**APPENDIX A (The input of INFELT-STEP-NC, DXF data file)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| point | X | Y | Z | point | X | Y | Z | vertex | Start Point | End Point | vertex | Start Point | End Point |
| 1 | 0 | 0 | 40 | 34 | 55 | 70 | 20 | 1 | 1 | 2 | 34 | 35 | 24 |
| 2 | 0 | 0 | 0 | 35 | 55 | 70 | 15 | 2 | 1 | 8 | 35 | 17 | 18 |
| 3 | 60 | 0 | 0 | 36 | 35 | 70 | 15 | 3 | 8 | 7 | 36 | 25 | 16 |
| 4 | 60 | 0 | 20 | 37 | 35 | 80 | 15 | 4 | 7 | 6 | 37 | 25 | 26 |
| 5 | 20 | 0 | 20 | 38 | 30 | 70 | 10 | 5 | 6 | 5 | 38 | 14 | 20 |
| 6 | 20 | 0 | 30 | 39 | 30 | 40 | 10 | 6 | 5 | 4 | 39 | 13 | 19 |
| 7 | 10 | 0 | 30 | 40 | 30 | 30 | 10 | 7 | 4 | 3 | 40 | 15 | 16 |
| 8 | 10 | 0 | 40 | 41 | 30 | 10 | 10 | 8 | 3 | 2 | 41 | 16 | 17 |
| 9 | 10 | 20 | 40 | 42 | 0 | 100 | 40 | 9 | 8 | 9 | 42 | 17 | 42 |
| 10 | 10 | 20 | 35 | 43 | 0 | 50 | 40 | 10 | 7 | 19 | 43 | 14 | 15 |
| 11 | 10 | 50 | 35 | 44 | 0 | 20 | 40 | 11 | 6 | 20 | 44 | 12 | 52 |
| 12 | 10 | 50 | 40 | 45 | 0 | 20 | 35 | 12 | 5 | 46 | 45 | 11 | 53 |
| 13 | 10 | 70 | 40 | 46 | 0 | 100 | 0 | 13 | 27 | 21 | 46 | 12 | 13 |
| 14 | 20 | 70 | 40 | 47 | 45 | 35 | 10 | 14 | 4 | 21 | 47 | 12 | 11 |
| 15 | 20 | 90 | 40 | 48 | 30 | 35 | 20  | 15 | 3 | 18 | 48 | 42 | 43 |
| 16 | 60 | 90 | 40 | 49 | 42 | 35 | 20 | 16 | 21 | 22 | 49 | 52 | 43 |
| 17 | 60 | 100 | 40 | 50 | 48 | 35 | 20 | 17 | 24 | 23 | 50 | 43 | 46 |
| 18 | 60 | 100 | 0 |  51 | 45  | 35  | 20  | 18 | 28 | 29 | 51 | 45 | 46 |
| 19 | 10 | 70 | 30 |  52 | 5  | 45  | 40  | 19 | 40 | 39 | 52 | 1 | 44 |
| 20 | 20 | 70 | 30 |  53 |  5 | 45  | 35  | 20 | 49 | 50 | 53 | 9 | 10 |
| 21 | 60 | 10 | 20 |  54 | 55  | 70  | 20  | 21 | 50 | 49 | 54 | 45 | 44 |
| 22 | 60 | 10 | 10 |   |   |   |   | 22 | 23 | 38 | 55 | 46 | 53 |
| 23 | 60 | 70 | 10 |   |   |   |   | 23 | 30 | 38 | 56 | 10 | 11 |
| 24 | 60 | 70 | 20 |   |   |   |   | 24 | 31 | 36 | 57 | 27 | 28 |
| 25 | 60 | 90 | 20 |   |   |   |   | 25 | 36 | 35 | 58 | 40 | 41 |
| 26 | 20 | 90 | 20 |   |   |   |   | 26 | 35 | 34 | 59 | 20 | 30 |
| 27 | 30 | 10 | 20 |   |   |   |   | 27 | 24 | 23 | 60 | 22 | 23 |
| 28 | 30 | 30 | 20 |   |   |   |   | 28 | 34 | 25 | 61 | 41 | 22 |
| 29 | 30 | 40 | 20 |   |   |   |   | 29 | 34 | 33 | 62 | 41 | 27 |
| 30 | 30 | 70 | 20 |   |   |   |   | 30 | 31 | 32 | 63 | 2 | 46 |
| 31 | 35 | 70 | 20 |   |   |   |   | 31 | 32 | 33 | 64 | 46 | 18 |
| 32 | 35 | 80 | 20 |   |   |   |   | 32 | 24 | 37 | 65 | 46 | 42 |
| 33 | 55 | 80 | 20 |   |   |   |   | 33 | 36 | 37 |   |   |   |

