



**CAK16d SERIES    CNC LATHES**  
**CAK36d SERIES    CNC LATHES**  
**CAK40d SERIES    CNC LATHES**  
**FTL16d SERIES    CNC LATHES**  
**FTL36d SERIES    CNC LATHES**  
**FTL40d SERIES    CNC LATHES**

# **INSTRUCTION BOOK**

## **(For Electrical Unit)**

**CNC System: FANUC 0i (Mate)-T**

**SHENYANG NO.1 LATHE WORKS**  
**SHENYANG MACHINE TOOL CO., LTD**  
**THE PEOPLE'S REPUBLIC OF CHINA**

IT IS NECESSARY FOR YOU TO READ THIS BOOK CAREFULLY AND THOROUGHLY BEFORE OPERATING THE MACHINE.

THE CHINESE VERSION OF THIS TECHNICAL DOCUMENT IN ENGLISH IS REGARDED AS FINAL.

**Explanations for product models mentioned in this Instruction Book:****CAK16d series: CAK1626di, CAK1626dj****CAK36d series: CAK3665di, CAK3665dj****CAK40d series: CAK4085di, CAK4085dj****FTL16d series: FTL1626di, FTL1626dj****FTL36d series: FTL3665di, FTL3665dj****FTL40d series: FTL4085di, FTL4085dj**

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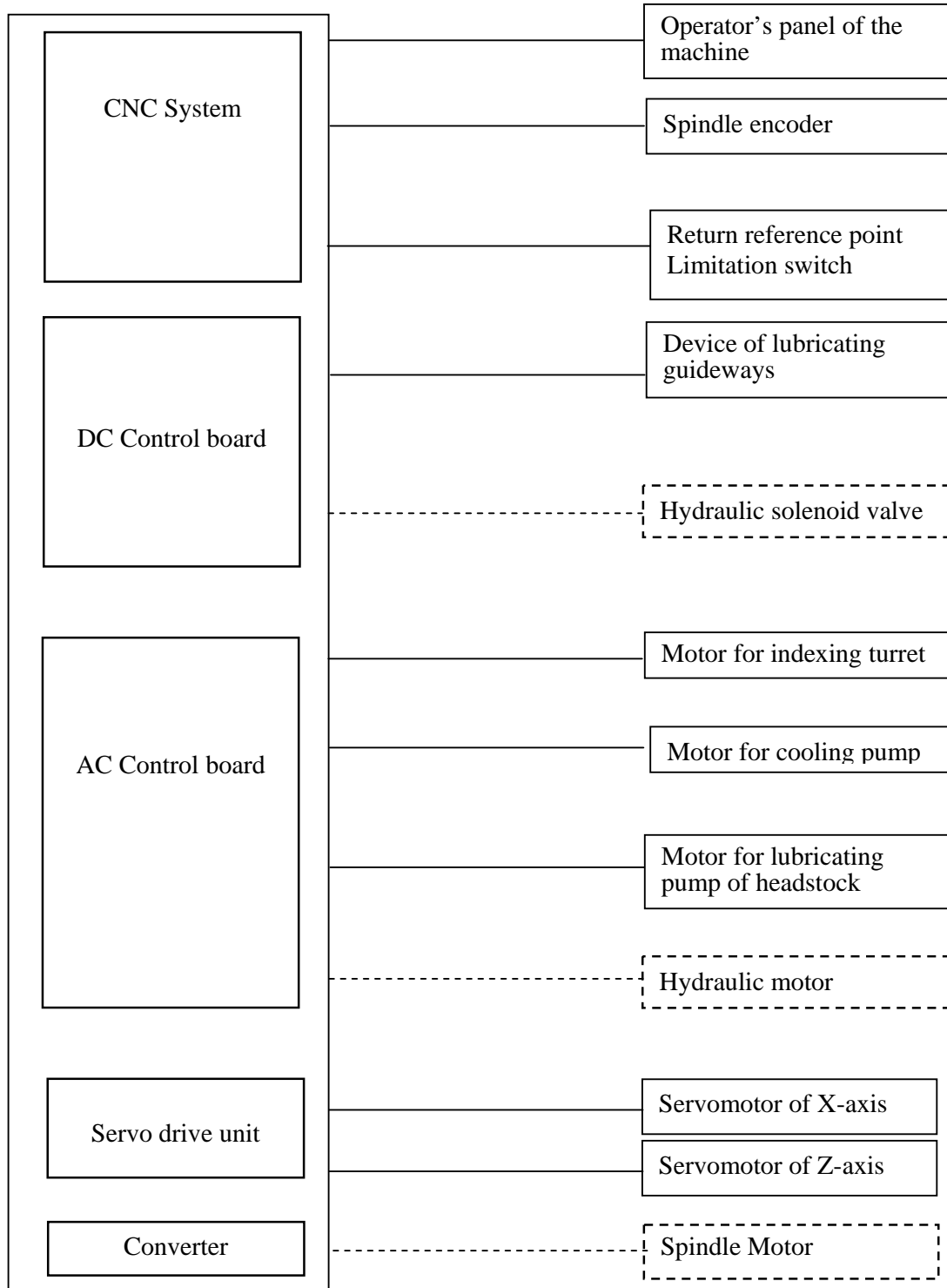
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**1 OVERVIEW OF ELECTRIC SYSTEM**

**1.1 Arrangement Diagram of Electrical Equipment**



## 1.2 Table of Basic Performances of CNC System

| Main Performance                       | Target                |
|--|-----------------------|
| CNC system                             | FANUC 0i-Mate T       |
| Min. command unit                      | 0.001mm               |
| Max. programming size                  | 9999.999mm            |
| Capacity of workpiece program          | 256 kB                |
| Absolute/Incremental program           | X,Z / U,W             |
| Straight/Circular interpolation        | ●                     |
| Metric thread                          | ●                     |
| End of threading                       | ●                     |
| Fix cycle                              | ●                     |
| Combination cycle                      | ●                     |
| Subprogram call                        | ●                     |
| Reversion of Metric and Inch           | ●                     |
| Tool compensation                      | ●                     |
| Tool tip radius compensation           | ●                     |
| Feed/rev., feed/min.                   | ●                     |
| Control of constant linear speed       | ●                     |
| Clearance compensation                 | ●                     |
| Compensation of pitch error            | ●                     |
| Parallel shift of workpiece coordinate | ●                     |
| Return reference point                 | ●                     |
| Protection of software over-travel     | ●                     |
| RS232C Communication                   | ●                     |
| Display device                         | LCD                   |
| Feed drive device                      | FANUC β iS Servomotor |

