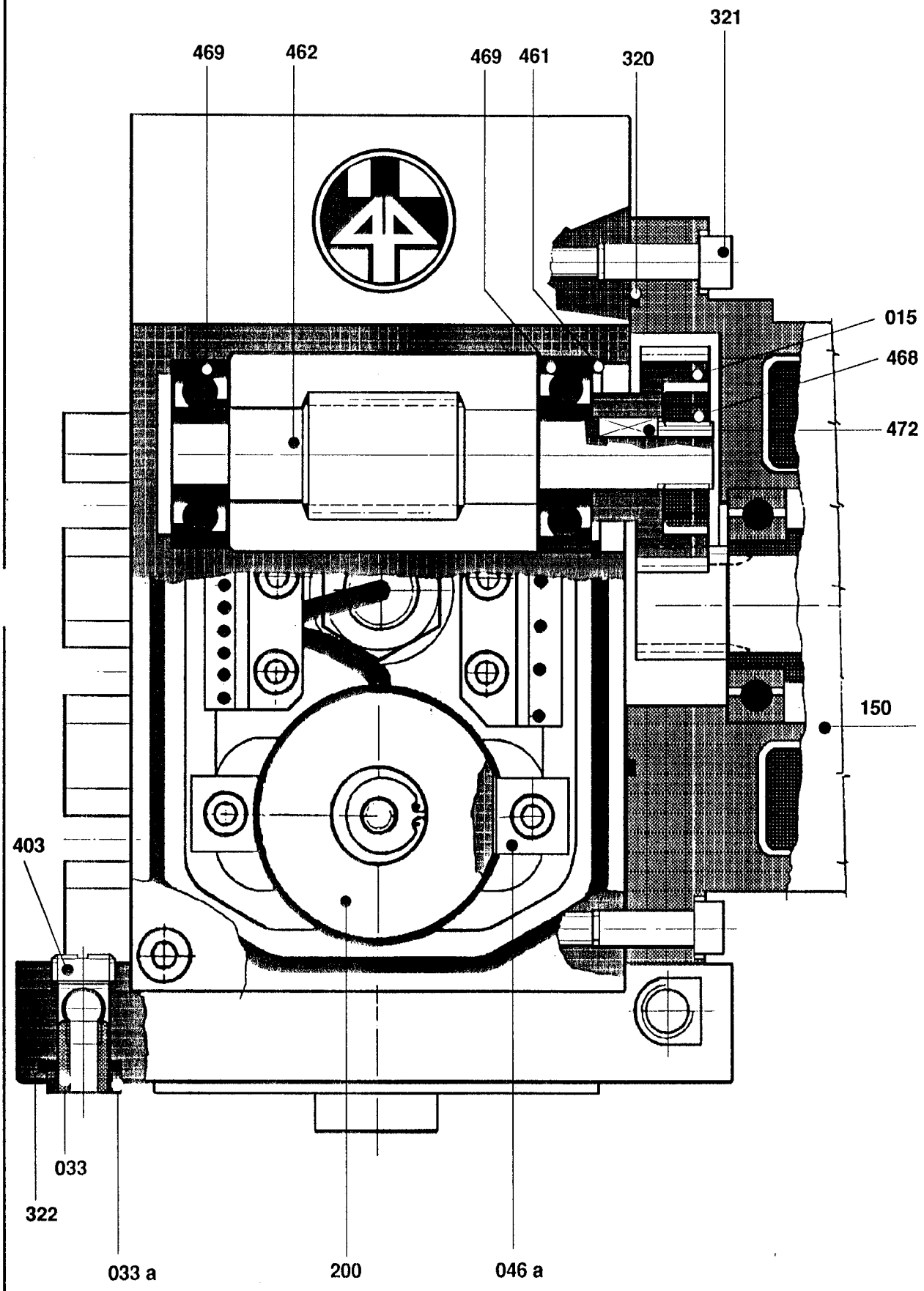


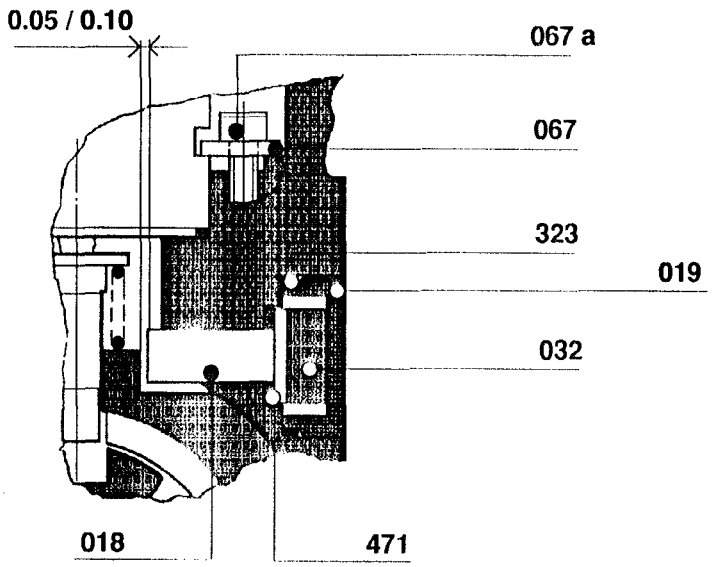
Locked turret (rollers at the beginning of the cam top face (313 proximity operating)