**APPENDIX B, ISO 10303-AP203**

ISO-10303-21;

HEADER;

FILE\_DESCRIPTION(('CATIA V5 STEP Exchange'),'2;1');

FILE\_NAME('C:\\Users\\Omid\\Desktop\\Part1.stp','2010-09-06T20:23:19+00:00',('none'),('none'),'INFELT STEP Case Study','Industrial Engineering Dep.','none');

FILE\_SCHEMA(('CONFIG\_CONTROL\_DESIGN'));

ENDSEC;

/\* file written by CATIA V5R17 \*/

DATA;

#5=PRODUCT('Part1','','',(#2)) ;

#1=APPLICATION\_CONTEXT('configuration controlled 3D design of mechanical parts and assemblies') ;

#14=PRODUCT\_DEFINITION(' ',' ',#6,#3) ;

#16=SECURITY\_CLASSIFICATION(' ',' ',#15) ;

#15=SECURITY\_CLASSIFICATION\_LEVEL('unclassified') ;

#47=CARTESIAN\_POINT(' ',(0.,0.,0.)) ;

#52=CARTESIAN\_POINT('Axis2P3D Location',(20.,90.,20.)) ;

#57=CARTESIAN\_POINT('Line Origine',(20.,90.,30.)) ;

#61=CARTESIAN\_POINT('Vertex',(20.,90.,20.)) ;

#63=CARTESIAN\_POINT('Vertex',(20.,90.,40.)) ;

#66=CARTESIAN\_POINT('Line Origine',(40.,90.,20.)) ;

#70=CARTESIAN\_POINT('Vertex',(60.,90.,20.)) ;

#73=CARTESIAN\_POINT('Line Origine',(60.,90.,30.)) ;

#77=CARTESIAN\_POINT('Vertex',(60.,90.,40.)) ;

#80=CARTESIAN\_POINT('Line Origine',(40.,90.,40.)) ;

#92=CARTESIAN\_POINT('Axis2P3D Location',(10.,70.,30.)) ;

.....(TRUNCATED)

#965=CARTESIAN\_POINT('Limit',(50.,70.,40.)) ;

#966=CARTESIAN\_POINT('Limit',(50.,80.,40.)) ;

#969=CARTESIAN\_POINT('Line Origine',(45.,80.,40.)) ;

#973=CARTESIAN\_POINT('Limit',(50.,80.,40.)) ;

#974=CARTESIAN\_POINT('Limit',(40.,80.,40.)) ;

#977=CARTESIAN\_POINT('Line Origine',(40.,75.,40.)) ;

#981=CARTESIAN\_POINT('Limit',(40.,80.,40.)) ;

#982=CARTESIAN\_POINT('Limit',(40.,70.,40.)) ;

#53=DIRECTION('Axis2P3D Direction',(0.,-1.,0.)) ;

(TRUNCATED)

#954=DIRECTION('Vector Direction',(1.,0.,0.)) ;

#962=DIRECTION('Vector Direction',(0.,1.,0.)) ;

#970=DIRECTION('Vector Direction',(-1.,0.,0.)) ;

#978=DIRECTION('Vector Direction',(0.,-1.,0.)) ;

#48=AXIS2\_PLACEMENT\_3D(' ',#47,$,$) ;

#55=AXIS2\_PLACEMENT\_3D('Plane Axis2P3D',#52,#53,#54) ;