● : Basic function

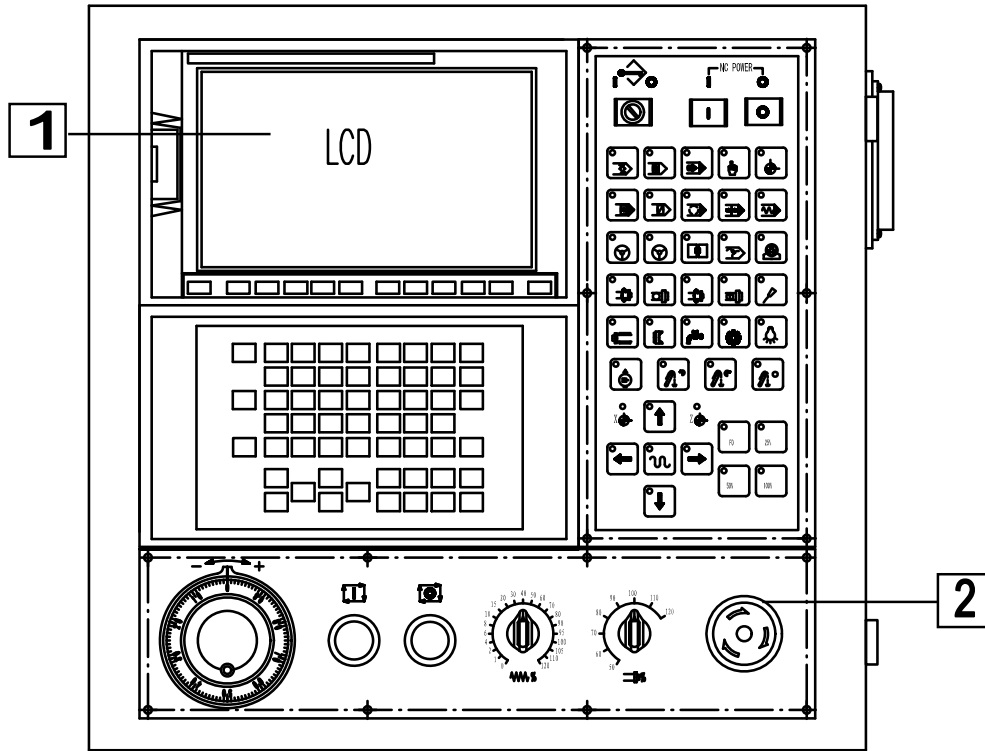
**1.3 List of Motors Used for the Machine**

| No. | Name                                   | Specification                                   | Remarks            |
|-----|--|---|--------------------|
| 1   | Spindle motor                          | YVP132M-33-B5,5.5kW/7.5kW<br>1450/ 2800 r/min   | For 36d/40d (380V) |
|     |  | YVPH132M-33-B5,5.5kW/7.5k<br>W 1450/ 2800 r/min | For 36d/40d (220V) |
|     |  | YVP112M-50-B5,4 kW<br>1500 r/min                | For 16d            |
| 2   | Motor for indexing<br>4-station turret | YLJ-1-50D 1 Nm 1400 r/min                       |                    |
|     | Motor for indexing<br>6-station turret | YLJ-3-6 3 Nm 1000 r/min                         |                    |
| 3   | Motor for cooling<br>pump              | AYB-25 90 W 2800 r/min                          |                    |
| 4   | Hydraulic motor                        | Y90L-6 1.1k W 1000 r/min                        | Optional           |
| 5   | Servo motor for X-axis                 | FANUC $\beta$ 8 / 3000 iS<br>1.2 kW             |                    |
| 6   | Servo motor for Z-axis                 | FANUC $\beta$ 8 / 3000 iS<br>1.2 kW             |                    |



### 1.4 Operator's Panel of the Machine






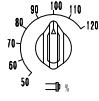

#### 1.4.1 Arrangement Diagram of Operator's Panel



1. Display and keys board of CNC device Operation keys board of the machine
2. Machine tool operator Panel

**1.4.2 Table of Functions of Operation Keys Board**

(Diagram 1)

| No. | Symbol   | Name                    | No. | Symbol   | Name                      |
|-----|--|-------------------------|-----|--|---------------------------|
| 1   | NC ON  | Power-on of CNC system  | 5   |  | Feed override switch      |
| 2   | NC OFF   | Power-off of CNC system | 6   |  | Emergency stop button     |
| 3   |   | Cycle start             | 7   |  | Handwheel pulse generator |
| 4   |   | Feed hold switch        | 8   |  | Spindle override Switch   |
| 9   |  | Data protect switch     |     |  |                           |

(Diagram 2)

| No. | Symbol | Name  |
|-----|--------|---|
| 1   |        | Edit mode   |
| 2   |        | MDI mode  |
| 3   |        | Auto mode of storage program                          |
| 4   |        | Manual feed mode                                      |
| 5   |        | X axis Handwheel pulse feed mode                      |
| 6   |        | Return zero   |
| 7   |        | Min. unit of handwheel pulse<br>G00 speed F0          |
| 8   |        | Handwheel pulse unit 0.01mm<br>G00 speed override 25% |
| 9   |        | Handwheel pulse unit 0.1mm<br>G00 speed override 50%  |
| 10  |        | Handwheel pulse unit 1mm<br>G00 speed override 100%   |
| 11  |        | Auto Door protect switch                              |
| 12  |        | Z axis Handwheel pulse feed mode                      |
| 13  |        | Single-program segment                                |
| 14  |        | Optional segment skip                                 |
| 15  |        | Locking of machine                                    |
| 16  |        | Optional stop   |
| 17  |        | Dry run   |
| 18  |        | Negative jogging of X-axis                            |
| 19  |        | Negative jogging of Z-axis                            |

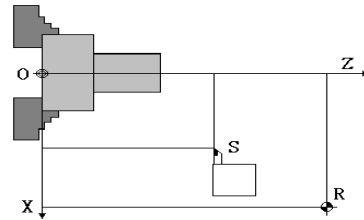
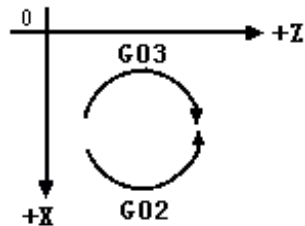
| No. | Symbol | Name                                   |  |
|-----|--------|--|--|
| 20  |        | Negative jogging of Z-axis             |  |
| 21  |        | Positive jogging of Z-axis             |  |
| 22  |        | Manual rapid speed                     |  |
| 23  |        | Start/stop of hydraulic device         |  |
| 24  |        | Manual tool selection                  |  |
| 25  |        | ON/OFF of coolant manually             |  |
| 26  |        | ON/OFF of manual lubrication           |  |
| 27  |        | Manual spindle forward                 |  |
| 28  |        | Manual spindle reverse                 |  |
| 29  |        | Manually stop spindle rotating         |  |
| 30  |        | Manual jogging spindle                 |  |
| 31  |        | Tailstock advancing and<br>withdrawing |  |
| 32  |        | Chip convey forward                    |  |
| 33  |        | Chip convey reverse                    |  |
| 34  |        | Chip convey stop                       |  |
| 35  |        | Manually reducing spindle<br>speed     |  |
| 36  |        | Center frame                           |  |
| 37  |        | Program is run                         |  |
| 38  |        |  | X axis reference point<br>indicate.<br>Z axis reference point<br>indicate. |

### 1.5 Coordinate Axes and Setting of Coordinate System

- The machine has two feed axes and adopts transmitting structure for AC servomotor to drive ball leadscrew to obtain plane continuous path movement.

