CNC Lathe Program
Structure Specification

Global Common

SD-1041

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1. SCOPE

1.1. The intent of this document is to provide specifications to Original Equipment Manufacturers (OEM) in their design and implementation of CNC programs for CNC lathes. This document establishes program templates and numbering systems to improve engineer and team member familiarity and understanding of the programs.

1.2. This specification assumes Fanuc control. Machines that utilize a different CNC manufacturer should follow similar guidelines.

1.3. Any deviation to the specification can be approved if the purchasing Manufacturing Engineer approves the deviation.

1.4. The use of the word “shall” indicates requirements and the use of the word “should” indicates recommendations. The use of the word “may” indicates permission or allowance and the use of the word “can” indicates a possibility.

2. PROGRAM STRUCTURE

2.1. CNC programs for lathes for Nexteer Automotive shall be structured in the following manner:

1.) Program Number and Title
2.) Header
3.) Variable List and Description
4.) Offset Linking (If necessary)
5.) Machining Program
6.) Program Completion

2.2. Absolute programming shall be used. Small incremental moves may be used but shall be denoted by U and W.

2.3. Tool nose radius compensation shall not be used.

2.4. Tool description and features machined shall be included at tool call per the following example:

```
T0101 (CNMG 433);
(ROUGH PREROLL DIAMETER);
```

3. MAIN PROGRAM NUMBER

3.1. The main program number should follow a four digit naming convention. It shall start with an 8 and be followed by the last 3 digits of the part number. See below for Subprogram Numbering Conventions.

```
O8742;
```

4. MAIN PROGRAM HEADER

4.1. The header of the main program shall include the following information at a minimum and be structured in the following format.

4.1.1. Complete Part Number, Rev Level, Rev Date, Brief description of program, Incoming blank or part number, person who wrote the most recent version of the program, and the date the last program version was written.

```
O8742;
(PART # 38005742);
(REV 006 20APR16);
(OP 20; FACE, DRILL, AND CHAMFER STEM);
(BLANK #38001033);
(PROGRAMMER NAME);
(PROGRAM DATE: 2AUG16);
```

4.1.2. Additional man readable information may be included after the main header where required or requested.

5. SAFE START

5.1. The program shall automatically start at the beginning of the program regardless of where the cursor is or where it was stopped during the last cycle.

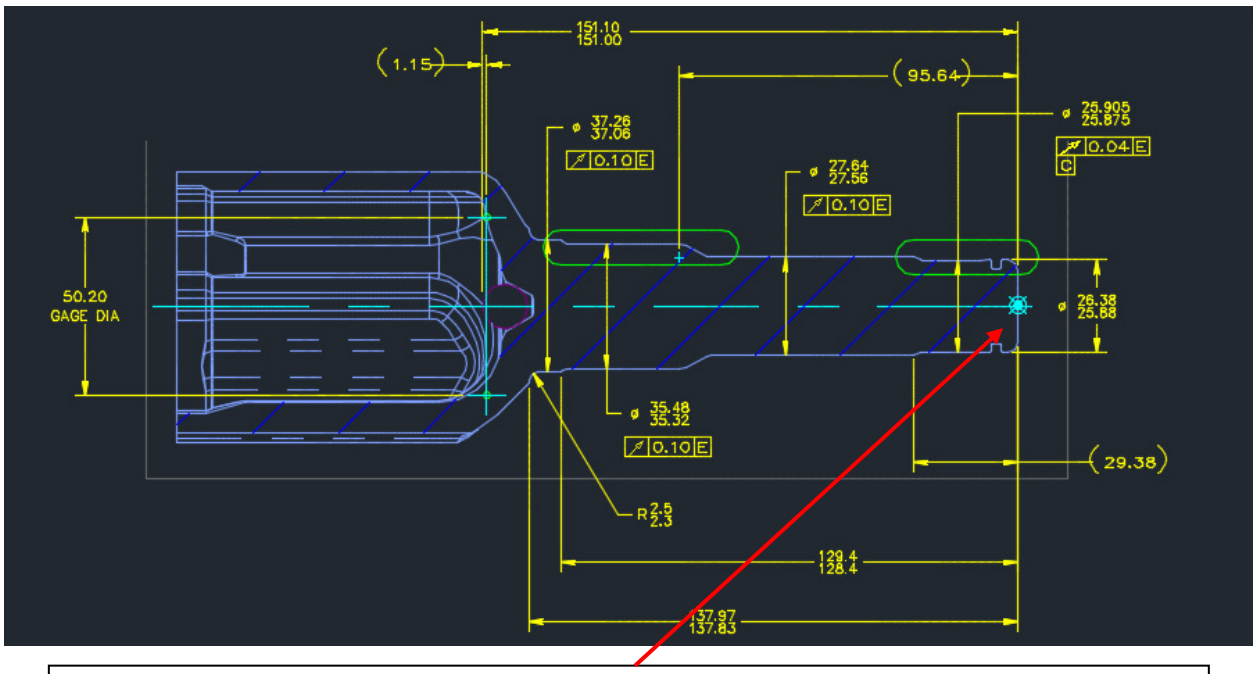
5.2. Provisions made so machine will not cycle start in the middle of a subroutine.