#95=AXIS2\_PLACEMENT\_3D('Plane Axis2P3D',#92,#93,#94) ;

(TRUNCATED);

#872=AXIS2\_PLACEMENT\_3D('Plane Axis2P3D',#869,#870,#871) ;

#907=AXIS2\_PLACEMENT\_3D('Plane Axis2P3D',#904,#905,#906) ;

#924=AXIS2\_PLACEMENT\_3D('Plane Axis2P3D',#921,#922,#923) ;

#941=AXIS2\_PLACEMENT\_3D('Plane Axis2P3D',#938,#939,#940) ;

#40=PRODUCT\_DEFINITION\_SHAPE(' ',' ',#14) ;

#985=COMPOSITE\_CURVE('Sketch.11',(#960,#968,#976,#984),.U.) ;

#960=COMPOSITE\_CURVE\_SEGMENT(.CONTINUOUS.,.T.,#959) ;

#968=COMPOSITE\_CURVE\_SEGMENT(.CONTINUOUS.,.T.,#967) ;

#976=COMPOSITE\_CURVE\_SEGMENT(.CONTINUOUS.,.T.,#975) ;

#984=COMPOSITE\_CURVE\_SEGMENT(.DISCONTINUOUS.,.T.,#983) ;

#31=APPROVAL\_PERSON\_ORGANIZATION(#25,#21,#19) ;

#25=PERSON\_AND\_ORGANIZATION(#22,#23) ;

#22=PERSON(' ',' ',' ',$,$,$) ;

#23=ORGANIZATION(' ',' ',' ') ;

#21=APPROVAL(#20,' ') ;

#20=APPROVAL\_STATUS('not\_yet\_approved') ;

#19=APPROVAL\_ROLE('APPROVER') ;

#13=DATE\_AND\_TIME(#11,#12) ;

#12=LOCAL\_TIME(23,53,19.,#10) ;

#10=COORDINATED\_UNIVERSAL\_TIME\_OFFSET(0,0,.AHEAD.) ;

#86=ORIENTED\_EDGE('',\*,\*,#65,.F.) ;

#87=ORIENTED\_EDGE('',\*,\*,#72,.T.) ;

#88=ORIENTED\_EDGE('',\*,\*,#79,.T.) ;

#89=ORIENTED\_EDGE('',\*,\*,#84,.F.) ;

#945=ORIENTED\_EDGE('',\*,\*,#838,.T.) ;

#946=ORIENTED\_EDGE('',\*,\*,#892,.T.) ;

#947=ORIENTED\_EDGE('',\*,\*,#930,.F.) ;

#649=FACE\_BOUND('',#642,.T.) ;

#670=FACE\_BOUND('',#667,.T.) ;

#711=FACE\_BOUND('',#704,.T.) ;

(TRUNCATED)

#51=CLOSED\_SHELL('Closed Shell',(#91,#131,#162,#193,#249,#289,#350,#376,#407,#447,#478,#504,#535,#575,#594,#650,#712,#724,#736,#758,#765,#772,#821,#845,#868,#903,#920,#937,#949)) ;

#59=VECTOR('Line Direction',#58,1.) ;

#68=VECTOR('Line Direction',#67,1.) ;

#75=VECTOR('Line Direction',#74,1.) ;

#951=ADVANCED\_BREP\_SHAPE\_REPRESENTATION('NONE',(#950),#46) ;

#49=SHAPE\_REPRESENTATION(' ',(#48),#46) ;

#91=ADVANCED\_FACE('',(#90),#56,.T.) ;

#131=ADVANCED\_FACE('',(#130),#96,.T.) ;

#162=ADVANCED\_FACE('',(#161),#136,.T.) ;

#193=ADVANCED\_FACE('',(#192),#167,.T.) ;

#249=ADVANCED\_FACE('',(#248),#198,.T.) ;

#289=ADVANCED\_FACE('',(#288),#254,.T.) ;

#350=ADVANCED\_FACE('',(#349),#294,.T.) ;

#376=ADVANCED\_FACE('',(#375),#96,.T.) ;