Longitudinal feed axis is in parallel with spindle and it is called Z-axis (feed), and direction pointing at tailstock is positive direction.

Traverse feed axis is perpendicular with Z-axis and it is called X-axis (feed), direction of away from workpiece is positive direction.



- In order to describe moving position and moving path of tool tip, first, it is necessary to establish a coordinate system on a certain point on workpiece which is chucked on the machine, then, edit program workpiece to be turned according to certain rules and on the basis of tool movement path. The two axes of workpiece coordinate system are separately parallel with two feed axes of the machine. The axis parallel with longitudinal feed axis is called Z (coordinate) axis, and that parallel with traverse axis is called X (coordinate) axis. Direction of coordinate axis is always in keeping with that of feed axis.

Point coordinate (X、Z) is referred to as absolute coordinate. Using absolute coordinate to program is called absolute programming. To use absolute programming, first, it is necessary to set coordinate system, that is, set the origin of coordinate system to a specified position. In normal case, z-axis is set on the rotary center of spindle and X-axis is set to position on chuck endface, workpiece endface, etc..

Point S shown in the right lower figure on last page is a original position for turning. Coordinate value set by G50 is the coordinate value of the point S. Point R is reference point of the machine.

- Programming mode of not using absolute coordinate and displacement amount of using new aim position to present position is called incremental programming. In general, there are two methods to obtain incremental programming. The standard method of the machine is (U, W) address mode; U is increment of x-direction; W

is increment of X-direction.

- For this machine, both the absolute programming and the incremental programming can be used, and combination programming is also used.
- Diameter programming is used in the direction of X-axis of the machine, therefore, programmed value X (U) is two times of practical coordinate value, coordinate value of X-axis displayed on screen is also two times of practical value, but movement amount of tool is only half of programmed value.
- Direction commanded by circular interpolation G02, G03 is shown by the figure in the last page.

### **Setting method of coordinates system:**

Practical setting method and the position of reference point are as follows:

#### **The first method:**

Previously set X-axis and Y-axis value separately into Prm.1240. After returning reference point, the system automatically establish a coordinate system. The reference point is (X ,Y) in this coordinate system. Absolute coordinates display (X,Y) on position display.

When workpiece is taken on the machine, if O point is considered as origin point, distance that is measured is taken into Prm.1240, then, return reference point and establish workpiece coordinates.

That is method that measures distance O point and reference point.  
steps as follow:

- ① Set 0 into Prm 1240. Return reference point. The absolute coordinate display (0,0).
- ② Take turret near workpiece to touch with the endface of workpiece by manual, record the Z-axis value, then the turret returns in X-axis direction.
- ③ Take turret near workpiece to touch with the circle of workpiece by manual, record the X-axis value and dia.of workpiece.
- ④ Set  $|x| + d, |z| + L$  into Prm1240
- ⑤ Return reference point, display of absolut coordinate is value of Prm 1240. Now origin is (0,0) that is established

- Coordinate system is not set by command G50 after help of this method establishes it. Only without accompanying or trouble, the position anywhere the tool moves tallies with the position displayed by absolute coordinate, thereby, as long as without interference, the tool can start program to turn workpiece at any position.
- If set coordinate system by G50 after it is automatically set through returning reference point, the coordinate system set by G50 is priority.

#### **The Second method:**

Edit command G50 in program.

Format: G50 X $\alpha$  Z $\gamma$ .

- ① Select reference tool (Ex. Tool No.1)
- ② Move the tool No.1 to nearby workpiece manually to cut endface of workpiece, then move it away from the workpiece along X-axis direction. Reset (clear) the position coordinate W.

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- ③ Turn O.D. of workpiece manually. And then, move the tool away from the workpiece along Z-axis direction. Reset the position coordinate U and measure value D of O. D. of workpiece.
- ④ Move the carriage manually until  $U = \alpha - D$ ,  $W = \gamma - L$  are displayed. ("L" is a distance from coordinate's origin to trial-turning endface of workpiece.)

### 1.6 Code Table of G Commands

| Code  | Group                           | Function  | Remarks                       |
|-------|---------------------------------|---|-------------------------------|
| ▣ G00 |                                 | Positioning of rapid travel                                   |                               |
| G01   | 01                              | Linear interpolation  |                               |
| G02   |                                 | Circular interpolation (CW)                                   |                               |
| G03   |                                 | Circular interpolation (CCW)                                  |                               |
| G04   |                                 | 00  | Dwell                         |
| G28   | Reference point return          |   |                               |
| G32   | 01                              | Thread cutting  |                               |
| G50   | 00                              | Coordinate system setting/setting of spindle speed limitation |                               |
| G65   | 00                              |   |                               |
| G70   | 00                              | Finishing cycle   |                               |
| G71   |                                 | Roughing cycle of external cylinder surface                   |                               |
| G72   |                                 | Cycle of roughing end face                                    |                               |
| G73   |                                 | Canned turning cycle  |                               |
| G74   |                                 | Cycle of drilling deep-hole on end-face                       |                               |
| G75   |                                 | Grooving cycle of on OD, ID.                                  |                               |
| G76   |                                 | Combination cycle for thread cutting                          |                               |
| G90   |                                 | 01  | Traverse canned cycle cutting |
| G92   | Canned cycle cutting of threads |   |                               |
| G94   | End-face canned cycle cutting   |   |                               |
| G96   | 02                              | Constant linear speed control                                 |                               |
| G97   |                                 | Cancel of constant linear speed                               |                               |
| ▣ G98 | 05                              | Feed / min.   |                               |
| G99   |                                 | Feed / rev.   |                               |

- Notes: 1. G codes in Group 00 are non-model and they are valid only blocks in which they are Specified.
2. Alarm occurs if G codes which are not listed in the table mentioned above are specified.
3. Codes in a few different groups can be specified in the same block. The last code is valid if codes in many different groups are specified.
4. The system is under this G code state when symbol "▣" shows switch-on.
5. The spindle can be set max speed by G50 when the system is under constant thread speed.
6. Counter Clockwise of G02 and G03 is up to the reference.
7. G90、G92、G93、G94 is relased by other G order except for G04 and G65. after that, M-code, S-code, T-code will be used.