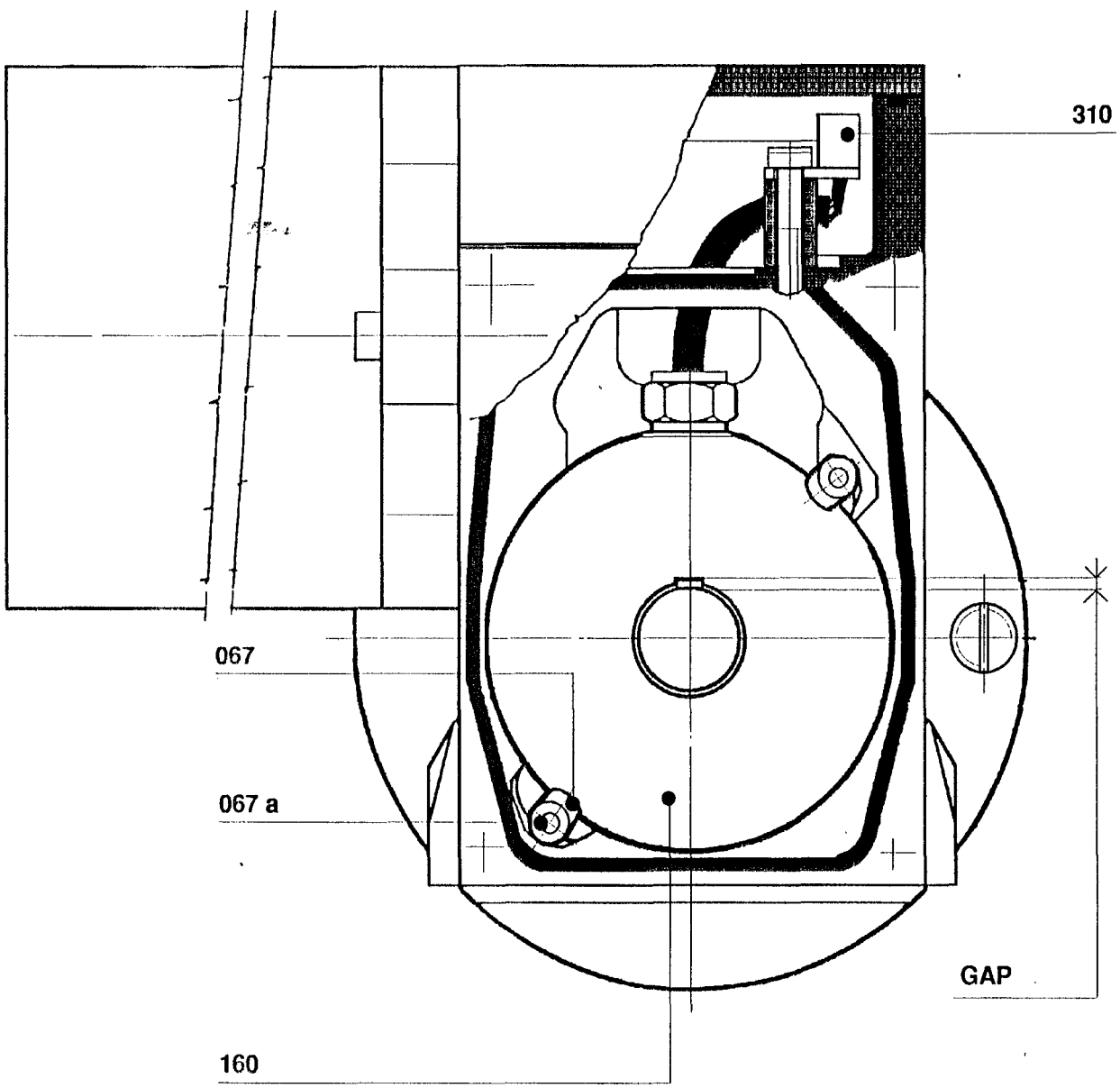


The pictures represent the stages corresponding to the toolholder disc clockwise rotation; for the counterclockwise rotation, movements are reversed.


001
044
313
200
038
328
042
042a
324
017
047
306
305
030
317
332
005
464
466
331
034
003
160
463
465
020
025
319
023
307
464
303
002
026
011
402
467
308
316
004
006
007
324a


321
469
462
469
461
320
015
468
472
150
403
033
322
033 a
200
046 a


0.05 / 0.10
067 a
067
323
019
032
018
471


310
067
067 a
GAP
160

FROM THE TOP SIDE

Take off the 044 top cover. Unscrew the 042 nut, extract the 042a washer and unscrew the 313 proximity. Remove the 046 a washers, extract the 200 electromagnet, extract the 017 lock and its 047 springs.

FROM THE TWO SIDES

Unscrew the 019 covers from the two sides, extract the 018 shock absorbing pins provided with the 032 pads.

FROM THE REAR SIDE

Remove the 011 cover, untighten the 067a screws and the 067 holder, extract the 160 encoder, pay attention to the nut, take off the 303 circlip.

FROM THE FRONT SIDE

Take off the toolholder disc, untighten the screws 305, take off the dowels 306, extract the entire central body composed by 003 mobile ring gear, 002 fixed ring gear, 005 indexing head, 006 roller carrier set, 007 helicoidal wheel. If dismantling this gear set too, were necessary, take off the 020 circlip, the 030 stepbush, the 319 gaskets, take off the screws 331 and the dowels 332, take off the 463 circlip, the 025 spacer, the 307 Belleville washers, the 026 washer and the 023 roller cage.

FROM THE MOTOR SIDE

Untighten the screws 321 which fix the 150 motor, take off the 320 O-ring.
Disconnect the cables of the terminal block on the top side of the turret. Thus take off the turret motor.
Unscrew the 468 ring nut, extract the 015 gear wheel, take off the 461 circlip, extract the 462 worm screw and the 469 cushion pad.