#407=ADVANCED\_FACE('',(#406),#381,.T.) ;

#447=ADVANCED\_FACE('',(#446),#412,.F.) ;

#478=ADVANCED\_FACE('',(#477),#452,.F.) ;

#504=ADVANCED\_FACE('',(#503),#452,.F.) ;

#535=ADVANCED\_FACE('',(#534),#509,.T.) ;

#575=ADVANCED\_FACE('',(#574),#540,.F.) ;

#594=ADVANCED\_FACE('',(#593),#540,.F.) ;

#650=ADVANCED\_FACE('',(#608,#649),#599,.T.) ;

#712=ADVANCED\_FACE('',(#666,#670,#711),#655,.F.) ;

#724=ADVANCED\_FACE('',(#723),#412,.F.) ;

#736=ADVANCED\_FACE('',(#735),#412,.F.) ;

#758=ADVANCED\_FACE('',(#757),#741,.F.) ;

#765=ADVANCED\_FACE('',(#764),#741,.F.) ;

#772=ADVANCED\_FACE('',(#771),#741,.F.) ;

#821=ADVANCED\_FACE('',(#820),#777,.T.) ;

#845=ADVANCED\_FACE('',(#844),#826,.T.) ;

#868=ADVANCED\_FACE('',(#867),#826,.T.) ;

#903=ADVANCED\_FACE('',(#902),#873,.T.) ;

#920=ADVANCED\_FACE('',(#919),#908,.T.) ;

#937=ADVANCED\_FACE('',(#936),#925,.T.) ;

#949=ADVANCED\_FACE('',(#948),#942,.T.) ;

#4=APPLICATION\_PROTOCOL\_DEFINITION('international standard','config\_control\_design',1994,#1) ;

#32=APPROVAL\_DATE\_TIME(#13,#21) ;

#950=MANIFOLD\_SOLID\_BREP('PartBody',#51) ;

#11=CALENDAR\_DATE(2010,6,9) ;

#30=CC\_DESIGN\_APPROVAL(#21,(#16,#6,#14)) ;

#18=CC\_DESIGN\_DATE\_AND\_TIME\_ASSIGNMENT(#13,#17,(#16)) ;

#29=CC\_DESIGN\_DATE\_AND\_TIME\_ASSIGNMENT(#13,#28,(#14)) ;

#17=DATE\_TIME\_ROLE('classification\_date') ;

#28=DATE\_TIME\_ROLE('creation\_date') ;

#27=CC\_DESIGN\_PERSON\_AND\_ORGANIZATION\_ASSIGNMENT(#25,#26,(#16)) ;

#33=CC\_DESIGN\_PERSON\_AND\_ORGANIZATION\_ASSIGNMENT(#25,#34,(#6)) ;

#35=CC\_DESIGN\_PERSON\_AND\_ORGANIZATION\_ASSIGNMENT(#25,#36,(#6,#14)) ;

#37=CC\_DESIGN\_PERSON\_AND\_ORGANIZATION\_ASSIGNMENT(#25,#38,(#5)) ;

ENDSEC;

END-ISO-10303-21;

**APPENDIX C (Feature list, the first output of INFELT-STEP-NC)**

#3 = SLOT('Small Slot',#11,(#107,#118),#12,#14,#17,#20,(#24));

#4 = SLOT('Big Slot',#11,(#121,#122),#25,#27,#30,#33,(#38));

#7 = CLOSED\_POCKET('Closed Pocket',#11,(#133,#135),#70,#72,(),$,#75,$,$,#78);

#8 = ROUND\_HOLE('Top Hole',#11,(#138,#139),#81,#83,#86,$,#87);

#9 = ROUND\_HOLE('Bottom Big Hole',#11,(#168,#148),#88,#90,#93,$,#94);

#10 = ROUND\_HOLE('Bottom Small Hole',#11,(#155,#160),#95,#97,#100,$,#101);

#48 = STEP('Step',#11,(#125,#126),#49,#51,#54,$,());