**1.7 Code Table of M Commands**

| <b>Code</b> | <b>Function</b>                                | <b>Remarks</b> |
|-------------|--|----------------|
| M00         | Unconditional stop of program                  |                |
| M01         | Conditional stop of program                    |                |
| M02         | End of program                                 |                |
| M03         | Spindle forward                                |                |
| M04         | Spindle reverse                                |                |
| M05         | Spindle stop                                   |                |
| M08         | Coolant ON                                     |                |
| M09         | Coolant OFF                                    |                |
| M10         | Chuck releasing                                |                |
| M11         | Chuck clamping                                 |                |
| M30         | End of program and return to program beginning |                |
| M41         | Low-speed                                      |                |
| M42         | Mid-speed                                      |                |
| M43         | High-speed                                     |                |
| M52         | Tailstock quill advance                        |                |
| M53         | Tailstock quill withdraw                       |                |
| M70         | Chip conveyor CW                               |                |
| M71         | Chip conveyor stop                             |                |

**1.8 Table of T Commands**

T commands are comprehensive commands of tool selection and tool compensation, and they consist of T+4 digits.

Format: T▲▲●●

▲▲:Tool No., from 01 to max. tool number of turret, more than this max. number is not allowed.

●●:Unit No. of tool compensation, from 01 to 32. 00 can be specified, which presents cancel of tool compensation. Tool No. and tool compensation No. can be freely combined. Each tool can use tool compensation unit of many groups.

| Code  | Function               | Remarks                    |
|-------|------------------------|----------------------------|
| T0100 | Selection of tool No.1 |                            |
| T0200 | Selection of tool No.2 |                            |
| T0300 | Selection of tool No.3 |                            |
| T0400 | Selection of tool No.4 |                            |
| T0500 | Selection of tool No.5 | For turret with 6 stations |
| T0600 | Selection of tool No.6 |                            |

For example, select No.2 tool and ready for using tool compensation unit of group 3 to compensate No.2 tool, it is necessary to edit statement T0203 at proper position of program.



## 2 FEEDING (POWER-ON) OF THE MACHINE

### 2.1 Major Technical Requirements of Electrical Unit of the Machine

| No. | Name of Equipment  | Specification   | Remarks   |
|-----|--|---|---|
| 1   | General power of the machine                                       | 15kW  |   |
| 2   | General current of the machine                                     | Power supply of 380V  | For more than 380V the electrified wire netting is the same as that of 380V |
|     |  | Power supply of 220V  |   |
| 3   | General fuse of user's power supply                                | Power supply of 380V  |   |
|     |  | Power supply of 220V  | 70A   |
| 4   | Wire system  | 3-phase 4-wire  |   |
| 5   | Voltage of electrified wire netting                                | Basic 3-phase 380V  | Optional voltage 220V/420V/440V/460V  |
| 6   | Allowed fluctuating range of voltage of electrified wire netting   | Voltage: Stable voltage value is 0.9~1.1 times of rated volt.   |   |
|     |  | Freq.: Stable freq. value is 0.99~1.01 times of rated freq. (continuous working and for the short time working, the value is 0.98~1.02 times of rated freq (short time working).                                      |   |
| 7   | Harmonic   | Sum of distorted harmonic through 2-5 times is not more than 10% of root mean square value of line volt.; for the sum of distorted harmonic through 6-30 times, not more than 2%                                      |   |
| 8   | Unbalancing voltage  | Composition of negative order and that of zero order of 3-phase main voltage are all not more than 2% of that of positive order.  |   |
| 9   | Interruption of voltage  | Continued time in interrupting of power supply or zero voltage at any time during the periodic of cycle of the power supply shall not be more than 3ms, the interval time of phase square shall be more than 1second. |   |
| 10  | Voltage drop   | Voltage drop shall not be more than 20% of peak voltage of one period and dropping interval time of phase distance should be more than 1second.   |   |
| 11  | Frequency of electrified wire netting                              | 50Hz  | Optional frequency: 60Hz  |
| 12  | Allowed fluctuating range of frequency of electrified wire netting | ±1%   |   |
| 13  | Temperature of working environment                                 | 0℃~45℃  |   |
| 14  | Relative humidity  | Less than 75%   |   |
| 15  | Vibration (when operating)   | Less than 0.5g  |   |

| No. | Name of Equipment                    |    | Specification     | Remarks |
|-----|--------------------------------------|----|-------------------|---------|
| 16  | Control voltage                      | AC | 110V/200VA        |         |
|     |                                      | DC | 24V/6.5A          |         |
| 17  | Voltage /Capacity for illuminating   |    | AC 220V/18W       |         |
| 18  | Voltage /Capacity for CNC system     |    | DC<br>24V/100VA   |         |
| 19  | Voltage /Capacity of servo amplifier |    | AC<br>210V/2.2kVA |         |

## 2.2 Basic Requirements before Power-on of the Machines

- Feeding (power-on) of electrical system of the machine must employ 3-phase, 4-wire (3 phase wires and 1 PE wire) AC power supply. Section of feeder shall not be less than recommended section, the end must be connected pressingly and firmly by cold pressing terminal whose capacity is specified.
- The special-purpose earth bolt set on the bed body of the machine must be connected firmly and reliably with ground wire.
- In order to prevent CNC system from interfering normal working high frequency equipment, some equipments, such as welding machine, etc, are not allowed to be connected nearby the machine.

## 2.3 Check before Power-on of the Machines

### First switch-on:

- It is necessary to confirm if the power supply of feeding of the machine conforms with requirements of “section 2.1” and “section 2.2”.
- It is necessary to confirm if protection ground wire is connected with earth bolt, firmly and reliably, specified by the machine. And earthing resistor shall be less than 10 ohms.
- Check whether any of contactors, relays and connectors on the AC board and the DC board is loose or flick off.
- Check whether any of modules, insertion connectors of CNC system is loose or flick off.
- Check whether the breakers on the AC distribution board in the electrical cabinet are all closed.
- Check whether all electrical devices, cables and control pendant are loose, flick away or damaged.
- Check whether the belt cover door is well closed otherwise, the breaker QF0 of the general power supply of the machine cannot be well closed.

## 2.4 Power-on of the Machine

The machine has been provided with feeding conditions after all checking jobs mentioned above are completed and are confirmed no any trouble. Feeding procedures

are as follows:

Switch-on of the breaker general power supply, after the motor for headstock lubricating pump starts, the working lamp lights on.



**It is necessary to confirm the phase sequence of the power supply at the first time feeding, erroneous sequence of the power supply may result in a series of troubles which should not occur, for example, tool post does not index, cooling pump does not pump water. Headstock is not lubricated, hydraulic system has no pressure, etc. , even component(s) may be damaged.**

**Simple method to judge the phase order:**

Observe whether in the oil window on the front of headstock lubricating oil flows on. If there is oil flow, it shows the phase order is correct, if there is no oil flow and the lubricating motor runs on normally, it shows the phase order is often not correct in the first time feeding. In this case you should switch off user's switch of power supply (Attention: Not the general switch of the machine) Correcting method is to change positions of two phases at the terminal of leading wires of external power supply.

