ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

CNC Coding Using Siemens 810d Control System For Manufacturing Konkurs-M Missile (Bush)

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ABSTRACT

We have taken up bush component for manufacturing at Bharat dynamic limited. According to process plan tools were selected and mounted as per given drawing and design CNC program is coded accordingly. Using Siemens 810D control system the program is executed and bush is manufactured in EMCO Turn 700 and Turn 365 machines. It consists of four stages 1. Process plan, 2. Selection of tools, the tools are selected according to the operation to be performed and precision level that has to be given, 3. CNC program, CNC program has been generated according to the sequence of operations, Clearance and precision, 4. Executed.

CNC machines are widely used to manufacture different parts in different types of materials. It is a highly precise way for manufactures to make sure all their parts are within the set tolerances. CNC is computer controlled whereas in the past it was manually controlled by the operator.

The project was to learn and properly write a code for a CNC milling machine. After studying the different codes of CNC, an exercise was completed to make a part to be milled by the milling machine. The codes were then ran on the CNC computers to show the part that would be created on the milling machine. A demonstration of the milling machine was then given.

The production of any given piece contains several steps and use a variety of tools. A CNC machine could be programmed to process a piece in a shorter amount of time and with higher accuracy. This automated process is possible using commands that guide the machine along X, Y, and Z coordinates. The machine operator would load the desired program along with the tools needed to create a piece. The goal of this lab is to learn the CNC metal cutting approach.

Keywords- CNC, Design, Drawing, Milling, Program, Machine tools.

1. Introduction

The 9M113 Konkurs missile is increasingly common place in current and recent conflict zones and represents a capable long-range system for its age. In recent months Konkurs systems have been employed by Houthi forces in Yemen pro-government fighters and separatist forces in Ukraine and various Syrian groups including Ahrar al-Sham and the Syrian Arab Army

The most advanced variant of the 9M113 missile documented in the hands of non-state actors so far is a 9M113M missile with upgraded 9N131M2-1 warhead that was captured by IS in Syria. Markings on the missile tube indicate it was manufactured in 2006.

Cite this article as: Syed Shoeb Pasha, Mohammed Abdul Rahil Juned, Mohammed Furqan Uddin, Mohammad Owais, Ghazi Rayyan Ahmed and Dr. Syed Azam Pasha Quadr, " CNC Coding Using Siemens 810d Control System For Manufacturing Konkurs-M Missile (Bush) ", International Journal & Magazine of Engineering, Technology, Management and Research(IJMETMR), Volume 7 Issue 3, 2020, Page 7-14

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The 9M113 Fagot and 9M113 Konkurs were partially co-developed as semi-automatic command to line-of-sight SACLOS replacements for the 9M14 Malyutka. The earlier 9M14 featured manual command to line-of-sight MCLOS guidance requiring an operator to manually guide the missile onto target. This method required a high degree of skill to operate and necessitated controlling the missile's flight through a magnifying periscope from a fixed position.

The man-portable deployment of 9M113 series missiles has proven much more commonplace in conflict zones largely due to the fact that 9P135M and later 9P135M-1 control units with 9M113 Konkurs missiles were adopted as part of the standard load out for the Soviet BMP-1P and BMP-2. In the case of the BMP-2 for example 9M113 missiles are launched from the 9P56M control unit firing post mounted atop the turret. However a spare 9P135M complete with tripod is issued and carried for use by dismounted infantry.

As a result of the proliferation of the BMP-2 additional 9M113 series missiles were produced and exported in large numbers to Soviet client states and remain in service around the world.

In the early 1990s an improved version known as the 9M113M NATO AT- 5B was introduced featuring a tandem heat warhead designed to defeat reactive armour. According to Russian sources it has an armour penetration of more than 750 mm rolled homogeneous armour equivalency compared to 600 mm for the 9M113. There are at least two updated warheads for the 9M113M and later 9N131M2-1. The later was documented in Syria in March 2016 with a production date of 2006.

