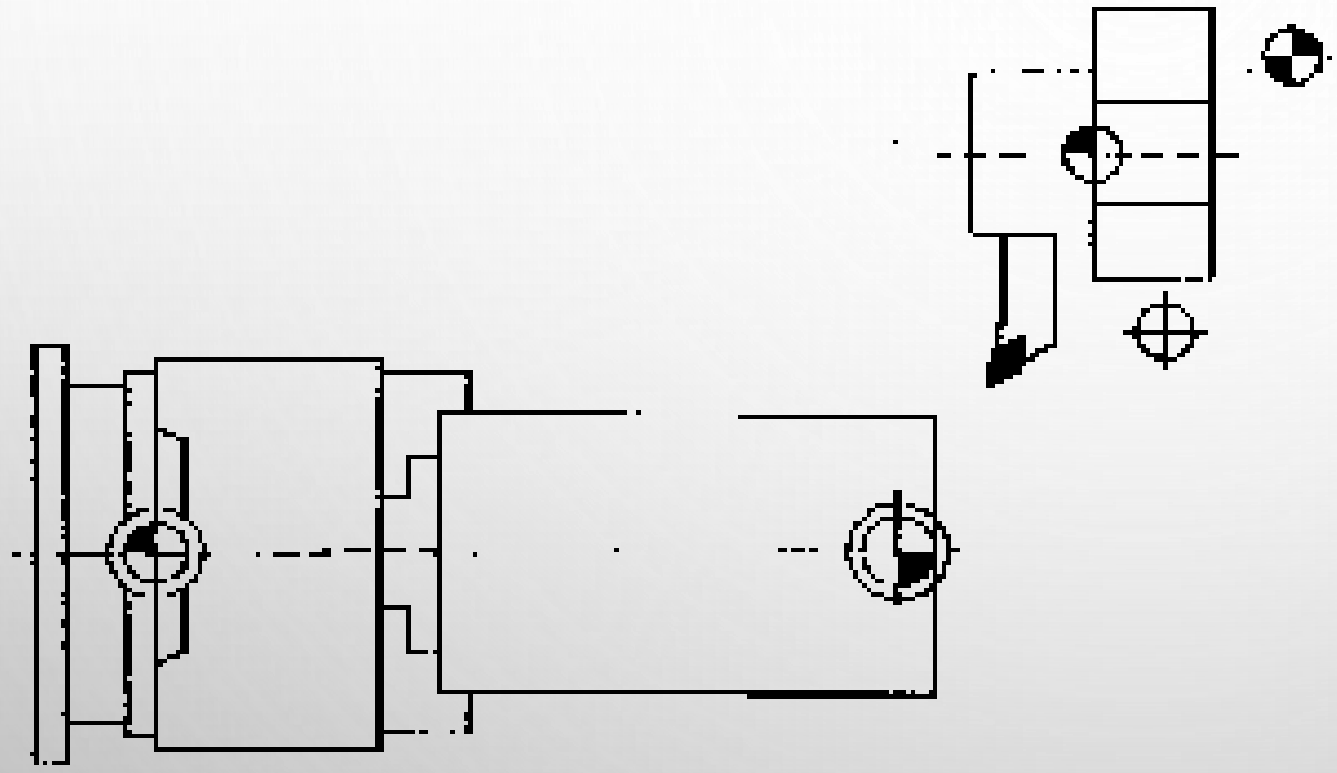
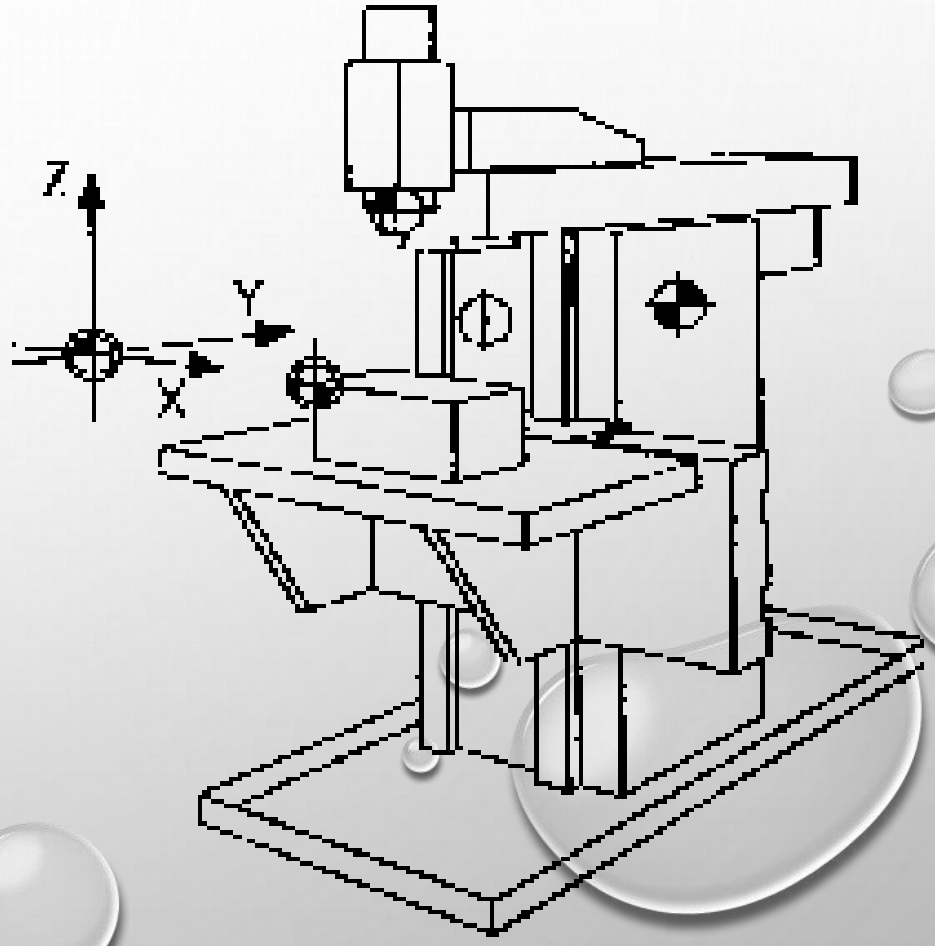
REFERENCE POINTS FOR CNC MACHINES