#57 = OPEN\_POCKET('Open Pocket',#11,(#129,#130),#58,#60,(),$,#63,$,#64,#65,$);

#176 = EDGE\_ROUND('Transition Feature',#11,(),#3,#4,#178,$,$);

**APPENDIX D (AP238 the second output of INFELT-STEP-NC)**

ISO-10303-21;

HEADER;

FILE\_DESCRIPTION(('PART PROGRAM GENERATED BY THE STEPCAM'),'1');

FILE\_NAME('', $, (‘ISO 14649’), (‘’), ‘CSU’, ‘PHATO, ’KOREA');

FILE\_SCHEMA (('MACHINING\_SCHEMA', ‘MILLING\_SCHEMA’,));

ENDSEC;

DATA;

..

#1 = PROJECT('Machining Precedence',#2,(#11,#11),#169,#170,$);

#2 = WORKPLAN('main workplan',(#102,#117,#119,#120,#123,#124,#127,#128,#131,#132,#136,#137,#146,#147,#175, #153,#154),$,#164,$);

#11 = WORKPIECE('Simple Cubic Wokpiece',$,$,$,$,$,());

#12 = AXIS2\_PLACEMENT\_3D('Small Slot',#13,$,$);

#13 = CARTESIAN\_POINT('Small Slot',(10,35,0));

#14 = PLANE('Small Slot Elementary Surface',#15);

#15 = AXIS2\_PLACEMENT\_3D('Small Slot',#16,$,$);

#16 = CARTESIAN\_POINT('Small Slot Depth',(0,0,-5));

#17 = LINEAR\_PATH($,#18,#19);

#18 = TOLERANCED\_LENGTH\_MEASURE(10.,$);

#19 = DIRECTION('Small Slot Direction',(-1,0,0));

#20 = SQUARE\_U\_PROFILE($,#23,$,0.,$,0.);

#23 = TOLERANCED\_LENGTH\_MEASURE(30.,$);

#25 = AXIS2\_PLACEMENT\_3D('Big Slot',#26,$,$);

#26 = CARTESIAN\_POINT('Big Slot',(15,0,0));

#27 = PLANE('Big Slot Elementary Surface',#28);

#28 = AXIS2\_PLACEMENT\_3D('Big Slot',#29,$,$);

#29 = CARTESIAN\_POINT('Big Slot Depth',(0,0,-10));

#30 = LINEAR\_PATH($,#31,#32);

#31 = TOLERANCED\_LENGTH\_MEASURE(70.,$);

#32 = DIRECTION('Big Slot Direction',(0,1,0));

#33 = SQUARE\_U\_PROFILE($,#34,#37,0.,#36,0.);

#34 = TOLERANCED\_LENGTH\_MEASURE(10.,$);

#36 = TOLERANCED\_LENGTH\_MEASURE(0.,$);

#37 = TOLERANCED\_LENGTH\_MEASURE(0.,$);

#38 = FLAT\_SLOT\_END\_TYPE();

#49 = AXIS2\_PLACEMENT\_3D('Step',#50,$,$);

#50 = CARTESIAN\_POINT('Step',(20,0,0));

#51 = PLANE('Step Elementary Surface',#52);

#52 = AXIS2\_PLACEMENT\_3D('Step',#53,$,$);

#53 = CARTESIAN\_POINT('Step',(0,0,-20));

#54 = LINEAR\_PATH($,#55,#56);

#55 = TOLERANCED\_LENGTH\_MEASURE(90.,$);

#56 = DIRECTION('Step',(0,1,0));

#58 = AXIS2\_PLACEMENT\_3D('Open Pocket',#59,$,$);

#59 = CARTESIAN\_POINT('Open Pocket',(45,40,-20));

#61 = AXIS2\_PLACEMENT\_3D('Open Pocket',#62,$,$);

#62 = CARTESIAN\_POINT('Open pocket',(0,0,-10));

#63 = PLANAR\_POCKET\_BOTTOM\_CONDITION();

#64 = TOLERANCED\_LENGTH\_MEASURE(5.,$);

#65 = SQUARE\_U\_PROFILE($,#66,#69,0.,#68,0.);