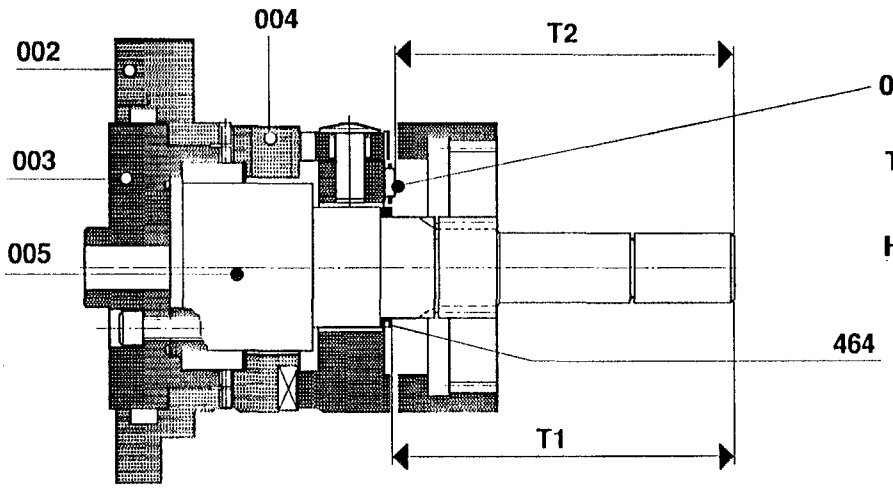
NOTE:
whenever the turret is disassembled check the state of the following elements which will have to be replaced in case of a negative result:

- **308 principal gasket**
- **all the grommets type O-ring**
- **032 cushioning pads**

and the following elements (only when the central body has been completely disassembled):

- **cam surface**
- **rollers**
- **Hirth coupling**
- **all gears**
- **supporting plate of the 003 ring gear with the 002 one**
- **007 helicoidal wheel**
- **462 worm screw**

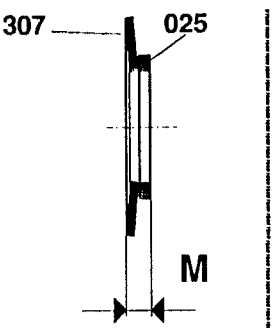
If one of the particular elements of the central body is replaced, before assembling it again, the values T and U, which determine the right load of the spring 307, will have to be checked and set up:
- assemble the elements as shown in the picture with the Hirth couplings touching, and the rollers on the cam top side. Make sure that the value T is between 0.15 - 0.18 mm. If it is not, grind new 464 spacer so that the recommended values include the T one.



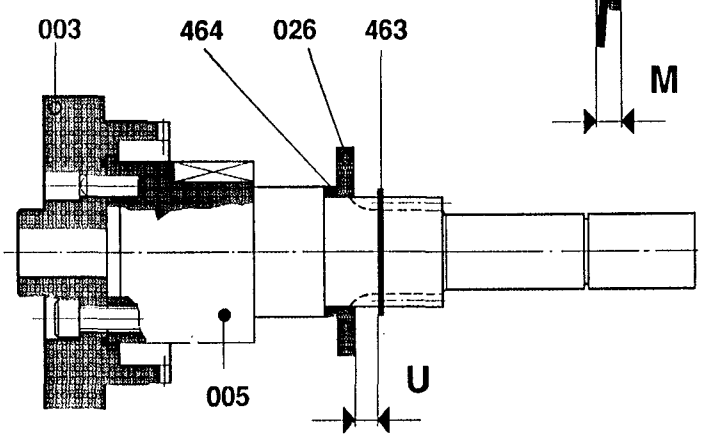
T = T1-T2 = 0.15 - 0.18 mm
gear protrusion

Hirth couplings in contact

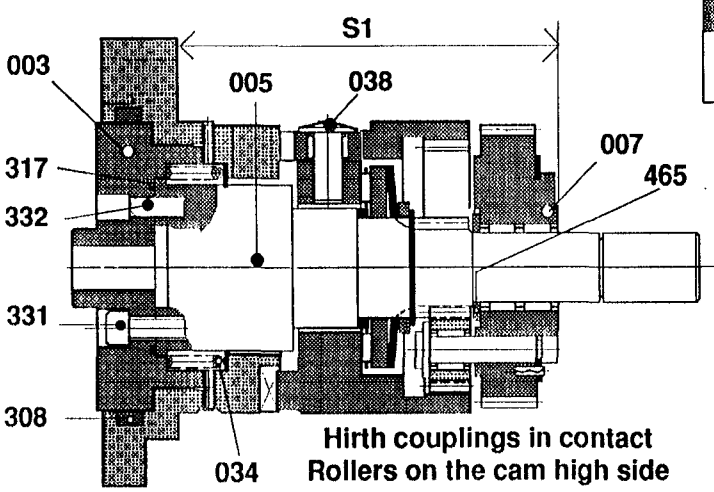
Rollers on the cam
central top side



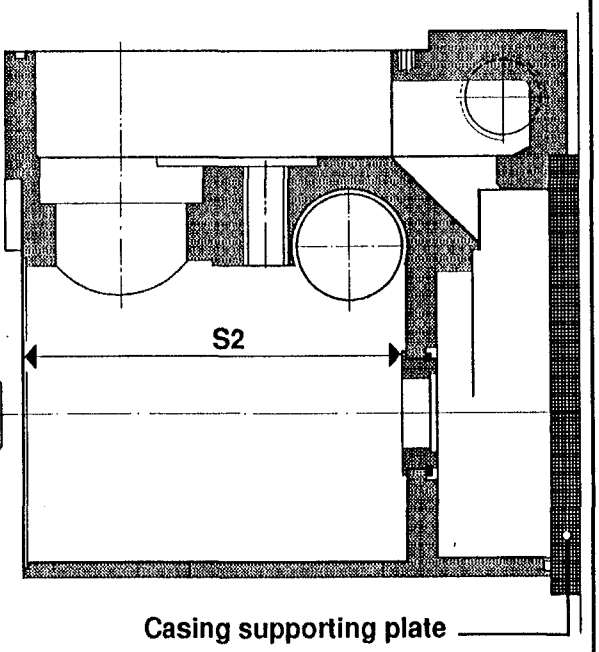
- assemble the elements as shown in the picture; measure the U and M values, calculate the value M according to the following formula: M = U - (0.65 - T a value previously calculated), in case it is not grind the 025 spacer so that the recommended values include the M one.



In case of replacement of the 007 helicoidal wheel and/or 465 spacer: assemble the elements as shown in the picture, check if the S value is included in the values S = S2 - S1= 0.2 - 0.3 mm.
If it is not, grind the 465 spacer; if there is a higher value, shim with washers.