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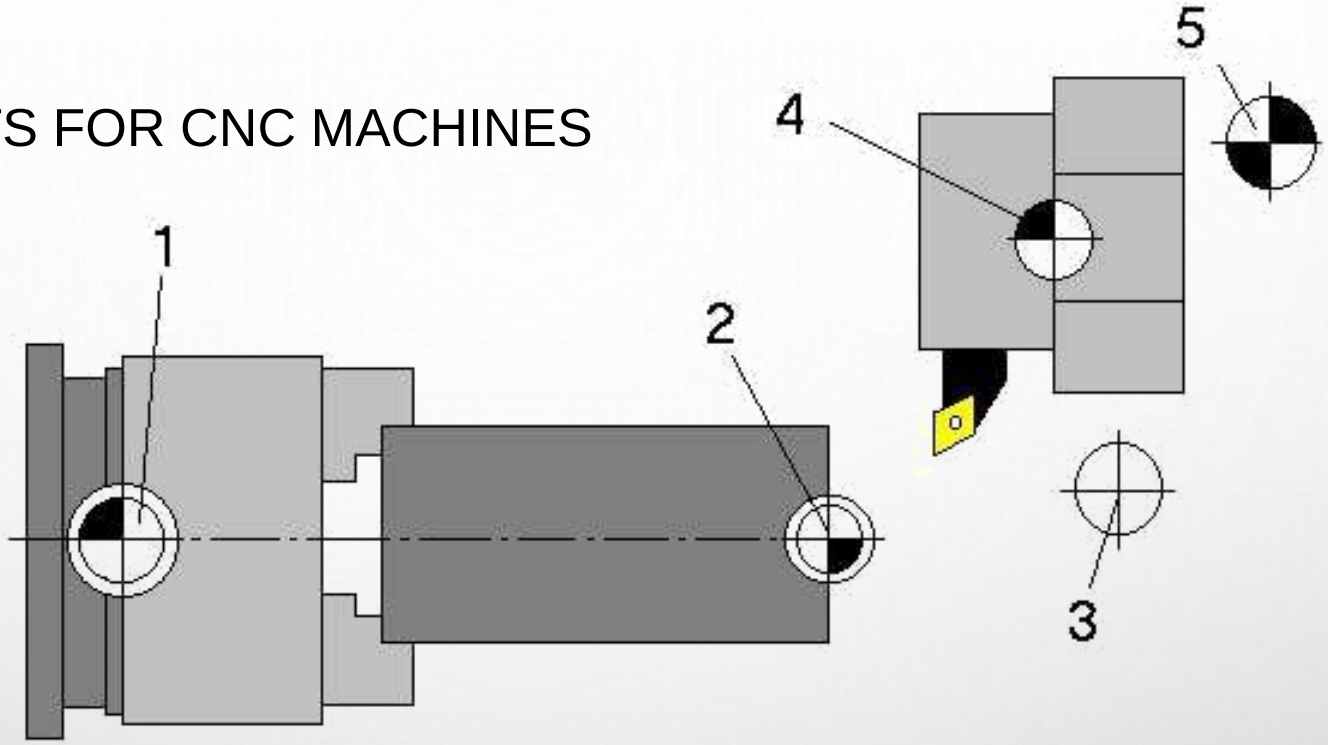