Computer Numerical Control Machining is the process through which computers control machine-based processes in manufacturing. The kinds of machines controlled include lathes, mills, routers and grinders all used for manufacturing of metal and plastic products.

CNC machining is a manufacturing process in which pre-programmed computer software dictates the movement of factory tools and machinery. The process can be used to control a range of complex machinery from grinders and lathes to mills and routers.

One reason for using CNC machining for production is efficiency. Since computers are used to control machines it means that all major operations of production can be automated to increase speed and quality of manufacturing. Another reason CNC machining is beneficial for manufacturing is its accuracy.

Fig: 1. Konkurs M-Missile

2.1.Literature Review

The Konkurs remains the primary anti-tank system for mechanized infantry in most Soviet successor states, including Russia. It also remains in service in other Eastern European countries of the former Soviet bloc and in formerly pro-Soviet countries elsewhere, including Syria and Algeria. In addition 9M113 or 9M113M missiles have been supplied with BMP-2 IFVs to India, Iran, Finland and other states. The former Czechoslovakia and former East Germany produced the 9M113 under license and production was also undertaken by Vazov Engineering Plant in Bulgaria and Bharat Dynamics in India. The later two manufacturers still offer the system for sale iran has also assembled Konkurs missiles under a licence which also included licenced production of the

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BMP-2 IFV signed in 1991. Several sources have claimed that the North Korean Bulsae-3 is a copy of the 9M113 series however this is unlikely.

The system has also been acquired by a number of non-state armed groups operating around the world. In particular, the 9M113 has been acquired by several groups in Syria and Iraq, including various Iraqi Shi'a militias, various factions aligned with the Free Syrian Army Jabhat al-Nusra and the Islamic State. One US government publication gives the 1992 export price of the 9M113 missile as approximately 13,000 USD whilst the 9P135M control unit sold for 135,000 USD.

The 9M113 is a wire-guided missile operating on the SACLOS guidance principle. This system only requires the operator to keep the 10x power 9Sh119M1 optical sight trained on the target during the missile's flight requiring significantly less operator training to achieve proficiency versus an MCLOS system.

Once the target has been acquired and the operator has pressed the firing trigger, there is a delay of approximately 300 m/s during which a thermal battery brings the 9B61 gyroscope up to operating speed.

A pyrotechnic gas generator is then initiated which expels the missile from its tube at some 64 m/s. This also inflates four thin sheet metal fins which are wrapped around the missile whilst in the tube. Small fins at the nose of the munition which serve as control surfaces for steering are held under spring tension and release once the missile has left the tube.

Objectives & Methodology

3.1 Objectives

The 9M113 is a wire-guided missile operating on the SACLOS guidance principle. This system only requires the operator to keep the 10x power 9SH119M1 optical sight trained on the target during the missile's flight requiring significantly less operator training to achieve proficiency versus an MCLOS system. Once the target has been acquired and the operator has pressed the firing trigger there is a delay of approximately 300 m/s during which a thermal battery brings the 9B61 gyroscope up to operating speed. A pyrotechnic gas generator is then initiated which expels the missile from its tube at some 64 m/s. This also inflates four thin sheet metal fins which are wrapped around the missile whilst in the tube. Small fins at the nose of the munition which serve as control surfaces for steering are held under spring tension and release once the missile has left the tube.

The operator tracks the target through the optical sight during the flight of the missile using the flywheels of the 9S474 control unit to traverse the sight in azimuth and elevation the 9S451 guidance unit is comprised of the 9S474 control hardware unit and the 9SH119 optical sight. Even at the maximum range of 4 km an operator only has to maintain a lock on the target for fewer than 20 seconds before impact occurs. Immediately after launch an IR beacon in the tail of the munition is activated. This is used to effect automatic flight corrections in the missile's position relative to the target. Throughout the missile's flight command signals are sent from the control system in the firing post via wire to the control system of the missile. By employing a physical wire connection the system is able to avoid radio frequency jamming that could cause a wireless system to fail.