#66 = TOLERANCED\_LENGTH\_MEASURE(60.,$);

#67 = TOLERANCED\_LENGTH\_MEASURE($,$);

#68 = TOLERANCED\_LENGTH\_MEASURE(5.,$);

#69 = TOLERANCED\_LENGTH\_MEASURE(5.,$);

#70 = AXIS2\_PLACEMENT\_3D('Closed Pocket',#71,$,$);

#71 = CARTESIAN\_POINT('Closed Pocket',(45,75,-20));

#72 = PLANE('Closed Pocket Elementary Surface',#73);

#73 = AXIS2\_PLACEMENT\_3D('Closed Pocket',#74,$,$);

#74 = CARTESIAN\_POINT('Closed Pocket',(0,0,-5));

#75 = PLANAR\_POCKET\_BOTTOM\_CONDITION();

#77 = RECTANGULAR\_CLOSED\_PROFILE($,$,$);

#78 = RECTANGULAR\_CLOSED\_PROFILE($,#79,#80);

#79 = TOLERANCED\_LENGTH\_MEASURE(10.,$);

#80 = TOLERANCED\_LENGTH\_MEASURE(20.,$);

#81 = AXIS2\_PLACEMENT\_3D('Top Hole',#82,$,$);

#82 = CARTESIAN\_POINT('Top Hole',(30,40,-20));

#83 = PLANE('Top Hole Elementary Surface',#84);

#84 = AXIS2\_PLACEMENT\_3D('Top Hole',#85,$,$);

#85 = CARTESIAN\_POINT('Top Hole',(0,0,-20));

#86 = TOLERANCED\_LENGTH\_MEASURE(10.,$);

#87 = THROUGH\_BOTTOM\_CONDITION();

#88 = AXIS2\_PLACEMENT\_3D('Bottom Big Hole',#89,$,$);

#89 = CARTESIAN\_POINT('Bottom Big Hole',(45,40,-30));

#90 = PLANE('Bottom Big Hole Elementary Surface',#91);

#91 = AXIS2\_PLACEMENT\_3D('Bottom Big Hole',#92,$,$);

#92 = CARTESIAN\_POINT('Bottom Big Hole',(0,0,-10));

#93 = TOLERANCED\_LENGTH\_MEASURE(10.,$);

#94 = THROUGH\_BOTTOM\_CONDITION();

#95 = AXIS2\_PLACEMENT\_3D('Bottom Small Hole',#96,$,$);

#96 = CARTESIAN\_POINT('Bottom Small Hole',(45,45,-30));

#97 = PLANE('Bottom Small Hole Elementary Surface',#98);

#98 = AXIS2\_PLACEMENT\_3D('Bottom Small Hole',#99,$,$);

#99 = CARTESIAN\_POINT('Bottom Small Hole',(0,0,-10));

#100 = TOLERANCED\_LENGTH\_MEASURE(5.,$);

#101 = THROUGH\_BOTTOM\_CONDITION();

#102 = MACHINING\_WORKINGSTEP('Roughing Small Slot',#103,#3,#107,$);

#103 = PLANE('Main Sec Plane',#104);

#104 = AXIS2\_PLACEMENT\_3D('sec plane',#105,$,$);

#105 = CARTESIAN\_POINT('Sec Plane',(0,0,20));

#107 = BOTTOM\_AND\_SIDE\_ROUGH\_MILLING($,$,'Roughing Small Slot',$,$,#108,#113,#114,$,$,$,$,$,$,$,$);

#108 = MILLING\_CUTTING\_TOOL('Main Cutter',#109,(),$,$,$);

#109 = BULLNOSE\_ENDMILL(#110,$,$,$,$);

#110 = MILLING\_TOOL\_DIMENSION(10.,$,$,$,$,$,$);

#113 = MILLING\_TECHNOLOGY($,.CCP.,$,$,$,.F.,.F.,.F.,$);

#114 = MILLING\_MACHINE\_FUNCTIONS(.F.,$,$,$,$,(),.F.,$,$,());