1. MACHINE ZERO POINT (M)
2. WORKPIECE ZERO POINT (W)
3. TOOL CHANGE POINT
4. TOOL REFERENCE POINT (F)
5. REFERENCE POINT (R)

- **MACHINE ZERO POINT, M:** MACHINE ZERO POINT IS THE STARTING POINT (ZERO POINT) OF A MACHINE'S NON-VARIABLE - NON-SHIFTABLE COORDINATE SYSTEM. THIS POINT IS FIXED BY THE MACHINE MANUFACTURER WITH RIDERS AND IS THE STARTING POINT FOR ALL ADDITIONAL COORDINATE SYSTEMS AND REFERENCE POINTS ON THE MACHINE
- **REFERENCE POINT, R:** THE REFERENCE POINT IS CHOSEN BY THE MACHINE TOOL MANUFACTURER AND IS FIXED SO THAT THE TOOL CAN BE SET TO A PRECISELY DEFINED STARTING POSITION (E.G. BEFORE STARTING WORK).
  - THE REFERENCE POINT IS SUITABLE AND USED FOR THE CALIBRATION AND VERIFICATION OF THE MEASURING SYSTEM OF TOOL AND SLIDE MOVEMENT.
  - WITH THE REFERENCE POINT, THE MEASURING SYSTEM IS ORIENTED ONCE, E.G. AFTER SWITCHING ON THE MACHINE, SO THAT ALL POINTS IN THE WORKING AREA OF THE MACHINE ARE CLEARLY ACCESSIBLE.
  - THE REFERENCE POINT IS USUALLY LOCATED AT THE BOUNDARY OF THE WORK COMPARTMENT AND IS AUTOMATICALLY ACCESSIBLE. SETTING THE REFERENCE POINT AFTER SWITCHING ON THE CONTROL DEVICE ALLOWS THE POSITION MEASUREMENT SYSTEM TO BE AUTHENTICATED.
  - THE COORDINATES OF THE REFERENCE POINT IN RELATION TO THE MACHINE ZERO POINT ARE ALWAYS THE SAME, PRECISELY KNOWN NUMERICAL VALUES

- **WORKPIECE ZERO POINT, W:** THE WORKPIECE ZERO POINT IS THE STARTING POINT (ZERO POINT) OF THE WORKPIECE COORDINATE SYSTEM. THIS POINT IS OPTIONAL AND IS FIXED IN RELATION TO THE MACHINE ZERO OR REFERENCE POINT WHEN THE MACHINE IS SET UP OR AT THE START OF THE PROGRAMME.
  - THE ZERO POINT OF THE WORKPIECE SHOULD NOT BE MARKED ARBITRARILY, BUT ALWAYS THINKING ABOUT MAKING PROGRAMMING WORK AS EASY AS POSSIBLE. IF POSSIBLE, TAKE COORDINATES DIRECTLY FROM THE WORKSHOP DRAWING. THE SIZE SPECIFICATION OF THE DRAWING MUST BE TAKEN INTO ACCOUNT
  - IN THE PARTS PROGRAM, COORDINATE VALUES MUST ALWAYS BE ENTERED IN THE WORKPIECE COORDINATE SYSTEM AS IF THE TOOL WERE MOVING.