The system is not without weakness as any barrier to clear observation of the IR illuminator such as heavy snow, sand storms, IR blocking smoke will cause the system to suffer from reduced or negated In this case MCLOS guidance is integrated into the launcher as a backup however its use is likely to result in reduced accuracy when employed by an operator primarily trained in the use of SACLOS guidance.

The 9M113 features a 9E234M fuse that is

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armed through the process of ejection from the launch tube via an inertial switch that functions when initial acceleration ends. Concurrently a separate 9KH237-1 electric initiator cartridge is used to function the 9Kh179-1 rocket sustainer motor accelerating the missile to an average 208 m/s for the duration of its flight. Propellant gases from the primary motor are vented through two ventral ports. To complete all of the electro-mechanical and pyrotechnic steps necessary for arming the warhead the 9M113 will travel approximately 70-75 m before energizing an internal firing capacitor and arming.

The firing function of the 2.7 kg OKFOL (95% HMX, 5% phlegmatiser HEAT warhead is accomplished by the 9E234M crush cone type point initiated base detonating fuse. This type of firing mechanism utilizes two spaced electrode cones which energize the firing circuit when the air gap between the two is crushed by the impact of the missile hitting an object. A crush cone system is a very reliable firing mechanism as it also allows for a graze to activate the firing circuit. In case of a clean miss no impact at the end of the full 4 km length of wire the 9M234M incorporates a pyrotechnic self-destruct feature.

The missile is stored in a fiberglass tube which is lightweight and designed to be buoyant even when fully loaded. The tube also incorporates several safety mechanisms including a short circuit plug which prevents the arming or firing of the missile with the front cover of the tube closed. The front cover of the tube is hinged on one side. Residual pressure developed by the gas generator is vented via twelve vent holes at the rear of the missile tube.

Introduced in 1991 the modernized 9M113M features a tandem HEAT warhead intended to defeat reactive armour. The 9M113M tandem warhead contains 3.3 kg of the same OKFOL explosive compound as the 9M113 but has divided the loading amongst a smaller primary HEAT warhead in the body and a precursor shaped charge to defeat reactive armour.

The addition of the tandem HEAT warhead accounts for only 95 mm of additional length to 1,260 mm and a weight increase of 2 kg to 16.5 kg. The 9M113M system also includes support for a thermal sighting system, and a warning function that alerts the operator to the use of an IR-based active protection system, enabling a switch from SACLOS to MCLOS guidance.

Fig: 3. Packed 9M113 missile.

3.2 Differential Identification

It can be difficult to distinguish between 9M111 series and 9M113 series missiles still contained within their tubes. These necessarily share very similar external geometry and are commonly produced in the same colour. The most distinctive diagnostic features are at the front and rear of the missile tube. The front of the missile tube is of a different design in 9M111 and 9M113 series tubes, with the latter being black in colour and of a more angular shape. The rear of the missile tube can also be a useful distinguishing characteristic.

It has a thicker black coloured rear portion although some later 9M111 series missiles have a black portion to the rear of the missile tube as well. Also as noted 9M113 series missiles

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features twelve vent holes at the rear of the missile tube whereas 9M111 series missiles are loaded in tubes with six venting holes.

