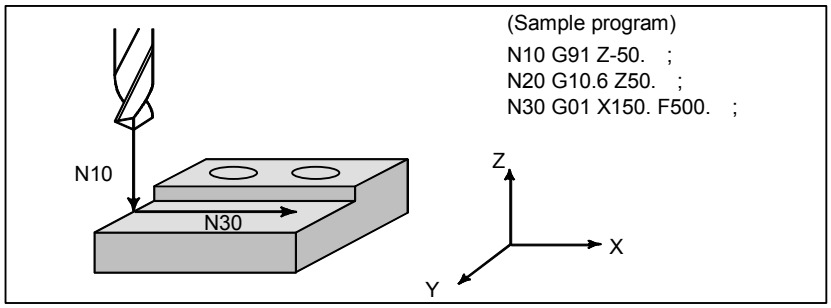
4.8 TOOL RETRACT AND RECOVER

The tool can be retracted from a workpiece to replace the tool, if damaged during machining, or to check the status of machining. Then, the tool can be returned to restart machining efficiently.

Procedure for tool retract and recover

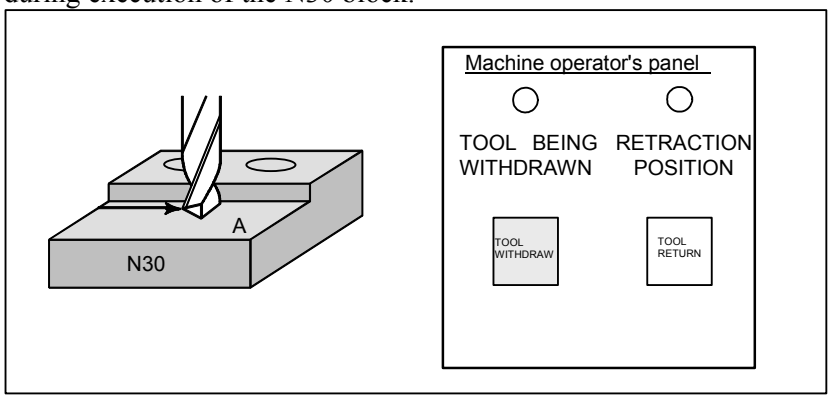
Procedure1 - Programming

Specify a retraction axis and distance in command G10.6IP_ beforehand.In the sample program below, the N20 block specifies that the Z-axis is the retraction axis and the retraction distance is to be 50 mm.

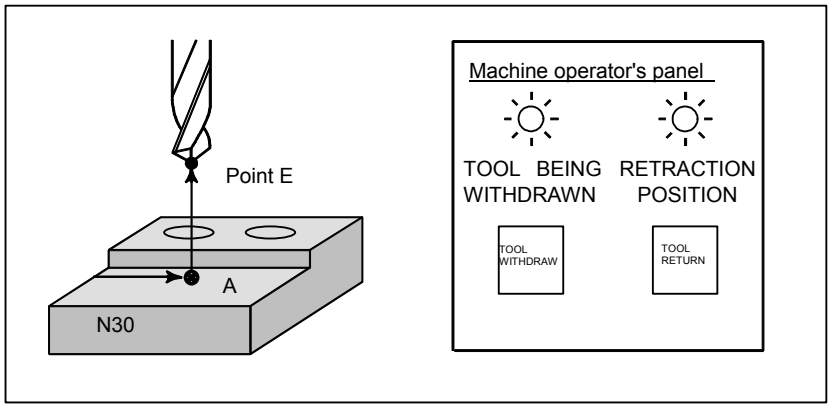


Procedure 2 - Retract

Suppose that the TOOL WITHDRAW switch on the machine operator's panel is turned on when the tool is positioned at point A during execution of the N30 block.