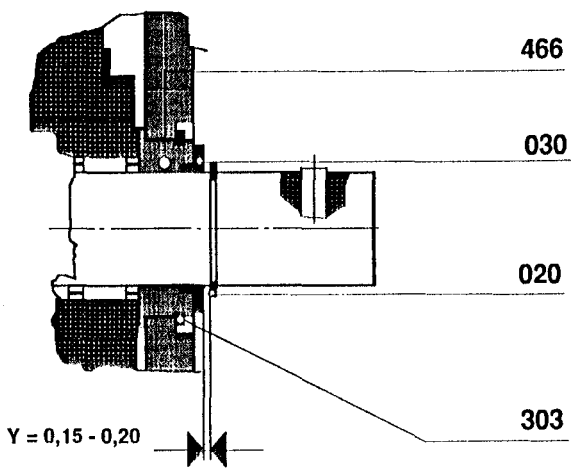
Hirth couplings in contact
Rollers on the cam high side

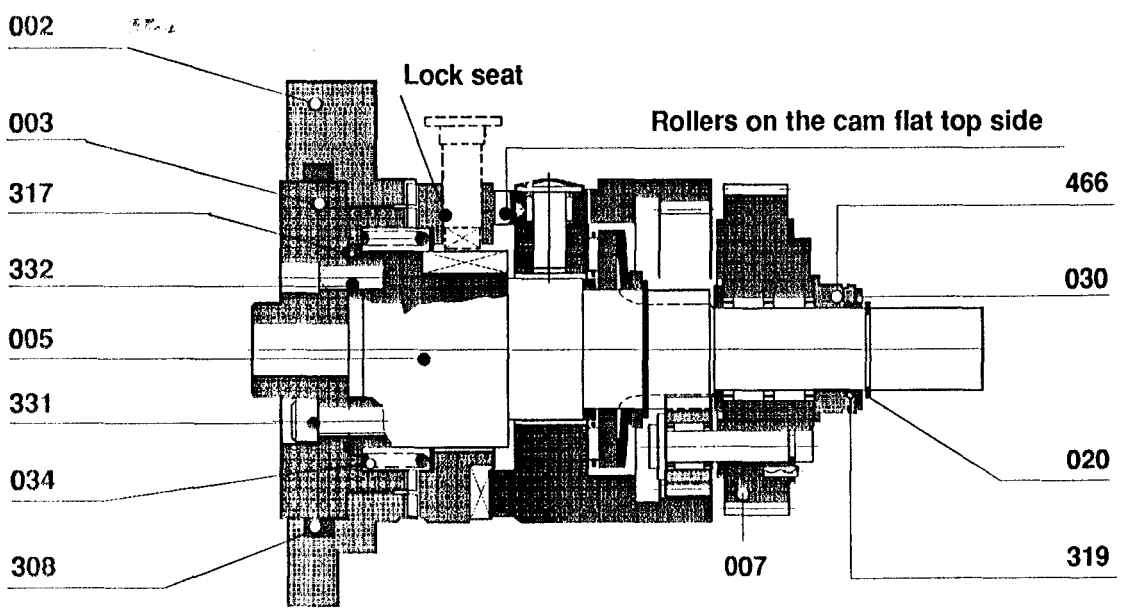


WHEN RE-ASSEMBLING EVERYTHING:

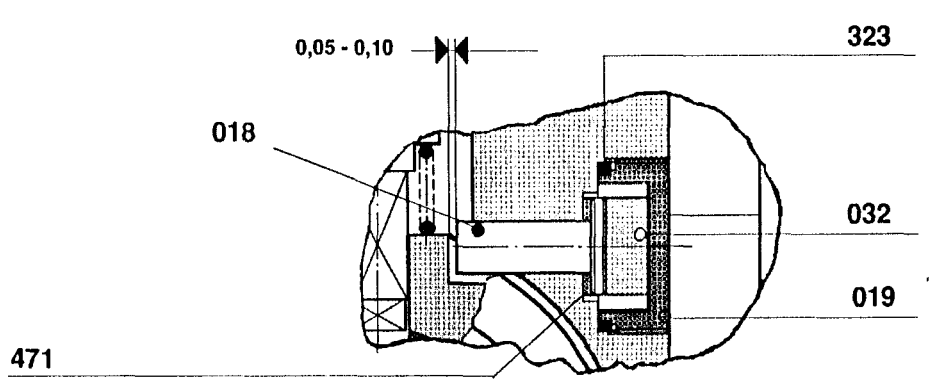
Before inserting the central body in the casing rotate the 007 helicoidal wheel to the point in which the lock seat is perpendicular to the milling plane of the 002 fixed tooth ring gear; insert the 017 lock, rotate by hand the helicoidal wheel 007 spider set untill the Hirth couplings are locked. (rollers placed on the cams plane). Extract the lock.
At this point put the quality and quantity of lubricant in the casing and in the spider hollow as shown on page 19.

- After assembling the rot-index unit in the casing, check the 030 washer clearance and the 466 hub clearance Y = 0.15 - 0.20 mm





Assemble the 018 pins complete with the cushioning pads and screw the 019 covers complete with gaskets.



The turret mechanical elements are lubricated for life.