Fig: 4. 9M113

Fig: 7. Emco Turn 700

Fig: 8. Emco Turn 365

Results & Discussion

4.1 CNC program bush operation-1

NO MSG (REFERENCE) TRTINDX
17 D1
GO G54 G94 X100 Z50 G01 X60 Z0.7 F3000
R1-1 MO
TRTINDX M01
NI MSG (ROUGH TURN) TRTINDX T7 D1
GO G54 X100 Z50 G95 S800 M4 M8 G01 X75 Z0 F5 X38 F0.2 G01 X80 Z3 F5
NCG#CYC95# (ROUGH TURN) GO X110 Z50
TRTINDX M01
N2 MSG (ROUGH TURN) TRTINDX
T11 D1
GO G54 X35 Z20 G95 S800 M3
G01 X38 Z5 F5 M8 NCG#CYC95# (ROUGH BORE) G0 220
TRTINDX MO
N3 MSG (ROUGH FIN BORE 1) TRTINDX T11 D1
GO G54 X45 Z20 G95 S800 M3
G01 X49.5 Z5 F5 M8 Z-17 F0.5 Z-24 F0.1 X50.2 Z-24.476 F0.05

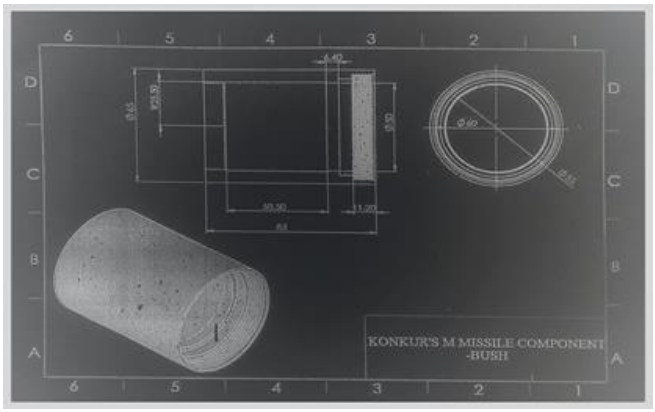

Fig: 19. Konkur's M missile bush design-1

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
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Fig: 20. Bush component after manufacturing at CNC machine-1

ISSN No: 2348-4845
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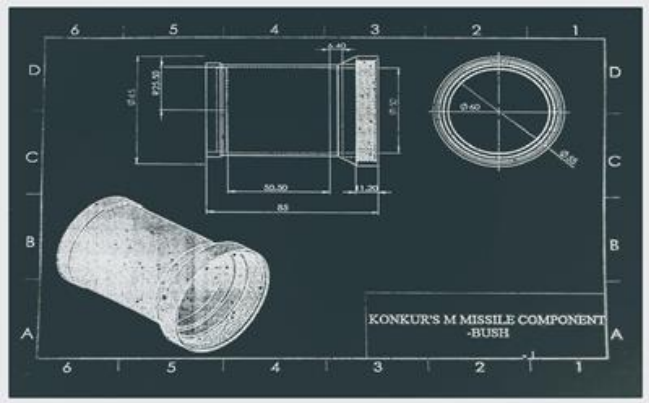

Fig: 21. Konkurs-M missile bush design 2

Fig: 22. Bush Component after manufacturing at CNC machine-2

Conclusions

5.1.Conclusions

1. Computer Numerical Control machine tools is an automation system that operated obey the instructions that are programmed in the form of a numeric code that is stored on a storage medium and there are two types namely the type of lathes turning machine and machinery frais milling machine.
2. The operation on CNC machine tools is the process of cutting the workpiece in the form of chisel instructed by computer numerical control to drive a chisel on a machine tool on the workpiece using the coordinate system of the CNC milling and turning machines namely coordinate system with three axes X, Y and Z axes. X-axis is defined as a moving horizontal axis, Y-axis moving a transverse axis and the Z-axis is a vertical axis that moves.
3. The programming language is a form of instruction in one block to another block using the code letters, numbers and symbols on CNC machine tools are computer device called the Machine Control Unit which serves to translate language code into the appropriate form persumbuan movement on the shape of the workpiece. The codes of language in CNC machine tools is called the G and M codes where the codes given by ISO International Standards.

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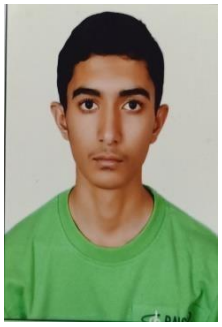
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