FEASIBILITY ANALYSIS OF TUBE CUTTING MACHINE (CUT OFF) OF ST MILLS IN TATA STEEL TUBE DIVISION , JAMSHEDPUR

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Abstract:- Tata Structura and Tata Pipes are manufactured by the High Frequency Induction Welding (HFIW) process. The process, also known as the Cold Process, uses HR strips, which are manufactured at Tata Steel's modern hot strip mill. In the HFIW process, the slit HR coil goes through the MIG welder, while a steady flow is assured from the horizontal coil accumulator. Cold stamping is done at this stage with the TATA seal of quality. The tubes then progressively form as the strip passes through successive rolls and is followed by the high frequency induction welding at the edges to complete the weld. External beads due to weld deposition on the outer surface of the tubes are then removed to ensure a smooth surface finish. Following the welding process, an eddy current non-destructive testing machine screens out the imperfectly welded tubes. Tubes that pass the test are cut into required lengths by cold saw, which gives a smooth burr-less square cutting edge. Tubes are then packed in hexagonal bundles by MAIR auto-packing machine.

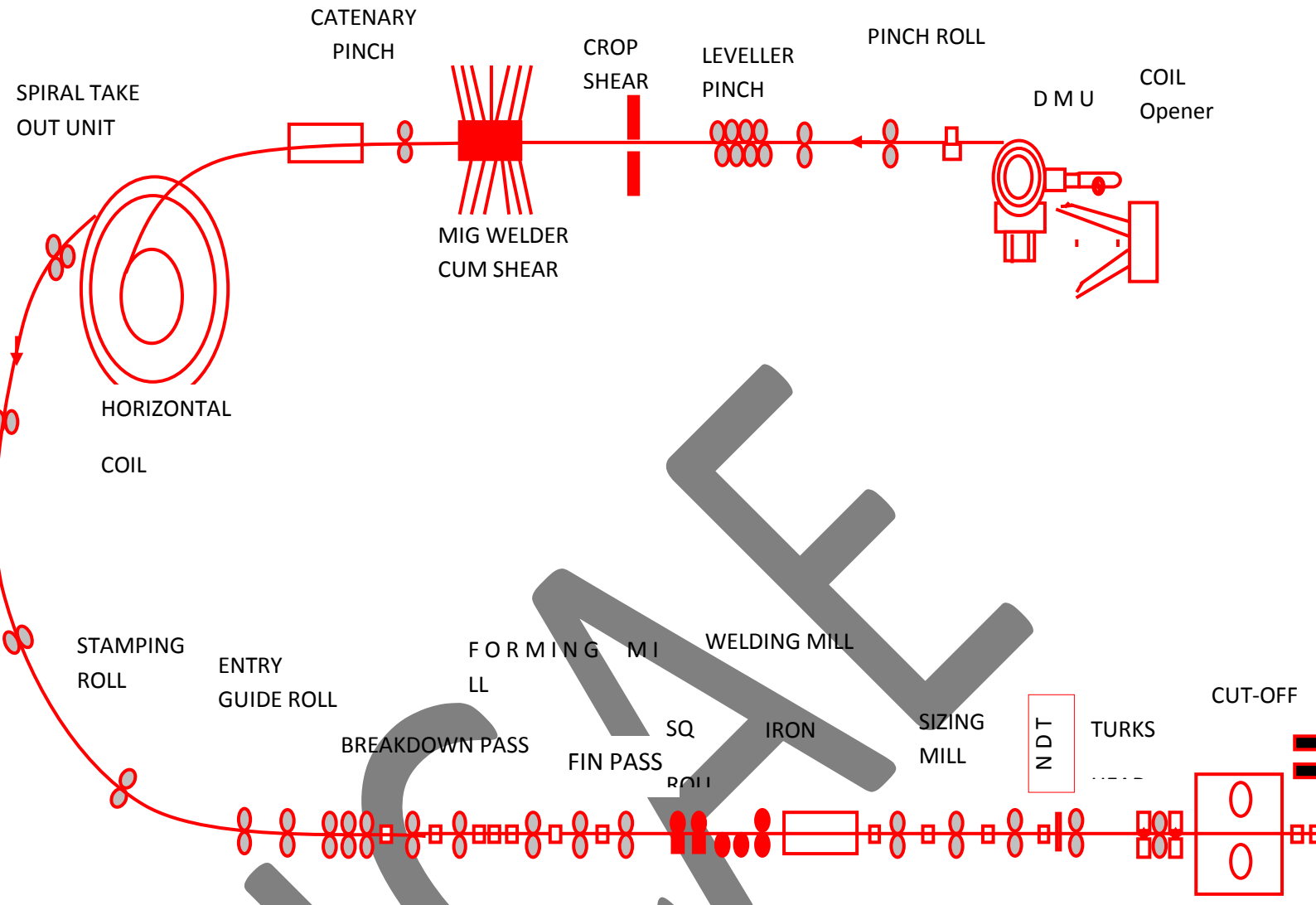
Keywords:- HFIW, MIG, PLC

Introduction

Tube manufacturing process is a continuous process for tube making in different sizes but the customer requires the tube in different lengths. To produce the tube as per customer requirement mill people are bound to cut the tube as per required length. To facilitate this process a tube cut-off machine is required and it is installed at the end of the tube mill. The purpose of the cut-off is that we have to