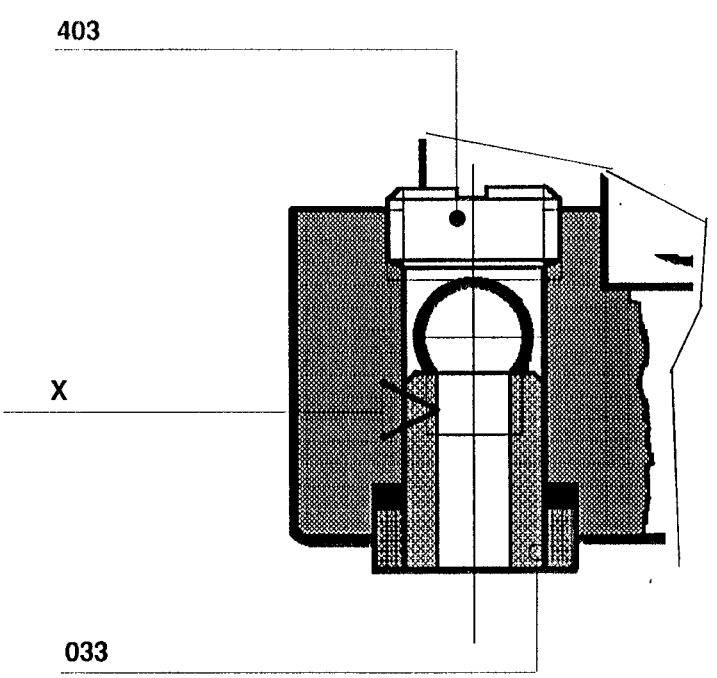
The lubricant must be replaced only in case the turret has been completely disassembled.
The lubricant (viscosity 80 SW 90) must be compatible with rubbers and teflon.
The table below indicates the right amounts to use:

LUBRICANT AMOUNT
0.06 Kg.

REPLACEMENT OF THE COOLANT BUSH

Take off the 403 threaded spring, then extract the 033 bush by using the proper thread. Scrape off the scale from the seat; grease the outside of the new bush then insert it in its seat.

X = M 6
Depth = 5 mm



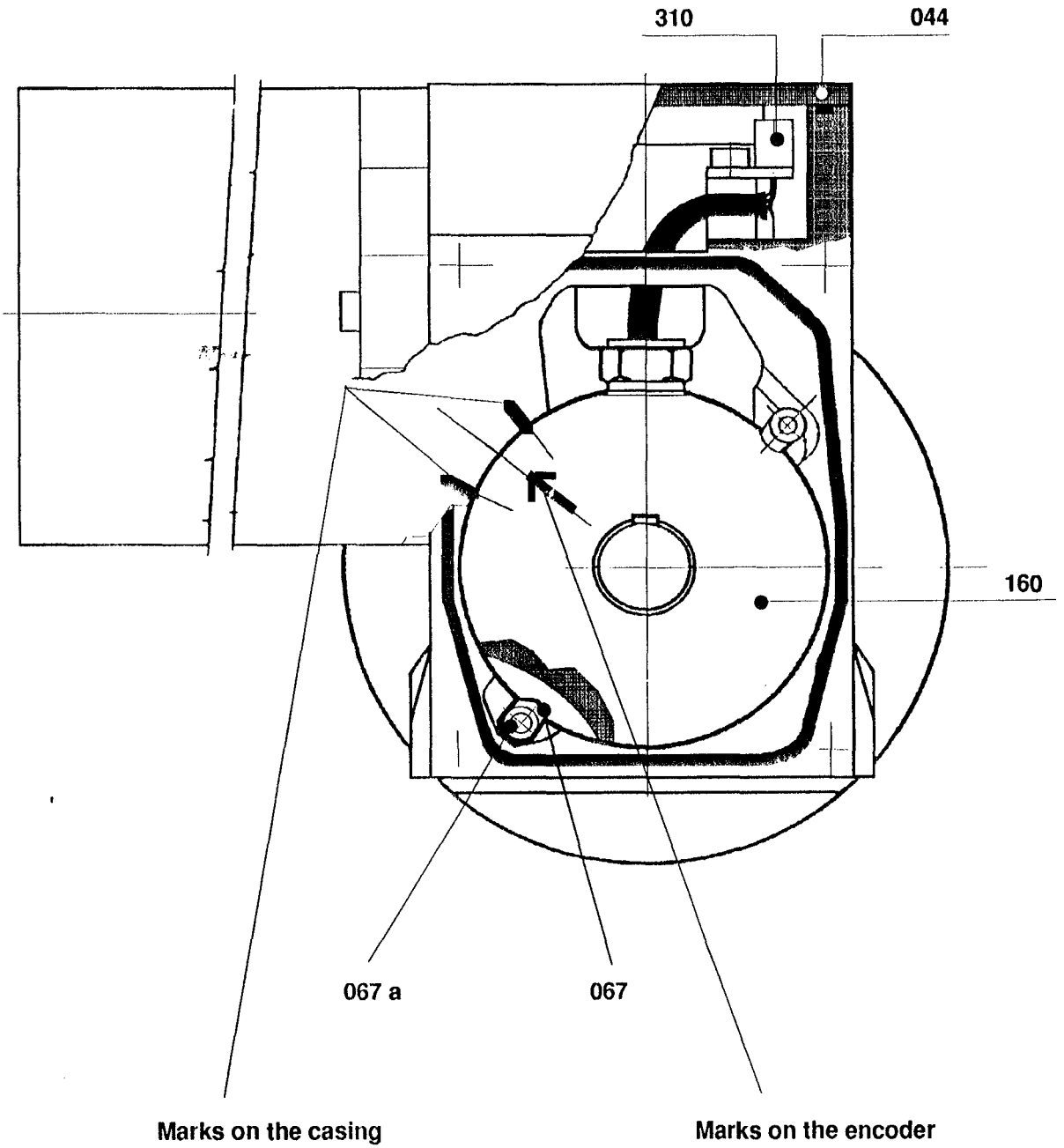
Take off the 044 top cover. Disconnect the feeding cables of the motor and of the thermostat from the terminal block. Release the screws 321, extract the 150 motor set.
Install the new motor set on the casing, connect the cables to the terminal block. Check the correct connection of the motor feeding stages: from the console carry out a tool change calling up the nearest station. If the motor stages have been properly connected, the change of station should follow the shortest way; if they have not, invert two motor feeding cables on the terminal block. Install the top cover again.

PRE - INDEXING ELECTROMAGNET REPLACEMENT

Take off the 044 cover top, remove the 046a washers, extract the 200 electromagnet, disconnect the electromagnet feeding cables.
Install the new electromagnet in the casing seat and lock it with the two washers.
Connect the electromagnet cables to the terminal block (see the electrical diagram), install the top cover again.