## **2.5 Power-on of CNC System**

Press the NC start key “ NC ON” on the Operator's Panel of the machine, a few seconds later, the screen will be lighting and display concerned positions and command information; All of the indicating lamps on the Operator's Panel of the machine are lighting, five seconds later, the display of tool No. and the display of step position will be alternatively displaying, the indicating lights of the other keys charge to normal displaying, the lubricating pump for lubricating guideways comes into work and starts to timing, power-on of CNC system is completed and the CNC system comes into operational able status. Wherever as long as NC switch-off button “ NC OFF “ is pressed, the system is immediately switched off.

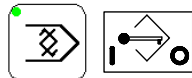
### 3 OPERATION OF THE MACHINES


#### 3.1 Selection of Operation Mode



Five keys shown in above figure are selection keys of operation mode and they are used to select five operation modes of the machine, in any case, only one mode can be selected, the indicating lamp whose operation mode is selected lights on. Only one indicating lamp lights on in any case, others are not normal status.

##### 3.1.1 Edit Mode



This mode is an operation mode to input, modify, cancel, inquiry and call turning program of workpiece. Open the switch  of program protection before inputting, modification, cancel of work turning program. In this mode, work program does not run.



For the operating procedures in detail of edit mode, refer to the 《BEIJING FANUC 0i-MATE OPERATION MANUAL》, please. For command codes used for programming, please refer to “sections 1.6、 1.7 and 1.8” of this Instruction Book.

##### 3.1.2 Manual Data Input (MDI) Mode



Under this mode, entry the paragraph of program from the keys board of CNC system, then, pressing the cycle start key to execute it. In general case, this mode is used to execute simple measuring operation.

Operating steps of MDI are as follows:

- ① Press  key, with indicating lamp lighting, and coming into MDI operation mode.
- ② Press 《 PRGRM 》 key on the CNC key board.
- ③ Press 《 PAGE 》 displaying page with MDI on the left upper on screen.
- ④ Press the 《 INRUT 》 keys through word character keyboard of CNC, displaying input command words on the right half part of screen.
- ⑤ Press the Cycle Start key  after all command words are input, the indicating lamp of this key will light on. Programs come into executing status. The indicating lamp goes out after the programs are completely executed, program commands are canceled with them.
- ⑥ It is necessary to reentry the commands in the same if they need to be executed again. Only one program segment block can be executed one time.
- ⑦ During executing, it is necessary first to execute operation of turning reference point if there is displacement command.



**It is necessary to modify parameters of the system under this operation mode!!**

### 3.1.3 Auto Operation Mode



Auto. operation mode is a mode which controls the machine to perform continuous and automatic turning according to commands of programs.



This operation mode is also referred as stored program operation mode because the programs executed by automatic operation (that is, work programs) are stored in the storage of CNC system before cycle start.

It is necessary to measure compensation value of each tool accurately by help of correct correcting tool method before starting automatic operation cycle, and then, set the measured compensation value in tool compensation unit which is specified by program.

It is necessary to move the turret exactly to the start position specified by work program before starting automatic operation cycle.

If returning reference point operation is correctly executed before starting automatic operation cycle (the lamp for reference point is not flashing), it is recommended that operator record the machine coordinate at turning start point, this is very useful to deal with possible emergency of sudden dump, tool insert damaged and rapidly back to turning.

Basic operating precedures of automatic operation are as follows:


- ① Press  key to select operation mode
- ② Select program to be executed
- ③ Press the Cycle Start key , with the indicating lamp of this key lighting on, automatic turning cycle starts.
- ④ After programs are executed to complete, the indicating lamp of cycle start key goes out, turning cycle ends, programs return to the beginning to prepare next execution.

If there is alarm information display of “PS000” on screen during operation, it shows there is any mistake in the programs or set data. Refer to the 《BEIJING FANUC 0i-MATE OPERATION MANUAL》 please.


Automatic running of programs may stop under following cases:

- ① Executing command M02 and M30 (normal stop) ;
- ② Reset key on the CNC keys board is pressed; Emergency stop button has been pressed.
- ③ Wrong alarm of program.
- ④ Servo alarms.



Automatic running of programs may dwell under following cases:

- ① Feed Dwell key  has been pressed, the indicating lamp of the feed dwell key lights on. In this time, as long as the Cycle Start key is pressed, program recovers to automatic running.


- ② Operation mode is out of automatic operation mode.

In this case, the machine returns to automatic operation mode as soon as press the key of automatic operation mode, then, press the Cycle Start key  , program recovers to automatic running immediately.

Program executed command M00;


- ① Press the Cycle Start key  , program recovers to automatic running immediately.
- ② Program executed command M01(Selection stop button of program is under ON status)
- ③ Press the Cycle Start key  , program recovers to automatic running immediately.

Single block switch has been switched on.

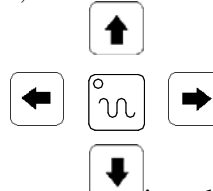
Press the Cycle Start key  , program runs continuously, but, it is necessary to press the Cycle Start key once after one block is executed as long as single switch is not switched off.





### 3.1.4 Manual Operation Mode





Press  key, the indicating lamp of this key lights on, the machine and comes into manual operation mode. Under this operation mode, all the manual operation functions can all be executed.

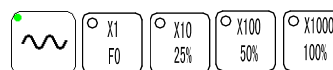
#### 3.1.4.1 Jog and Jog Rate of X-axis and Z-axis




- Pressing  key, the carriage is moving to negative direction of X-axis, releasing the key, the carriage stops moving.
- Pressing  key, the carriage is moving to positive direction of X-axis, releasing the key, the carriage stops moving.
- Pressing  key, the carriage is moving to negative direction of Z-axis, releasing the key, the carriage stops moving.
- Pressing  key, the carriage is moving to positive direction of Z-axis, releasing the key, the carriage stops moving.

Moving rate of feed axis is determined by position of feed override  switch 10% corresponds to the lowest rate of 2mm/min and 150% to the highest rate of 1260mm/min. Please refer to the 《BEIJING FANUC 0i-MATE OPERATION MANUAL》 for details.

 **The feed override switch is not set to the zero position in normal case, otherwise, the feed axis does not move.**



### 3.1.4.2 Rapid Jog and Jog Override

Rapid travel of the carriage can be conducted by pushing Rapid Selection key  together with the jog key of certain direction. Release the Rapid Selection key, the indicating lamp of that key lights off, moving of the feed axis recovers to jog speed.




Rapid moving rate = rapid moving rate set by Prm.1422 × rapid override. Rapid override has four selections: F0, 25%, 50%, 100% .



To use four keys to select them. Any one of them is pressed, its indicating lamp lights on, the other three key's indicating lamps light off. The percentage of the key is current rapid override.

Rapid overrides are also available for program rapid commands (G00, G28 and G30, rapid travel block of canned cycle). And it is valid for rapid travel of manual return reference point, too.