Next, the tool withdrawal mode is set and the TOOL BEING WITHDRAWN LED goes on. At this time, automatic operation is temporarily halted. The tool is then retracted by the programmed distance. If point A is the end point of the block, retraction is performed after automatic operation is stopped. Retraction is based on linear interpolation. The dry run feedrate is used for retraction. Upon completion of retraction, the RETRACT POSITION LED on the operator's panel goes on.

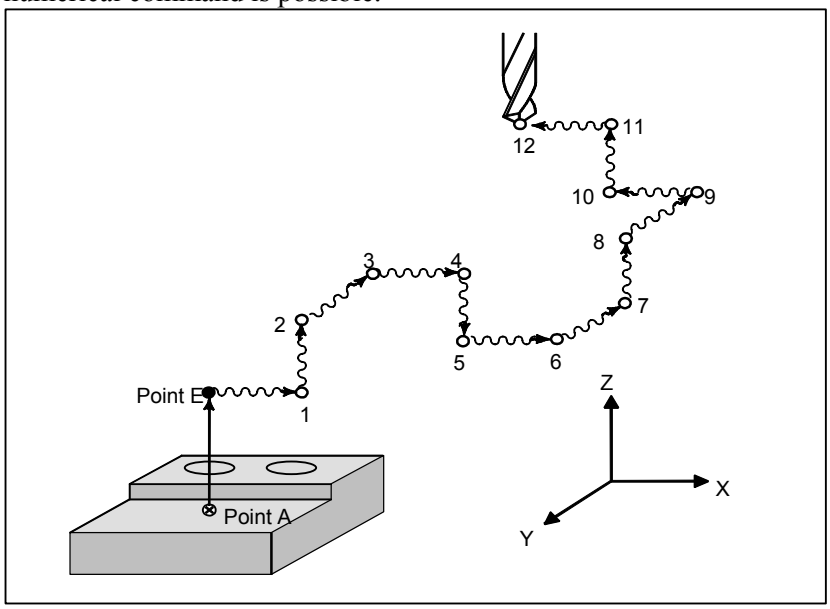


During retraction, the LCD screen displays PTRR and STRT.

- PTRR blinks in the field for indicating states such as the program editing status.
- STRT is displayed in the automatic operation status field.
- MTN is displayed in the field for indicating status such as movement along an axis.

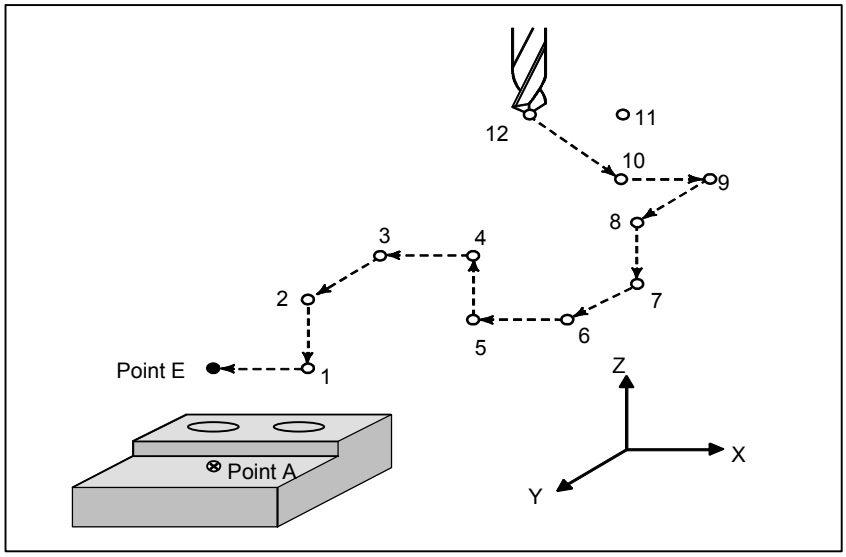
Procedure 3 - Withdrawal

Set the manual operation mode, then withdraw the tool. For manual operation, either jog feed incremental feed, handle feed, or manual numerical command is possible.