Remove the 011 rear cover and the 044 top cover, disconnect the encoder cables from the 310 terminal block, take off the 067 holders and extract the encoder paying attention to the encoder nut. Assemble the encoder in the opposite order, and connect it to the terminal block. Before fixing the encoder permanently, set it:

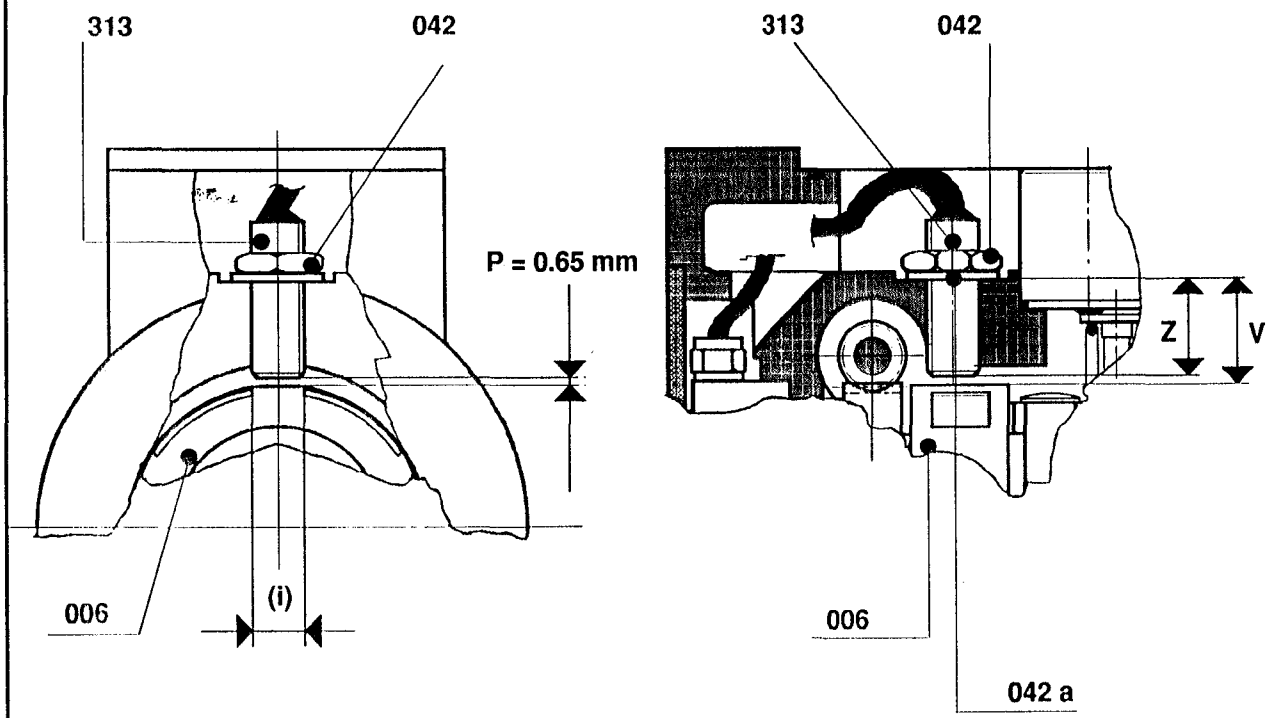
stop the turret in any locked position, slowly rotate the encoder until the strobe signal (detectable both by instrument and voltmeter) disappears. Mark the encoder position with respect to the support. Slowly rotate the encoder in the opposite direction until the strobe signal disappears again; mark the new position on the support. In this way the strobe signal area is spotted. Rotate the encoder backwards so that the mark is half way between the two marks on the casing. Block the 067 holders, install the rear and top covers again.



Remove the 044 top cover, untighten the 042 nut, extract the 042a washer, unscrew the 313 proximity and disconnect the proximity cables from the terminal block.
Screw the proximity to the casing, the set up of the operating reach result from the difference:

$$P = 0{,}65 \text{ mm} = V - Z$$

where V and Z are calculated real values. To measure V the closing sector (i) of the 006 roller carrier must be against the proximity, that is to say with the turret locked. If the turret is not locked, lock it by hand (see page 23).
After setting up the value P of the operating distance screw the 042 nut (3Nm tightening torque).
Connect the proximity cables to the terminal block (see in the electrical diagaram). With the proximity energized, the (red) pilot lamp on the proximity end will be visible: the enlightened red lamp indicates that the turret is locked.
Install again the top cover.