### 3.1.4.3 FWD, REV and Stop of Spindle

- Select changing step and required speed of spindle according to the Changing Step Chart for spindle and by M commands.
- Press the Spindle FWD key , its indicating lamp lights on, having spindle forward.
- Press the Spindle REV key , its indicating lamp lights on, having spindle reverse.
- Press the Spindle Stop key , indicating lamps which indicate spindle forward and reverse light off, spindle stops rotating.
- In the same time when spindle executes to stop rotating, spindle has a braking, the spindle is changing speed by double-speed motor and clutch is forced to make its own rapidly be stopped running through electromagnet breaker attracting on. Braking time is set by parameter T16. User may properly adjust it if necessary. The spindle of changing frequency-regulating speed realizes braking by means of energy consumption of resistor connected outside of converter. The converter determines the braking time.



**No starting Spindle under neutral position!**



**It is necessary to close the protection door well before start of spindle!**




**It is strictly forbidden to open the protection door while the spindle is running.**



**Do not start spindle at high speed in case of workpiece is not clamped for the machine equipped with non-hydraulic chuck!**


## 3.1.4.4 ON/OFF of Coolant



- Press the “ON/OFF of coolant” key  , its indicating lamp lights on, the cooling pump is working. Open the cock of coolant, coolant is gushing. If press it again, the lamp is off, the cooling pump is off and coolant stops gushing.
- Under Auto. Mode or MDI mode, if command (M08) of coolant ON is executed, its indicating lamp also lights on. Command(M09)of coolant OFF is executed, or press this key again, its indicating lamp is off, coolant is off.

## 3.1.4.5 Manual Tool Selection



- Pressing the Manual Tool Section key  , turret is automatically releasing, then, it is counterclockwise indexing and searching required tool station. After the Tool Selection key is released, the turret counter leans against the seat automatically, then, it is locked on the target position.
- Lightly to press the Tool Selection key can realize pressing one time to select one tool station.





**Non-enough of delay of tool post locking can affect locking rigidity of tool post, but ov but too long delay of tool post locking can make the tool post motor overheat and resulting in damage. Delay time of tool post locking is set by parameter T7. And the parameter had been well set before delivery, it should not be changed as own will. If you find that locking of tool post is not enough and affecting machining accuracy, properly increasing time setting value is allowed. Pay attention to temperature of tool post motor when increasing the Value. Record the time data in the Parameter Table after adjustment.**

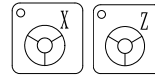
■ Manual correcting tool method

- ① Select a reference tool (for example, Tool 1#)
- ② Move the tool 1# to near workpiece to turn the endface of workpiece, then, move the tool away from the workpiece along x-axis direction. Reset the position coordinate W.
- ③ Turn external cylinder of workpiece manually, then, move the tool away from the workpiece along Z-axis direction. Reset the position coordinate U.
- ④ Move the turret to safe area to change the second tool.
- ⑤ Make the second tool tip touch lightly with endface of workpiece, press the Z key, then, press the (WR) key.
- ⑥ Make the second tool tip touch lightly with O.D of workpiece, press the X key, then, press the INPUT key. Up till now, tool compensation of the second tool is automatically input into 2# unit.
- ⑦ Repeat ④-⑥ steps to complete tool compensation input of all tools.









### 3.1.5 Feed Mode of Manual Pulse Generator

Press  or  key, its indicating lamp lights on, the machine is under feed mode of handwheel pulse generator. Operator can turn the handwheel of handwheel pulse generator to make turret moving of all sides (forwards, backwards, left and right). Its speed can be adjusted as will. It is very available for correcting tool operation in short distance, etc.





Operating procedures are as follows:

- ① Select the handwheel Pulse Override keys .    
- ② Handwheel pulse overrides have three: 0.001/0.01/0.1mm. You can select any kind of them according to rapid, slow, finishing and rough. The indicating lamp of selected override lights on, thus, equivalent value per scale on the handwheel can be determined.
- ③ Selection of manual feed axis:  
Turn the switch  to the position X , with x-axis selected; Turn the switch  to the position Z, with z-axis selected.
- ④ Turn the hand wheel clockwise or counter-clockwise.

- Manual feed mode can execute manual operations, such as spindle changing speed, manual spindle start and stop, manual coolant ON and OFF, manual tool selection, etc.

### 3.2 Cycle Start and Feed Hold




- Cycle start key  Starting program operation can be performed under either Auto. mode or MDI mode. During program being performed, the indicating lamp on the left-upper corner of the key lights on.
- Feed hold key  During program being performed under Auto. mode or MDI mode, press the key, having the indicating lamp on the left-upper corner of the key lights on. Program being performed is held. Repress the feed hold key; its indicating lamp is off. The program is continuously performed.

### 3.3 Trial-running (Dry Running)



Trial- running is also referred as dry run, it is a operation which is to test, check the newly input programs of turning workpiece under non-turning condition. In order to short debugging time, feed rate is forced to max. value by the system during trial - running.

Operating procedures are as follows:


- ① Select Auto. mode to call out program to be tested.
- ② Press the Trial-running key  , in this time, its indicating lamp lights on, showing that trial-running status is valid.

- ③ Press the Cycle Start key, its indicating lamp lights on, trial - running operation begins.
- ④ Feed override is controlled by rapid feed override button, when the system is dryrunning

| STATUS OF RAPID FEED BUTTON | FEED SPEED IN VARIOUS ORDER |                      |
|-----------------------------|-----------------------------|----------------------|
|                             | RAPID ORDER G00             | FEED ORDER G01 ETC.  |
| ON                          | SPEED OF RAPID FEED         | MAX SPEED OF FEED    |
| OFF                         | SPEED OF RAPID FEED         | MANUAL SPEED OF FEED |

### 3.4 Lock Operation of the Machine




- Press  key, its indicating lamp lights on, showing lock of the machine is valid. Press it again, having the indicating light off, showing lock status of the machine is released.
- Under locking status of the machine, moving operation (jog, handwheel feed) of each axis under manual mode can only change displayed values of position and not move every axis of the machine, but, spindle, coolant and turret work normally.

Under locking status of the machine, the programs under Auto. and MDI are normally running, position display values are changing, but every axis of the machine doesn't move, and spindle, coolant and turret work normally.


### 3.5 Operation of Optional Skip of Block



- Press  key, its indicating lamp lights on, block skip function is valid. Press it again, its indicating lamp goes out, block skip function invalid.
- Under Auto. mode, during valid period of block skip function, all of blocks which are preceded by symbol “/” (erase character) in front of block number all skip over not to be executed. During invalid period of block function, all of blocks are all executed normally.
- Functional application : Edit some special blocks, such as trial-turning, measurement and correcting tool in program. Precede block numbers with symbol “/” .To use this kind of block skip function can control the machine to execute these blocks by selection.

### 3.6 Operation of Single Block



- Press  key in Auto. mode, its indicating lamp lights on, single block function is valid. Press it again, the indicating lamp goes out, single block function is canceled. The Single Block Function key is allowed to be switched


over while program is continuously running.

- During valid period of single block in Auto. mode, the Cycle Start key is pressed every time, executing one block, it is pressed again, executing next block.
- Functional application: It is mainly used to measure program, and it also combined with trial-run, lock of the machine and block skip functions can be used with together according to practical conditions.