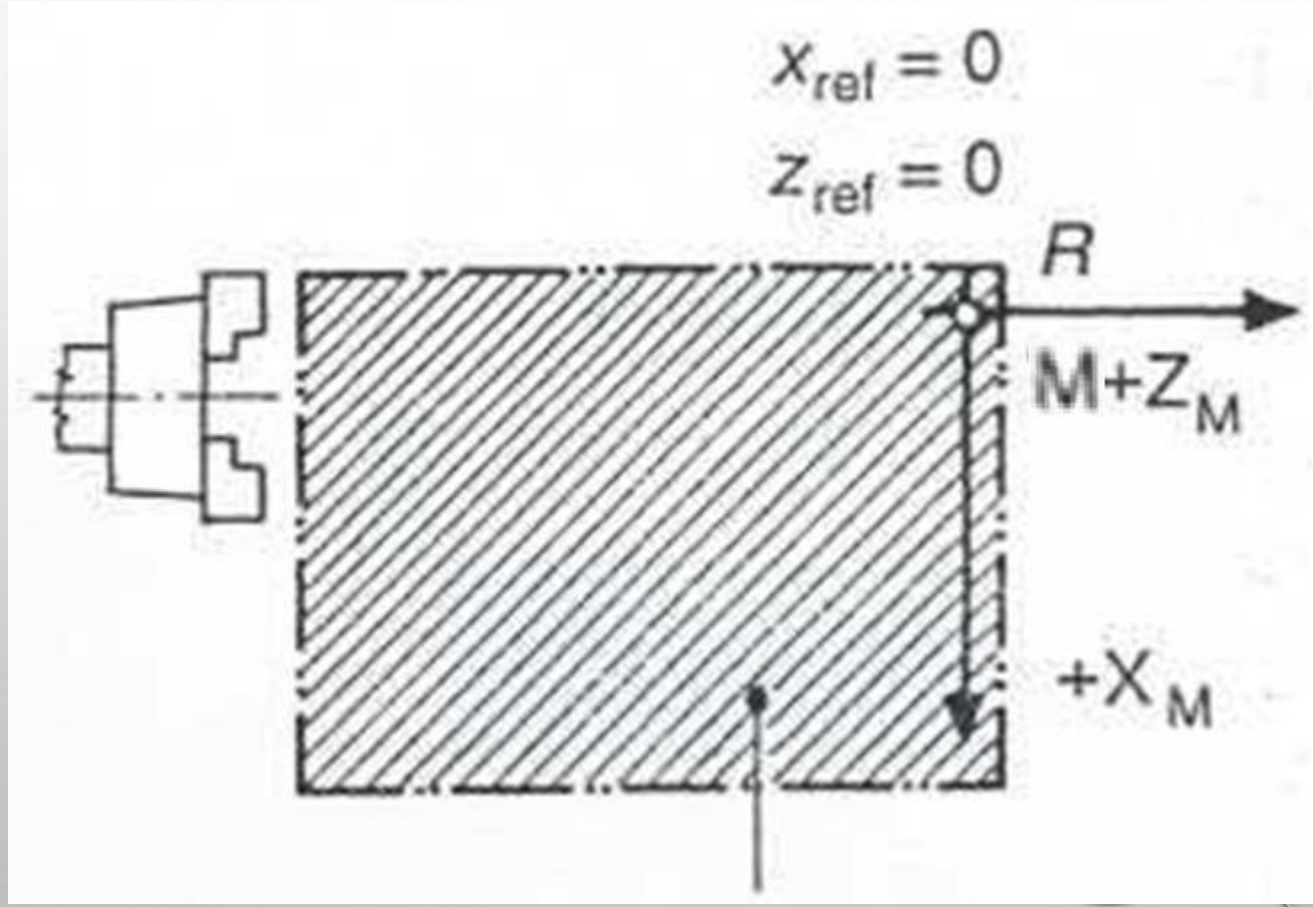
- **TOOL REFERENCE POINT, F:** THE STARTING POINT OF THE TOOL COORDINATE SYSTEM
  - *THE GEOMETRIC DIMENSION OF THE TOOL MUST BE SPECIFIED RELATIVE TO THIS POINT. THESE DIMENSIONS ARE CALLED TOOL CORRECTION DATA.*

- **TOOL CHANGE POINT: OPT**IONAL, SELECTABLE POINT
  - *IT MUST BE LOCATED IN THE WORKING SPACE IN A PLACE WHERE TOOL CHANGES CAN TAKE PLACE SMOOTHLY AND WITHOUT COLLISION WITH THE WORKPIECE OR OTHER ELEMENT.*

MACHINE ZERO POSITION

ON MACHINE TOOLS, BASED ON ITS POSITION IN RELATION TO THE REFERENCE POINT, THE MACHINE ZERO MAY BE:

- **FIXED**: MACHINE ZERO AND REFERENCE POINT COINCIDE, THEIR DISTANCE IS ZERO



MACHINE ZERO POSITION

ON MACHINE TOOLS, BASED ON ITS POSITION IN RELATION TO THE REFERENCE POINT, THE MACHINE ZERO MAY BE:

- **FLOATING**: THE MACHINE ZERO IS WITHIN OR OUTSIDE THE RANGE OF MOTION AND ITS POSITION IN RELATION TO THE REFERENCE POINT IS KNOWN