006 Roller carrier

(i) Closing sector

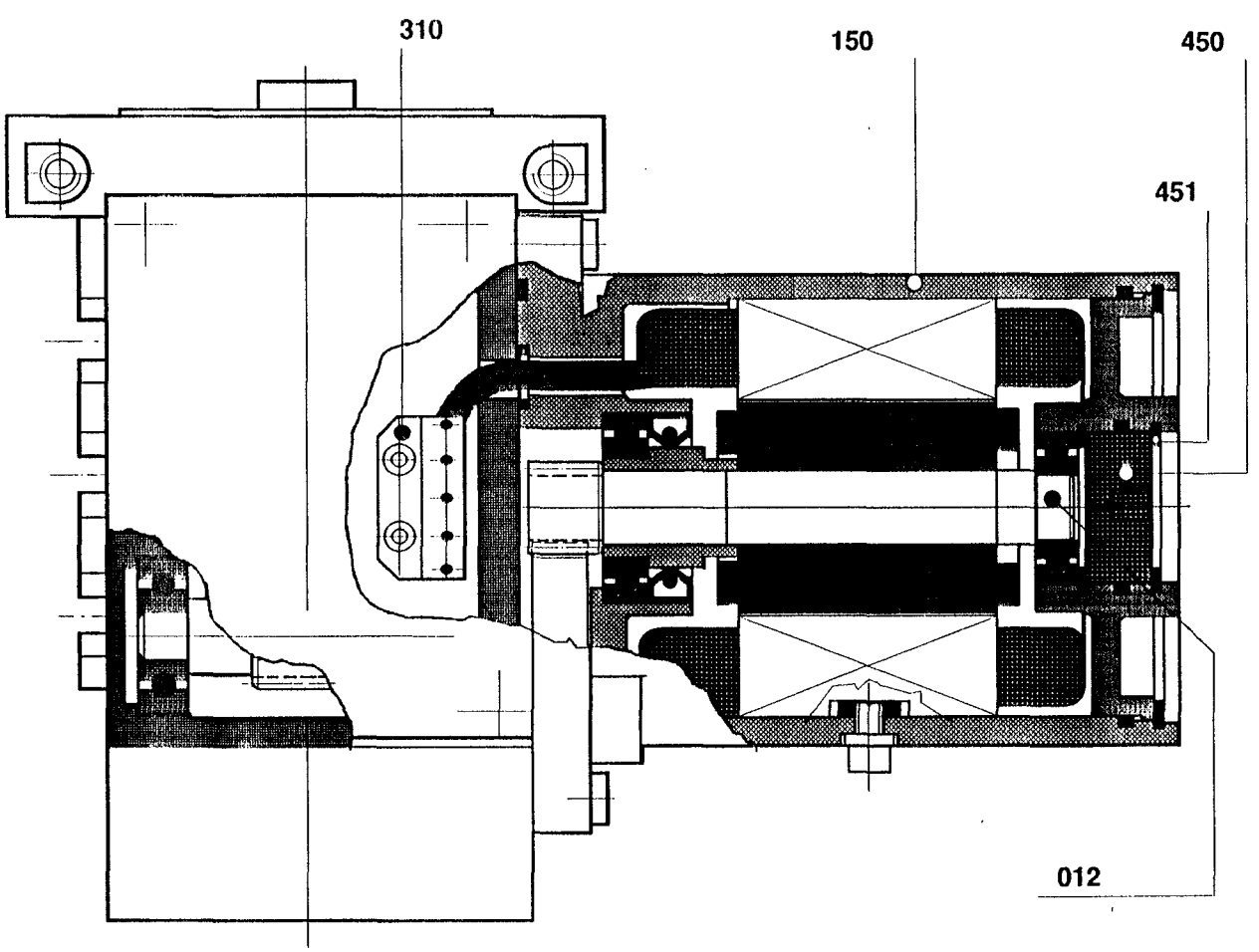
What to do if the positioning cycle is uncomplete (due to an emergency or casual stop)

Act on the motor casing top side, extract the 451 circlip (by using the M6 extraction hole depth 7) take off the 450 cover. Take off the 044 top cover, disconnect from the 310 block the motor feeding cables (but keeping the proximity fed). Extract the 200 electromagnet. By using a hexagonal spanner (see the table) rotate the 012 motor shaft so that the toolholder disc rotates in the same direction as it did when stopped. At the same time push the 017 lock of the 200 electromagnet until enters a hole in the 006 indexing head. Keeping the lock pushed, reverse the motor shaft rotation until the (red)= pilot lamp of the 313 proximity (visible on the control board) lights up. Rotate the shaft again of a further turn, making sure that the pilot lamp is still on. The motor shaft will have to rotate in the same direction as the one before the reversal in the following cases:
- If the disc direction when it stopped is unknown
- If there is a mechanical stop after the reversal without succeeding in locking the turret.

Reconnect the cables to the terminal block, install the 450 cap cover.

IMPORTANT: for an automatic positioning, please refer to the electrical manual

Spanner Size = 5 mm



After around 400.000 manoeuvres:

- check the sliding of the 073 core of the 200 electromagnet.. To do this take off the security cap of the electromagnet. Push the core end many times and by letting it recover through the 047 spring effect; then rotate it some turns. Remove any possible partreak of contamination from the core and the nearby parts. Oil the core external surface which penetrates into the electromagnet.

- Check the wear - rate of the 033 coolant bush and replace it if necessary.

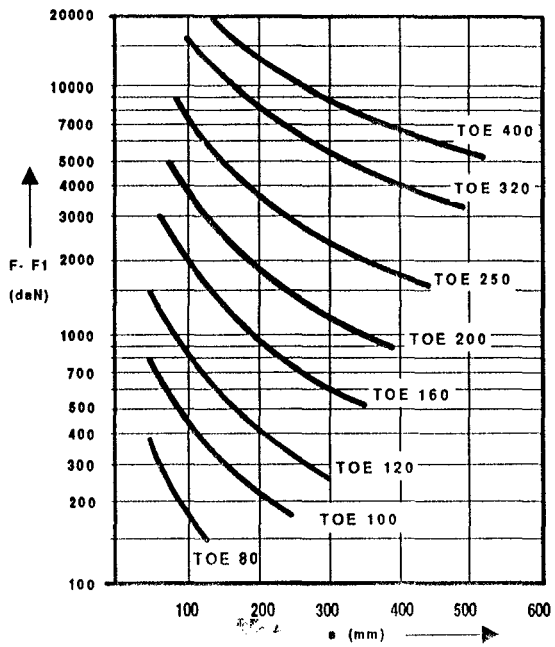
- Check the 308 gasket state; if they are deterioreted or clearly worn out, they must be replaced.