### 3.7 Limitation and Release of Over travel of the Machine

#### 3.7.1 Limitation of Store Travel (Soft limitation):

During operation, the carriage of the machine may move out of safe area set by Prm.1320, 1321 in some direction due to some reasons (operation fault, programming data error, etc.), CNC system alarms and stops moving of carriage. Move the carriage out of forbidden area in opposite direction, then, you can do normal operation.

 **After the coordinate system of the machine is established when manual reference point is executed after power-on of the machine, only can soft limitation function be valid.**

#### 3.7.2 Limitation of Store Travel (Hard limitation):

The machine is equipped hard limitation switches on negative and positive direction of X-axis and Z-axis. The position of switchblock is up to operator. During operation, the turret of the machine may move in some direction due to some reasons (operation fault, programming data error, etc.) to press the Hard limitation switch. CNC system is into emergency status alarms and stops moving of turret. Move the turret out of forbidden area in opposite direction, then, you can do normal operation.

 **The Hard limitation switch is very important safety device. User should check up regular for avoiding dangerous**

### 3.8 E-stop Operation

- A red mushroom emergency stop button is on the right- upper corner on the Operator's panel. If emergency case occurs, all actions of the machine stop immediately as soon as the emergency stop button is pressed and the button is self-locked automatically. To turn the button to a certain angle clockwise can make it be recovered after emergency-shooting or trouble-shooting.
- After the emergency stop button is pressed, spindle may run for 3-5 seconds due to inertia. The turret can also rotate a little.

### 3.9 Operation of Lubricating Guideways




The machine has automatic intermittent lubricating function of guideways.

The machine comes automatically into travel lubricating state of guideways after power-on. The travel lubricating controls “stop” and “start” (ON and OFF) of the lubricating pump of guideways through calculating the moved distance of the servo axis. Start time (Filling oil time) is set by T21 (ms), and upper limit of travel is set by D153 (cm). Operator may adjust them by himself according to practical requirement.


If you keep pressing the button for lubricating the guideways, the lubricating pump will be continuously working.

## 4 OPERATION OF HYDRAULIC SYSTEM , PNEUMATIC AND HYDRAULIC CHUCK AS WELL AS HYDRAULIC TAILSTOCK

### 4.1 Start of Hydraulic System


- ① Press the auto. air-switch “QF5” on in the electrical cabinet.
- ② Press the button of Hydraulic Start/Stop  with its indicating lamp lighting, the hydraulic pump will be starting. Press it again; the indicating lamp goes out, hydraulic pump will stop. After there is emergency stop operation, the hydraulic pump stops. Hydraulic pump should be restarted.
- ③ Adjust the pressure of hydraulic system and the pressure relay to the pressure required by chucking workpiece.

### 4.2 Operation of Hydraulic Chuck

- Using  can all complete chucking and unclamping of chuck. Also using the foot-pedal switch of hydraulic chuck complete chucking and unclamping of chuck. Press the key or step the foot-pedal switch one time, chuck is chucking, the key's indicating lamp lights on. Repress the key or step the pedal switch again, chuck is unclamping, the key's indicating lamp goes out.
- Chucking of hydraulic chuck is indicated by pressure relay, user according practical condition, also to select travel switch to indicate it, may adjust chucking force.

In order to avoid accidents, to operate the chuck is not allowed when the spindle is under running status. It is necessary to make spindle's speed retarding to zero, and you can be allowed to operate the hydraulic chuck.

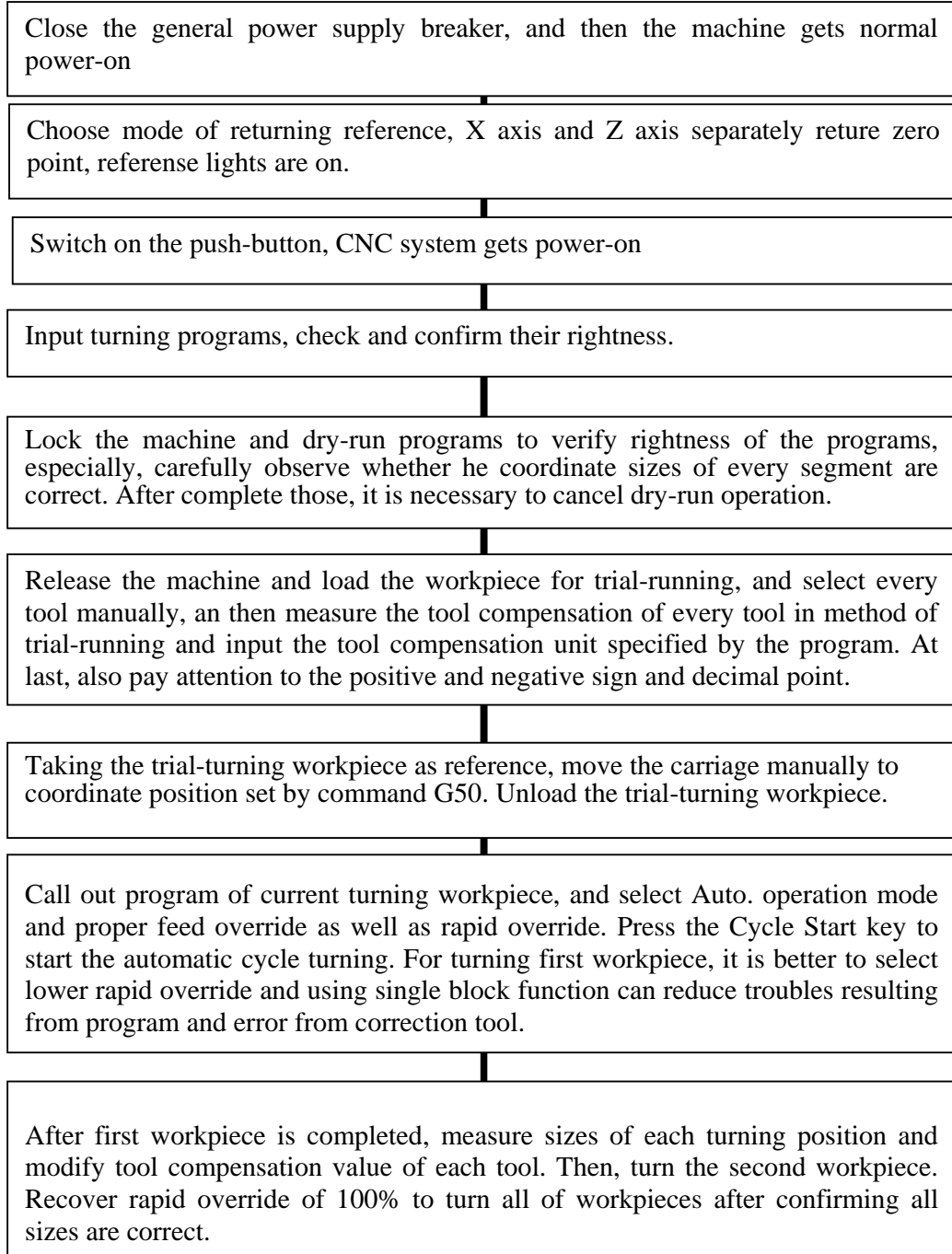
### 4.3 Operation of Hydraulic Tailstock

Using the key  can complete advancing and withdrawing of the hydraulic tailstock's quill, also using the foot-pedal switch SQ50 to complete action of the tailstock quill. Press the key (or step the foot-pedal switch) once, the quill of tailstock is advancing with the indicating lamp lighting; and press it (or step it) again, the quill is withdrawing, the indicating lamp goes out. The lowest tightening up pressure of advancing of the hydraulic tailstock quill is indicated by the pressure relay. The tightening up pressure may be adjusted by user according to the practical situation, also to select travel switch to indicate it.