Procedure 4 - Return

After withdrawing the tool and any additional operation such as replacing the tool, move the tool back to the previous retraction position. To return the tool to the retraction position, return the mode to automatic operation mode, then turn the TOOL RETURN switch on the operator's panel on then off again. The tool returns to the retraction position at the dry run feedrate, regardless of whether the dry run switch is on or off.
When the tool has returned to the retraction position, the RETRACTION POSITION LED comes on.

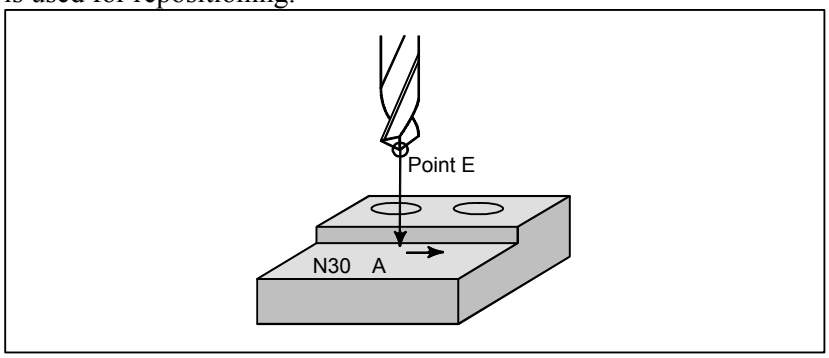


During return operation, the LCD screen displays PTRR and MSTR.

- PTRR blinks in the field for indicating states such as program editing status.
- MSTR is displayed in the automatic operation status field.
- MTN is displayed in the field for indicating states such as movement along an axis.

Procedure 5 - Repositioning

While the tool is at the retraction position (point E in the figure below) and the RETRACTION POSITION LED is on, press the cycle start switch. The tool is then repositioned at the point where retraction was started (i.e. where the TOOL WITHDRAW switch was turned on). Repositioning is based on linear interpolation. The dry run feedrate is used for repositioning.



Upon completion of repositioning, the tool withdraw mode is cancelled, and the TOOL BEING WITHDRAWN LED goes off and restart N30.

Limitation

1 If the origin, presetting, workpiece origin offset value (or external workpiece origin offset value), or workpiece coordinate shift amount (for a lathe system) is changed after the retraction position is specified with G10.6 in the absolute mode, the change is not reflected in the retraction position. After such changes are made or the workpiece origin offset value (or external workpiece origin offset value) or workpiece coordinate shift amount (for a lathe system) is changed, respectively the retraction position with G10.6.

2 When retracting the tool manually in the tool withdrawal mode, do not use the machine lock, mirror-image, or scaling function.

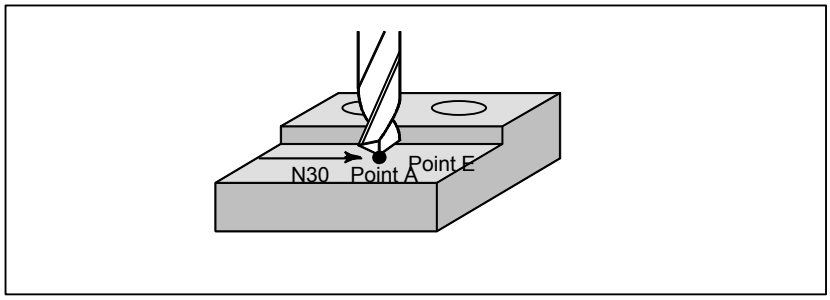
> ⚠ **WARNING**
> The retraction axis and retraction distance specified in G10.6 must be changed in an appropriate block according to the figure being machined. Be very careful when specifying the retraction distance; an incorrect retraction distance may damage the workpiece, machine, or tool.

4.8.1 Retract

Explanation

- When no retraction distance is specified

If no retraction distance or direction required for retraction are specified, retraction is not performed when the TOOL WITHDRAW switch on the operator's panel is turned on. Instead, the block being executed in automatic operation is interrupted (automatic operation is held or stopped). In this state, the tool can be withdrawn and returned.