feed the required length data to cut-off PLC monitor and save it for giving the feedback command to cut-off manager or it's PLC. These facility is achieved by the measuring wheel encoder and attached decoder to the PLC. Pulses of measuring roll converted into linear length of the tube and it gives command to cut-off to part off

General Description of the Cutoff machine

Cut-off machine with cold saw appropriately designed to be inserted in a production line of tubular tube



.where high quality cut and high speed production is required.

Machine basically consist of a basement on which carriage slides carrying the cutting head, the clamp unit, a type system located just before the clamps and a v support located just after clamp outlet which leads the bar to the run out table for the ejection. The initial part of the cutting head a safety sensor is placed and able to stop the machine in case that the tube striker on the clamp or finds an obstacle during it shifting towards the ejection zone. On the sides of the basement appropriate coupled shock absorbers are properly placed in order to stop the carriage in order to stop the drive unit can not control it in the rear part of the basement the carriage drive unit consisting of an A.C motor and a reduction gear box is housed and protected from the working area of the cutting head.

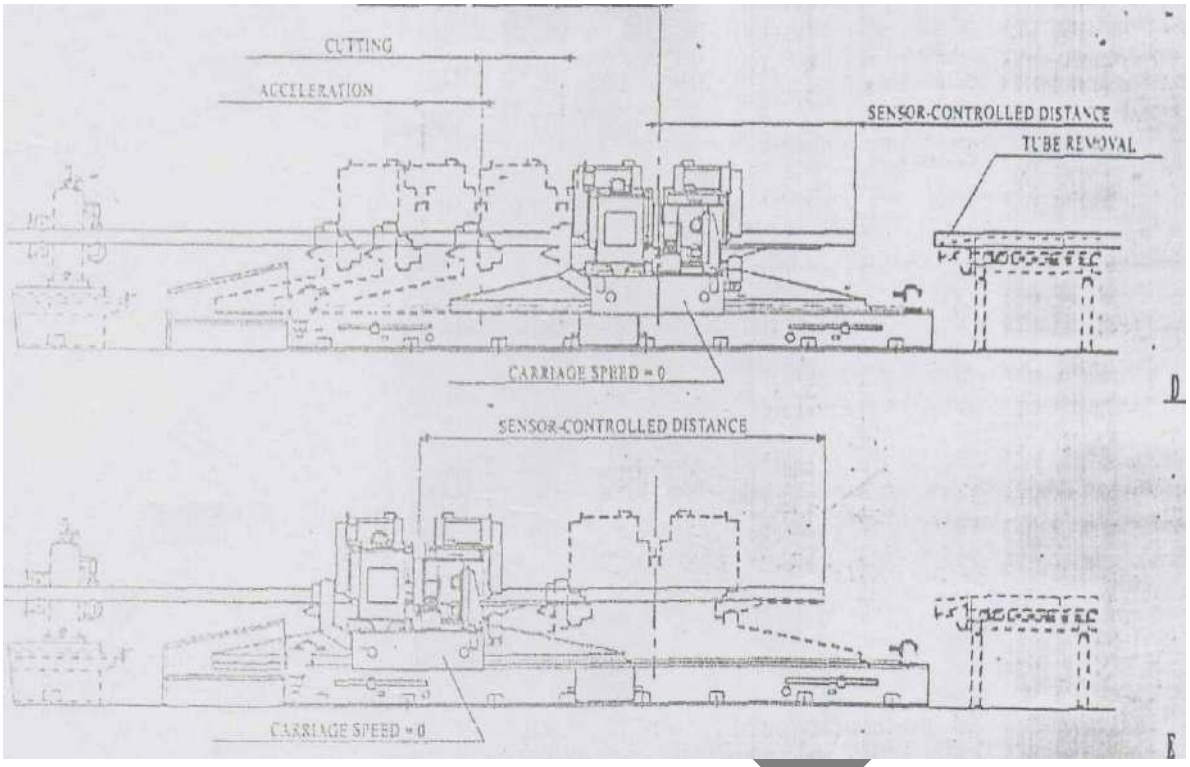


Fig-twin saw cut off TCC90 machine(used in HF#1)

The "TCC 90" system is the fastest, most advanced flying cutoff saw (Twin electric cold saw type) for heavy gauge tubes currently available on the international market. It can handle any hollow section, whether circular, square, rectangular, or otherwise.