In order to avoid accidents, to operate the tailstock is not allowed when the spindle is under running status. It is necessary to make spindle's speed retarding to zero, you can be allowed to operate the hydraulic tailstock.

## 5 OPERATING FLOW DIAGRAM AND USER'S PARAMETERS

### 5.1 Operating Flow Diagram



**5.2 Table of User's Parameters**

| <b>Prm.No.</b> | <b>Meaning of Prm.</b>                 | <b>Prm. Value</b> | <b>Remarks</b>   |
|----------------|--|-------------------|--|
| 1420           | x/z-axis rapid speed                   |                   |  |
| 1851           | Clearance compensation of x/z-axis     | -9999—+9999       | This Prm. should be adjusted after the machine is used for a certain period. |
| 1240           | Coordinate of x/z axis reference point |                   |  |
| 5132           | G71/G72 Deep turning                   | 1-9999999M        |  |
| 5133           | G71/G72 Relief                         | 1-9999999M        |  |
| 5135           | G73 X-axis relief                      | 1-9999999M        |  |
| 5136           | G73 Z-axis relief                      | 1-9999999M        |  |
| 5137           | G73 Fragmenting digit                  |                   |  |
| 5139           | G74/75 Return amount                   | 1-9999999M        |  |
| 5140           | G76 Minimum turning depth              |                   |  |
| 5141           | G76 Permissible error for finishing    |                   |  |
| 5142           | G76 Repeat digit                       |                   |  |
| 5143           | G76 Tool tip angle                     | 0/29/30/55/60/90  |  |
| 5013           | Allowing worn limit of tool            |                   |  |
| 5014           | Max. wearing value of tool             |                   |  |

## 6 ELECTRICAL MAINTENANCE AND ADJUSTMENT OF THE MACHINE

When alarm information appears on the display screen, some PLC alarms can be canceled by outer reset key RESET and some must be deleted by the reset key of the system, please do trouble-shooting according to remedy of relative alarm given by 《BEIJING FANUC 0i-MATE OPERATION MANUAL》.

Batteries under dump status protect the parameters and turning programs of CNC system. The screen displays alarm warn when energy of the batteries is not enough, in this case, it is necessary for user to change them immediately under status of power-on of CNC system, otherwise, the parameters and the programs may be lost.

It is necessary for you to read this INSTRUCTION BOOK and 《BEIJING FANUC 0i-MATE OPERATION MANUAL》, carefully and thoroughly before operating the machine to avoid operation failure to result in accidents.

### Appendix: Alarm Information and Remedy Method

| Alarm Code | Displayed Information     | Meaning of Alarm Information                 | Alarm Condition or Cause   | Consequence Resulted from Alarm or Triggered Action | Remedy Method Alarm  |
|------------|---------------------------|--|--|---|--|
| #2005      | MAIN MOTOR OVERHEAT       | Heat-protection of main motor is off         | The built-in overheat protection switch of the main motor is off.              | Intermittent stop, spindle has stopped.             | Shoot the trouble and press the outer reset key RESET.             |
| #2010      | HYDRAULIC NOT RUN         | Hydraulic device is not started.             | Hydraulic device is not started after the machine is started.                  | Restarting the turning programs is forbidden.       |  |
| #2012      | HYDRAULIC CHUCK PRESS LOW | Pressure of the hydraulic chuck is tool low. | Pressure of the hydraulic chuck is too low                                     | Intermittent stop, the spindle has stopped.         |  |
| #2015      | M CODE IS NOT FINISHED    | M code is not finished                       | Execute appointed M code in appointed time, CNC don't receive finished signal. | The program is stop, The CNC system don't respond   |  |
| #2017      | OIL LOW                   | The lever of oil in the grease-box is low.   | The lever of oil in the grease-box is low.                                     | The program is stop.                                | Add lubricant oil into grease-box. Press the outer reset key RESET |



| <b>Alarm Code</b> | <b>Displayed Information</b>            | <b>Meaning of Alarm Information</b>                                       | <b>Alarm Condition or Cause</b>   | <b>Consequence Resulted from Alarm or Triggered Action</b> | <b>Remedy Method Alarm</b>                                    |
|-------------------|---|---|---|--|---|
| #2018             | SIGNAL OF TURRET POSITION IS WRONG.     | Signal of turret position is wrong.                                       | Judge the signal of turret switch is whether the same as turrent position or not. | The program is stop.<br>The system don't respond.          | Shoot the trouble and press the outer reset key RESET.        |
| #2020             | TURRET CODE ERROR                       | Turret code is error  | More than practical tool No. or tool No. 0 has been instructed.                   | The programs have stopped and the system does not response | Shoot the trouble and press the outer reset key RESET.        |
| #2021             | TURRET RUN OVERTIME                     | Rotating o the turret is overtime.  | Time of arriving at the instructed tool station is overtime specified.            |  |   |
| #2023             | TURRET NOT LOCK                         | The turret has not been locked.   | Signal is not sent when back-leaning and locking the turret.                      |  |   |
| #2040             | TRANSDUCE R ALARM                       | The transducer fault  | The transducer fault or the outer fault.  | Starting the spindle is forbidden                          | Shoot the trouble and press the outer reset key RESET.        |
| #2041             | TRY TO RUN SPINDLE WHILE CHUCK NOT LOCK | The spindle is tried to be started while the chuck is not firmly clamped. | The spindle is tried to be started while the chuck is not firmly clamped.         | Starting the spindle is forbidden                          | Tighten up the tailstock and press the outer reset key RESET. |
| #2042             | TRY TO RUN SPINDLE WHILE TAIL NOT LOCK  | The spindle is tried to be started while the chuck is not tightened up.   | The spindle is tried to be started while the chuck is not tightened up.           |  | Shoot the trouble and pres the reset key RESET.               |
| #2053             | SAFETY DOOR BE OPENED                   | The safety door has been opened.  | The safety door has been opened during normal turning.                            | Intermittent stop; the spindle stops.                      | Close the safety door and pres the outer reset key RESET.     |