6. UNITS AND SETTING THE WORK COORDINATE SYSTEM

6.1. All programs shall be in metric units.

6.2. Constant surface speed should be used.

6.3. The zero point for the work coordinate system shall be centerline of part for the X axis and should be the finished face of part for the Z-Axis per datum structure on part print. Z coordinates may be negative if needed.



- ***<u>The locating datum in this example is the 50.20mm Gage Diameter. The Z axis zero position is the outer most finished face and the X- axis zero is the part centerline.</u>***

6.4. Machine shall be set-up and programmed in diameter mode.

7. OFFSET LINKING AND CHECKS

7.1. Max incremental wear offset shall be 0.100 mm.

7.2. Max cumulative wear offset shall be 1.0 mm.

7.3. Wear offsets shall be linked so rough to finish depth of cut is maintained. If for some reason offsets are not linked they shall have a measureable diameter and height feature on the finished part.

7.4. Tool offsets should be linked to part datums so that if that feature is shifted, all other related geometry will shift with it.

7.5. Geometry offsets should be locked out from operator adjustment.

8. VARIABLE AND PARAMETRIC PROGRAMMING ORGANIZATION AND DESCRIPTION

8.1. All variables used in the program shall be listed at the beginning of the program under the program header. See following example:

```
O8742;
(PART # 38005742);
(REV 006 20APR16);
(OP 20; FACE, DRILL, AND CHAMFER STEM);
(BLANK #38001033);
(PROGRAMMER NAME);
(PROGRAM DATE: 2AUG16);

(#100: ROUGH PASS COUNTER);
(#101: X CLEAR STARTING POSITION);
(#102: Z CLEAR STARTING POSITION);
```

8.2. All variables and variable mathematics must include a description of what they are being used for.

```
#100 = 1 (INITIALIZE ROUGH PASS COUNTER);
G0 X[#101] Z[#102] (RAPID TO CLEAR STARTING POSITION);
#100 = #100+1 (INCREMENT ROUGH PASS COUNTER);
```

8.3. All conditional branching and loops shall include a description of the process they are controlling

```
IF [#1 EQ 5] GOTO 100 (AFTER 5 ROUGH PASSES GOTO LINE N100);
```

9. M-CODE ORGANIZATION AND DESCRIPTION

9.1. M-Code descriptions shall be included in program for machine specific processes the first time that they are used. See following examples:

M51 (OPEN SUB-CHUCK)
M753 (EJECTOR ADV.)
M754 (EJECTOR RET.)
M69 (PART CATCHER RET.)

10. SUBPROGRAMS

10.1. Numbering convention for subprograms shall be:

6000= All subroutines for non-machining functions; example warm-up program.
7000= All subroutines for machining functions
8000= All main part machining programs.
9000= All subroutines created by the machine manufacturer for machine specific operations.

10.2. All subprograms shall have a header including a description of the program, programmer name, and date of last revision. Additional information may be included but after the header.

```
O7001;
(FACING MACRO PROGRAM);
(PROGRAMMER NAME);
(PROGRAM DATE: 14OCT16);
```

10.3. If using a Macro B subprogram call, description of the variables and routine testing of mandatory arguments shall be included in the subprogram. Below is an example of how this may be done, but does not mean it shall be done in this manner

```
G65 P7001 A135.0 D3.5 H76.3 (CALL FACING MACRO);

IN START OF PROGRAM O7001;

(A IS DATUM A ON PART PRINT)
(D IS AMOUNT OF STOCK TO REMOVE FROM PART FACE);
(H IS PART OD);

IF [#1 EQ #0] GOTO 100 (VERIFY VALUE IN A);
IF[#7 EQ #0] GOTO100 (VERIFY VALUE IN D);
IF[#11 EQ #0] GOTO100 (VERIFY VALUE IN H);
```

```
.
.
.
M99;
N100 #3000 = 150 (DATA MISSING IN MACRO CALL);
```

10.4. Tool change programs shall position the turret in an ergonomically correct position for the operator. Each tool shall have its own tool change subprogram that will position the turret and tool in an ergonomically correct position. After the tool is changed the tool life counter shall automatically reset and wear offsets set back to zero.

10.5. The warm up program shall be its own unique program. The operator or engineer shall not have to make any adjustments to the main program to use it as a warm-up program.

10.6. Tool Management option shall be utilized.

RECORD OF REVISIONS

Revision #	Date	Section	Description
001	31JA17	ALL	Initial Release
002			
003			
004			
005			
006			
007			
008			
009			
010			
011			
012			
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