#117 = MACHINING\_WORKINGSTEP('Finishing Small Slot',#103,#3,#118,$);

#118 = BOTTOM\_AND\_SIDE\_FINISH\_MILLING($,$,'Finishing Small Slot',$,$,#108,#113,#114,$,$,$,$,$,$,$,$);

#119 = MACHINING\_WORKINGSTEP('Roughing Big Slot',#103,#4,#121,$);

#120 = MACHINING\_WORKINGSTEP('Finishing Big Slot',#103,#4,#122,$);

#121 = BOTTOM\_AND\_SIDE\_ROUGH\_MILLING($,$,'Roughing Big Slot',$,$,#108,#113,#114,$,$,$,$,$,$,$,$);

#122 = BOTTOM\_AND\_SIDE\_FINISH\_MILLING($,$,'Finishing Big Slot',$,$,#108,#113,#114,$,$,$,$,$,$,$,$);

#123 = MACHINING\_WORKINGSTEP('Roughing Step',#103,#48,#125,$);

#124 = MACHINING\_WORKINGSTEP('Finishing Step',#103,#48,#126,$);

#125 = BOTTOM\_AND\_SIDE\_ROUGH\_MILLING($,$,'Roughing Step',$,$,#108,#113,#114,$,$,$,$,$,$,$,$);

#126 = BOTTOM\_AND\_SIDE\_FINISH\_MILLING($,$,'Finishing Step',$,$,$,$,$,$,$,$,$,$,$,$,$);

#127 = MACHINING\_WORKINGSTEP('Roughing Open Pocket',#103,#57,#129,$);

#128 = MACHINING\_WORKINGSTEP('Finishing Open Pocket',#103,#57,#130,$);

#129 = BOTTOM\_AND\_SIDE\_ROUGH\_MILLING($,$,'Roughing Open Pocket',$,$,#108,#113,#114,$,$,$,$,$,$,$,$);

#130 = BOTTOM\_AND\_SIDE\_FINISH\_MILLING($,$,'Finishing Open Pocket',$,$,#108,#113,#114,$,$,$,$,$,$,$,$);

#131 = MACHINING\_WORKINGSTEP('Roughing Closed Pocket',#103,#7,#133,$);

#132 = MACHINING\_WORKINGSTEP('Finishing Closed Pocket',#103,$,#135,$);

#133 = BOTTOM\_AND\_SIDE\_ROUGH\_MILLING($,$,'Roughing Closed Pocket',$,$,#108,#113,#114,$,$,$,$,$,$,$,$);

#135 = BOTTOM\_AND\_SIDE\_FINISH\_MILLING($,$,'Finishing Closed Pocket',$,$,#108,#113,#114,$,$,$,$,$,$,$,$);

#136 = MACHINING\_WORKINGSTEP('Roughing Top Hole',#103,#8,#138,$);

#137 = MACHINING\_WORKINGSTEP('Finishing Top Hole',#103,#8,#139,$);

#138 = DRILLING($,$,'Drilling Top Hole',$,$,#140,#113,#114,$,$,$,$,$,$);

#139 = BORING($,$,'Boring Top Hole',$,$,#143,#113,#114,$,$,$,$,$,$,$,$,$);

#140 = MILLING\_CUTTING\_TOOL('Big Drilling Bit',#141,(),$,$,$);

#141 = CENTER\_DRILL(#142,$,$,$,$);

#142 = MILLING\_TOOL\_DIMENSION(10.,$,$,$,$,$,$);

#143 = MILLING\_CUTTING\_TOOL('Boring Tool',#144,(),$,$,$);

#144 = BORING\_TOOL(#145,$,$,$,$);

#145 = MILLING\_TOOL\_DIMENSION(10.,$,$,$,$,$,$);

#146 = MACHINING\_WORKINGSTEP('Roughing Bottom Big Hole',#103,#9,#168,$);

#147 = MACHINING\_WORKINGSTEP('Finishing Bottom Big Hole',#103,#9,#148,$);

#148 = REAMING($,$,'Reaming Bottom Big Hole',$,$,#150,#113,#114,$,$,$,$,$,$,$,$,$);