- Retraction from the automatic operation hold or stop state

When the single block switch is turned on during automatic operation, or the TOOL WITHDRAW switch is turned on after the automatic operation hold or stop state is set by feed hold: Retraction is performed, then the automatic operation hold or stop state is set again.

- Stopping retraction

During retraction, feed hold operation is ignored. However, reset operation is enabled (retraction is stopped at reset). When an alarm is issued during retraction, the retraction is stopped immediately.

- Repositioning immediately after retraction

After retraction is completed, tool repositioning can be started without performing the withdraw and return operations.

4.8.2 Withdrawal

Explanation

- Axis selection

To move the tool along an axis, select the corresponding axis selection signal. Never specify axis selection signals for two or more axes at a time.

- Path memorization

When the tool is moved in manual operation along an axis, the control unit memorizes up to ten paths of movements. If the tool is stopped after being moved along a selected axis and is then moved along another selected axis, the position where this switch takes place is memorized. After ten paths have been memorized, the control unit does not memorize any additional switching points.

- Reset

Upon reset, memorized position data is lost and the tool withdraw mode is cancelled.

NOTE
If an attempt is made to move the tool simultaneously along two axes using the manual numeric command in the tool withdrawal mode, an alarm (PS0015) is issued.

4.8.3 Return

Explanation

- Return path

When there are more than ten return paths, the tool first moves to the tenth position, then to the ninth position, then to the eighth position, and so forth until the retraction position is reached.

- Single block

The single block switch is enabled during return operation. If the single block switch is turned off, continuous return operation is performed. If the single block switch is turned off, the tool stops at each memorized position. In this case, return operation can be resumed by turning the TOOL RETURN switch on then off again.

- Interruption of return operation

When an alarm is issued during return operation, return operation stops.

- Feed hold

The feed hold function is enabled during return operation.

4.8.4 Repositioning

Explanation

- Feed hold

The feed hold function is disabled during repositioning.

- Operation after completion of repositioning

The operation after completion of repositioning depends on the automatic operation state present when the TOOL WITHDRAW switch is turned on.

1 When automatic operation is being started
After completion of repositioning, the interrupted execution of the block is resumed.

2 When automatic operation is held or stopped
After completion of repositioning, the tool stops once at the repositioned point, then the original automatic operation hold or stop state is set. When the cycle start switch is pressed, automatic operation is resumed.

4.8.5 Tool Retract and Return for Threading

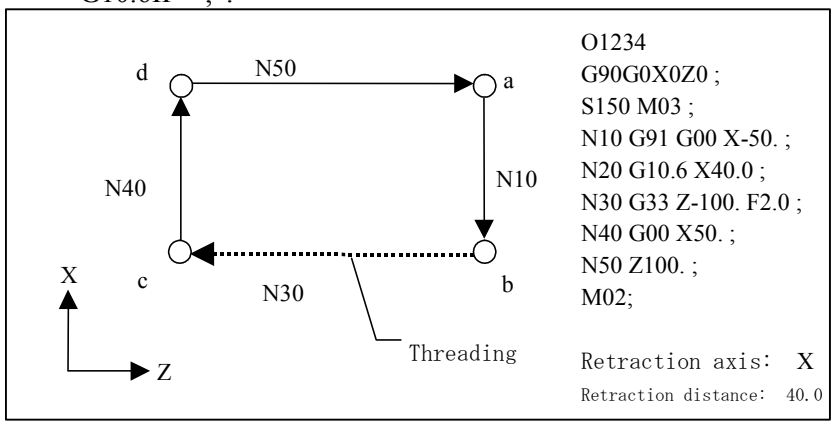
Explanation

- Differences between ordinary tool retract and return and tool retract and return for threading

1 During retraction, chamfering is performed between the specified retraction axis and threading axis.
2 After retraction, one block that does not specify threading is executed and the tool stops.
3 When the major axis for threading is specified as the retraction axis, retraction is not performed by turning the TOOL WITHDRAW switch on. In this case, after a block that does not specify threading is executed, an alarm (PS0429) is issued and the tool stops.
4 As repositioning, the tool is returned to the position specified in the first block that does not specify threading.