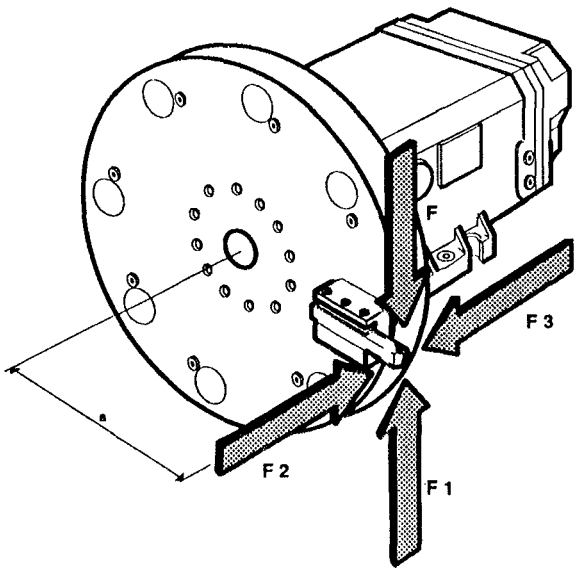
- To check the gaskets: release the screws 331, extract the dowels 332 and the 003 mobile ring gear. If a large amount of oil leaks out, load it again.

032	Pads (n. 2)
033	On - off coolant liquid valve
150	Motor set
160	Encoder set
200	Electromagnet
308	Gasket
313	Locking proximity
316	O - ring
317	O - ring
319	O - ring
321	O - ring
322	O - ring
323	O - ring
324	O - ring

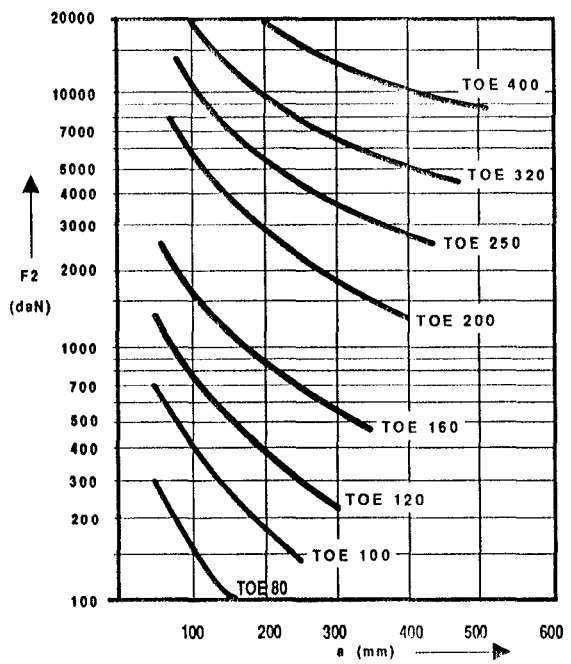
TURRET SIZE		TOE 80	
Ratio code		TOE 80/../0	TOE 80/../1
Maximum moment of inertia of carriable masses	Kgm^2	0.11	0.07
Tangential torque	Nm	120	120
Max. out of balance torque by weight carried when turning axis of the turret is in horizontal position	Nm	2	2
Accuracy of repeatibilty	(Degr)°	+/- 6"	+/- 6"
Weight of standard turret	Kg	9.6	9.6
Manoeuver	N° p/h	1080	1200

As a function of the tangential thrust F and F1

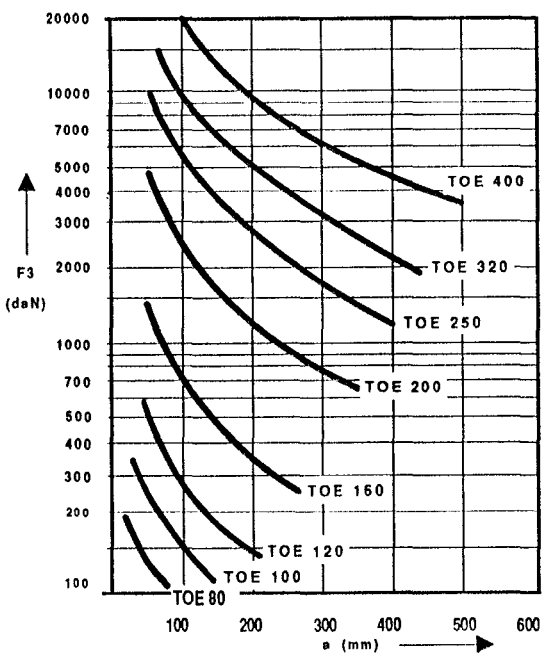




As a function of the pressing axial force F2



As a function of the lifting axial force F3



PROBLEM	REASON	SOLUTION
The turret does not start	There is no motor rotation	Reset the motor feeding
	Damaged motor	Replace the motor (see page 20)
	Thermostat emergency switch in function	See next point
The turret does not complete the indexing cycle due to the thermostat, emergency switch or to uncomplete cycle signal	Higher number of indexes/hour than is permitted	Reduce the number of manoeuvres (see the technical data table on page 25)
	With released turret in selected station and energised motor, there is no 313 proximity signal	
	Locking proximity damaged	Replace the locking proximity (see page 22)
	The locking proximity is not properly set	Set the locking proximity (see page 22)
	Restart after an emergency or casual stop in the opposite direction with respect to the proper one	See page 23
	Electromagnet core jamming	See page 24
The turret goes further than the selected station	Delay in the electromagnet energizing	Reset the control equipment

PROBLEM	REASON	SOLUTION
The turret does not remain locked	Delay in motor de-energizing	Reset the control equipment
The turret keeps rotating without stopping at the selected station	Damaged angular encoder	Replace the angular encoder (see page 21)
	Damaged electromagnet	Replace the electromagnet (see page 20)
	The electromagnet is de-energised or the voltage is lower than necessary	Reset the voltage in the suggested value
	Power cable continuity faulty	Reset the continuity
The turret approaches the called station through the longest route	Inverted motor phases	Reconnect the phases properly (see page 20)
Excessive impact during the pre-indexing	Excessive elasticity of the cushioning pads	Replace the cushioning pads
	Higher moment of inertia of the applied masses than the permitted one	Reset the moment of inertia of the applied masses till the permitted one (see page 25)
	Higher unbalancing moment of the applied masses than the permitted one	Reset the applied unbalanced masses till the permitted one (see page 25)
Disk stick-slip-motion	Higher unbalancing moment than the permitted one	Reset the applied unbalanced masses till the permitted one (see page 25)