#150 = MILLING\_CUTTING\_TOOL('Big Reamer',#151,(),$,$,$);

#151 = REAMER(#152,$,$,$,$);

#152 = MILLING\_TOOL\_DIMENSION(10.,$,$,$,$,$,$);

#153 = MACHINING\_WORKINGSTEP('Roughing Bottom Small Hole',#103,#10,#155,$);

#154 = MACHINING\_WORKINGSTEP('Finishing Bottom Small Hole',#103,#10,#160,$);

#155 = DRILLING($,$,'Drilling Bottom Small Hole',$,$,#157,#113,#114,$,$,$,$,$,$);

#157 = MILLING\_CUTTING\_TOOL('Small Drilling bit',#158,(),$,$,$);

#158 = TWIST\_DRILL(#159,$,$,$,$);

#159 = MILLING\_TOOL\_DIMENSION(5.,$,$,$,$,$,$);

#174 = ADDRESS('The University of Auckland',$,$,$,$,$,$,$,$,$,$,$);

#173 = PERSON('amok007','Mokhtar','Alireza',$,$,$);

#172 = LOCAL\_TIME(4,$,$,$);

#171 = CALENDAR\_DATE(2008,20,7);

#170 = DATE\_AND\_TIME(#171,#172);

#169 = PERSON\_AND\_ADDRESS(#173,#174);

#168 = DRILLING($,$,'Drilling Bottom Big Hole',$,$,#140,#113,#114,$,$,$,$,$,$);

#167 = CARTESIAN\_POINT('setup',(0,0,0));

#166 = AXIS2\_PLACEMENT\_3D('Setup axisplacement',#167,$,$);

#165 = WORKPIECE\_SETUP(#11,#166,$,$,());

#164 = SETUP('main setup',$,#103,(#165));

#160 = REAMING($,$,'Reaming Bottom Small Hole',$,$,#161,#113,#114,$,$,$,$,$,$,$,$,$);

#161 = MILLING\_CUTTING\_TOOL('Small Reamer',#162,(),$,$,$);

#162 = REAMER(#163,$,$,$,$);

#163 = MILLING\_TOOL\_DIMENSION(5.,$,$,$,$,$,$);

#175 = MACHINING\_WORKINGSTEP('Round Edge Milling',#14,#176,#177,$);

#178 = TOLERANCED\_LENGTH\_MEASURE(5.,$);

#177 = SIDE\_FINISH\_MILLING($,$,'Finishing the chamfer',$,$,$,$,$,$,$,$,$,$,$,$);

#179 = MACHINING\_ HARD\_PRECEDENCE(#180, #123, $, #127, #131, #136, #146, #153);

#180 = TFA ();

#181 = MACHINING\_HARD\_PRECEDENCE (#182, #127, #136, #137, $);

#182 = HIR ();

#185 = MACHINING\_HARD\_PRECEDENCE (#186, #175, #117, #120, $)

#186 = TFE ();

#188 = MACHINING\_SOFT\_PRECEDENCE (#189, #127, $, #131);

#189 = SAC ();

#190 = MACHINING\_SOFT\_PRECEDENCE (#191, #119, $, #116);

#191 = ICF ();

#192 = MACHINING\_SOFT\_PRECEDENCE (#193, #146, #153, #154, $);

#193 = HHI ();

#195 = MACHINING\_SOFT\_PRECEDENCE (#196, #128, $, #147, #154);

#196 = HDB ();

#197 = MACHINING\_SOFT\_PRECEDENCE (#198, #124, #127, #131, $);

#198 = UFC ();

#199 = MACHINING\_SOFT\_PRECEDENCE (#198, #119, $, #117, #124);

#200 = MACHINING\_SOFT\_PRECEDENCE (#198, #120, #116, #123, $);

#201 = MACHINING\_SOFT\_PRECEDENCE (#198, #127, $, #132);

#202 = MACHINING\_SOFT\_PRECEDENCE (#198, #128, #131, $);

ENDSEC;

END-ISO-10303-21;