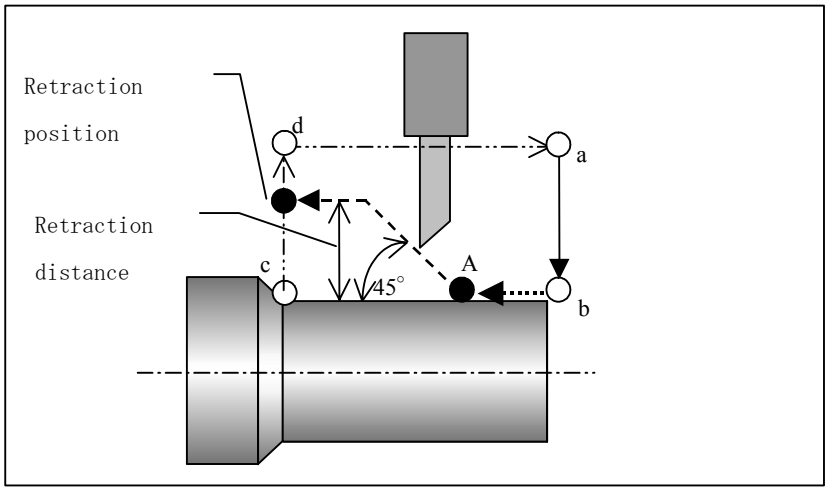
- Operation procedure

1 Specify a retraction axis and retraction distance in command "G10.6IP- -;".



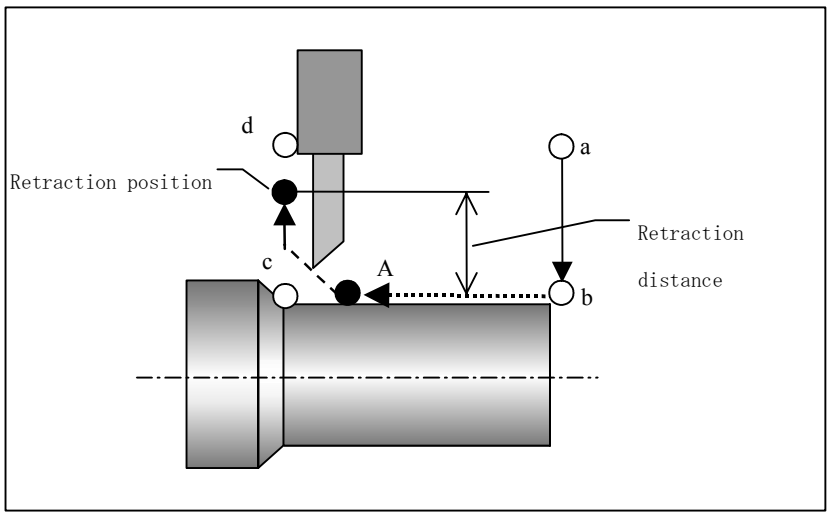
2 Turn the TOOL WITHDRAW switch during the execution of a threading command block.
3 The tool withdrawal mode is set and retraction is performed. Chamfering at 45 degrees is performed between the retraction axis and major axis for threading using the retraction distance as the chamfering amount during retraction.
Details of retraction differ depending on whether the remaining travel distance for the threading command is smaller than the retraction distance when the TOOL WITHDRAW switch is turned on as follows:

(1) When remaining travel distance for threading ≥ retraction distance



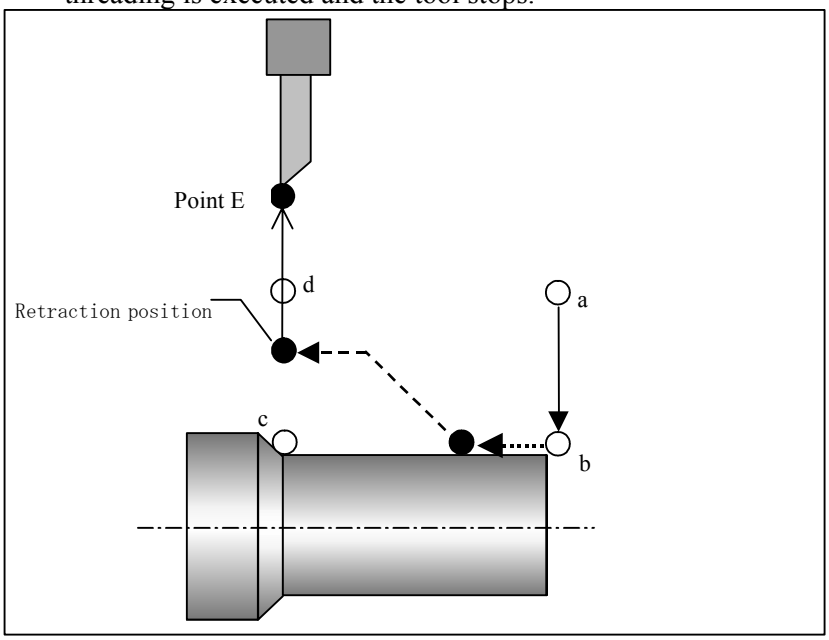
When the position where 45-degree chamfering by the retraction distance ends does not exceed the threading end position (c), the tool moves to the threading end position after the termination of chamfering.

(2) When the remaining travel distance for threading < retraction distance



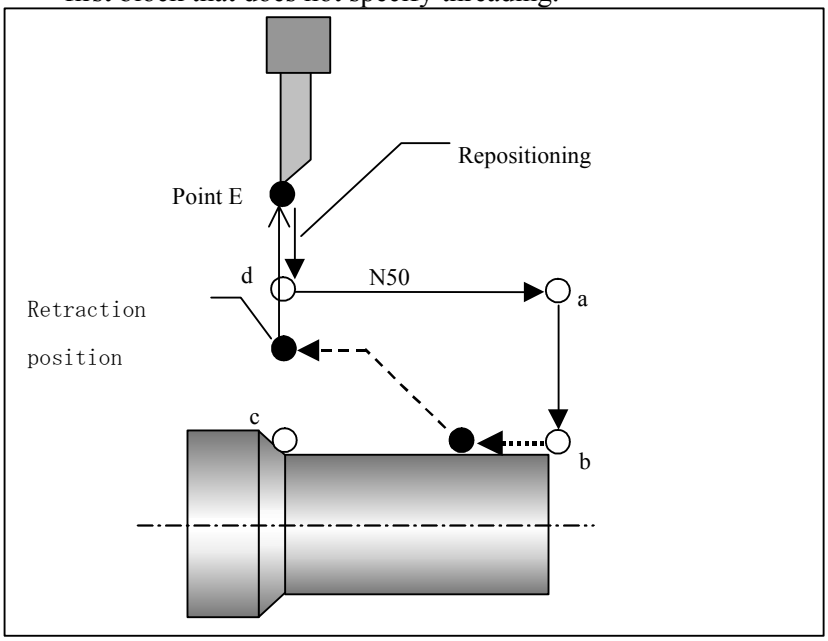
When the position where 45-degree chamfering by the retraction distance ends exceeds the threading end position (c), the tool moves to the retraction position along the retraction axis after it reaches the threading end position.

4 After retraction is completed, the next block that does not specify threading is executed and the tool stops.



In this example, “X50.0” is specified in the first block that does not specify threading in the incremental mode, the tool moves to point E and stops.
If the major axis for threading is specified as the retraction axis, the block that does not specify threading is executed without performing retraction, an alarm (PS0429) is issued, and the tool stops.