Moreover the "TCC 90" offers exceptional speed and precision due to dedicated control system.

At a maximum continuous speed of 70meter/min or more cutting precision is guaranteed to within ±2.5mm, although in practice even grater precision can be achieved. The machine guarantees a clean cut with practically no burring or distortion of the tube

Cutting Synchronism of the Cutoff is shown below:-

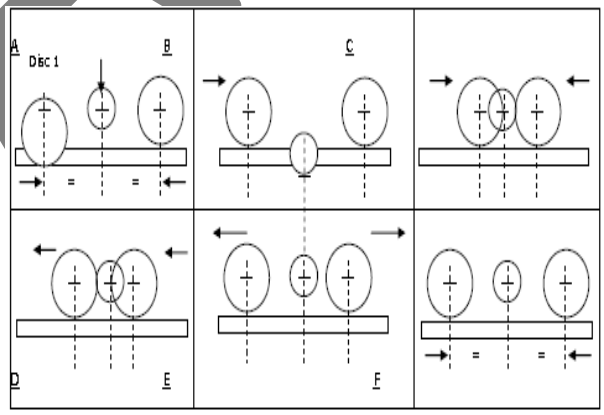


Fig- Cutting action of blades

CUTTING ACTION OF THE BLADES

Fig. A: The carriage position after a manual tube cutting operation prior to start-up.

Fig. B: The carriage clamping the tube having first accelerated away a certain

distance to allow the tube to be fed through a distance equal to the length required.

Fig. C: The synchronism phase when the carriage and tube move at the same speed and the saw head approaches to cut the tube.

Fig. D & E: the deceleration and return phases of the carriage whose movement together with the tube length is controlled by microprocessor

Technical specifications

Tube diameter mm	Min. 57 Max. 168,30	
Dimensions for square profiles mm	Min. 50x50 Max. 125x125	
Dimensions for rectangular profiles mm	Min. 60x35 Max.160x100	
Tube or profile thickness mm	Min.1,20 Max. 7,1	
Maximum speed of tube mill mpm	90	
Tolerance for cut length of 6m	± 2,0	
Carriage weight (approx.) kg	5600	
Saw blade (diameter) mm	Max. 550	
Saw blade thickness mm	Min. 4 Max. 8	
Cutoff unit motors power kW	22	
Saw translation motors power kW	7,5	
Accelerator motor power kW	104	
Hydraulic power unit capacity I	150	
Hydraulic power unit motor kW	7,5	
Hydraulic power unit working pressure	110 bar	
Total installed power kW	170,5	
Type of lubrication	Manual/automatic	
Noise level dB(A)	Only definable following installation(*)	

SPECIFICATION OF HYDRAULIC POWER UNIT FOR CLAMPS AND GIB LOCKING CYLINDERS

Actuators: tube clamping unit	
Power	7,5 kW
Reservoir capacity	150 l
Flow rate	30 l/1’
Pressure	110 bar

ELCTRICAL SPECIFICATION

Three-phase power supply voltage	380 V±10%
Mains frequency	50 Hz±0,5 Hz
Mains type TN-S	Neutral not required
Panel installed power	290 KVA
Accelerator motor rated power	104 Kw
Average power factor (cos ø)	0,77
Operating temperature range	-2 °C÷ + 38°C
Humidity (non-condensing)	60%
Panel protection class	IP 54
Control console protection class	IP 54
Max. altitude above sea level	1000m
Auxiliary voltages inside panel	110 V-50 Hz/24 V d.c. 220 V-50 Hz/24 V a.c.
Console controls voltage	24 V d.c.
Asynchronous motors voltage	380 V/50 Hz
Single-Phase air conditioner voltage	220 V/50 hz
D.C. motor voltage	400 V d.c.
Solenoid values voltages	24 V d.c.
Machine sensors voltage	24 V d.c.

SAFETY MEASURES TO BE TAKEN

- The machine cuts tubular sections by way of a cold metal removal technique so the machine is associated with a number of risks (carriage translation, cutting, blades breakage, flying chips etc) which may result in accidents. So the operating zone should be protected by a perimeter panel.

- The electrical equipment is powered by an electrical current sufficiently high to cause serious injury to persons and even death so the access is strictly restricted to qualified electricians.

- The insulated barriers assembled inside the panel protect the personnel from inadvertent contact with components powered by dangerously high voltages. For this reason their removal is extremely dangerous and must only be carried out when the machine is disconnected.

- The d.c. and a.c. drives controlling the speed of the motors, contain electrical energy storage devices(capacitors) which store electrical energy even when the power supply to the panel has been disconnected. So at least wait for one minute before accessing the panel after disconnecting the power supply.

REFERENCES

1. Tata steel tube division HF#1 machine manuals
2. Material science and engineering by William D. calliester.