5 As repositioning, the tool returns to the position specified in the first block that does not specify threading.



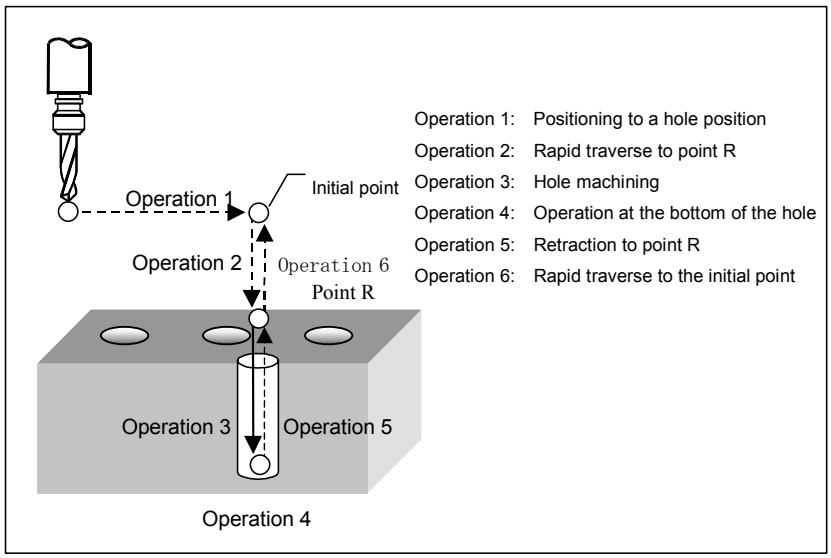
In this example, the repositioning position is point d. Automatic operation after repositioning starts at the N50 block.

4.8.6 Operation Procedure for a Canned Cycle for Drilling

Explanation

- Retract

When the TOOL WITHDRAW switch is turned on during a canned cycle for drilling (abbreviated as a canned cycle below), retraction is performed depending on the cycle operation being executed at that time.



1 During operation 1, the tool moves by the retraction distance specified in G10.6 in the same way as for ordinary retraction.

2 During operation 2, the tool stops operation 2, moves to the initial point, and stops.

3 During operation 3, the tool stops operation 3, executes cycle operations 4, 5, and 6 from that position, and stops at the initial point.

4 During operation 4, 5, or 6, the tool continues the operation and stops at the initial point.
When the TOOL WITHDRAW switch is turned on during operation 2 to 6, the tool does not move according to the retraction specified in G10.6. After the TOOL WITHDRAW switch is turned on and the tool moves to the initial point, however, the tool withdrawal mode is set.
When the second or subsequent canned cycle is being executed and the TOOL WITHDRAW switch is turned on during operation 2 to 6, the retraction position differs depending on G98 (return to initial level) or G99 (return to point R level).
   - G98 (return to initial level): The tool moves to the initial level.
   - G99 (return to point R level):The tool moves to the point R level.

5 During operation 2 to 6, the tool also moves to the initial point and stops when the TOOL WITHDRAW switch is turned on without the G10.6 command specified.

- Repositioning

When the tool is at the retraction position and the cycle start switch is pressed, repositioning is performed for the canned cycle.

1 Repositioning performed when the TOOL WITHDRAW switch is turned on during operation 1
After the completion of repositioning, automatic operation is resumed in the same way as for ordinary repositioning.

2 Repositioning performed when the TOOL WITHDRAW switch is turned on during operation 2
The canned cycle is reexecuted from operation 2.

3 Repositioning performed when the TOOL WITHDRAW switch is turned on during operation 3
The canned cycle is reexecuted from operation 2.

4 Repositioning performed when the TOOL WITHDRAW switch is turned on during operation 4, 5, or 6
The canned cycle is reexecuted for the same hole position from operation 2.