VIBRATION DEPRECIATION IN PILGER MILL

Solanki Vijaysinh G., Mevada Chiragkumar J., Chaudhary Jayeshkumar L., Darbar Rajendrasinh B.
Mechanical Department
Hansaba College of Engineering & Technology,Sidhpur,India
vijaysinhrajput123@gmail.com,chiragmevada9@gmail.com,jayeshchaudhary7567@gmail.com,darbarraju@gmail.com

Abstract - Heavy Metal & Tubes Ltd. Industry is labour intensive and faces tremendous labour and optimal problems, which challenge the quality of the product. Heavy Metal & Tubes Ltd. Industry has occupied a major section amongst all tubes industry. In today’s world, the role of Tube & Pipe can’t be ignored and these crucial products are manufactured by various methods likes, by pilgering process, by tube drawing process and so on. Actually when we are producing these pipes and tubes by pilgering process and it’s oblivious that pilgering is cold working process where high and enormous amount of forces are generating , and handling of these forces is quite periculous. So some disorderness might be there, and its consequences makes vibration, noise, inaccuracy and all, so our aim is to overcome these problems, and by using various process, somehow effects can be reduced like by damping or non damping process, by provide isolated material(rubber and synthetics) and so on.In this project, efforts have been made to reduce the ill effects caused due to machine vibration problems along with the tubes and optimizing the process and trying to increase the overall efficiency.

Index Terms - Tube drawing process, Pilger mill, Dies, Tube and Pipe

1.INTRODUCTION

INTRODUCTION TO MANUFACTURING PROCESS

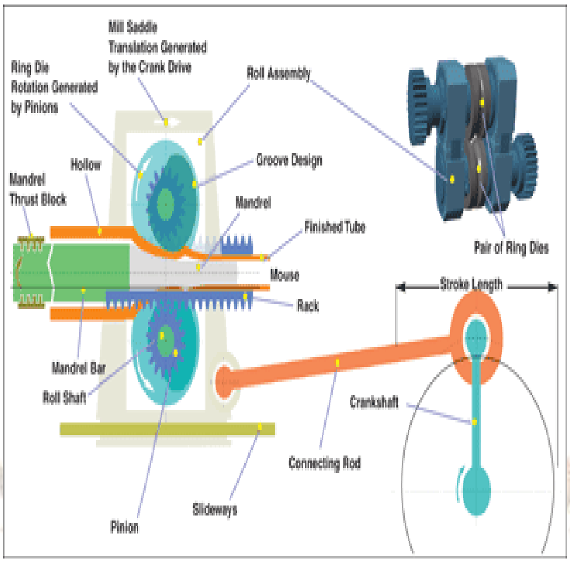
1 PROCESS FOR STAINLESS STEEL SEAMLESS TUBES & PIPES

> COLD PILGERING
> COLD DRAWING PROCESS
>HOT PERCING MILL

INTRODUCTION TO COLD PILGER MILL TECHNOLOGY

(Fig.1 Cold Pilger Process)

The cold mill pilgering process uses ring dies and a tapered mandrel to reduce tube cross sections by up to 90 percent. Because the process relies on large number of small forming steps, the result is tube or pipe that has nearly homogenous material characteristics. It is suitable for every metal.



(Fig.2 Cold Pilgering Machine)

The rolling tools in the cold pilger process comprise a pair of ring dies and a mandrel. The mandrel is located inside the tube in a fixed position and rotated by the mandrel thrust block. The mandrel itself is tapered in the rolling direction. The dies have matching grooves on their circumferences.

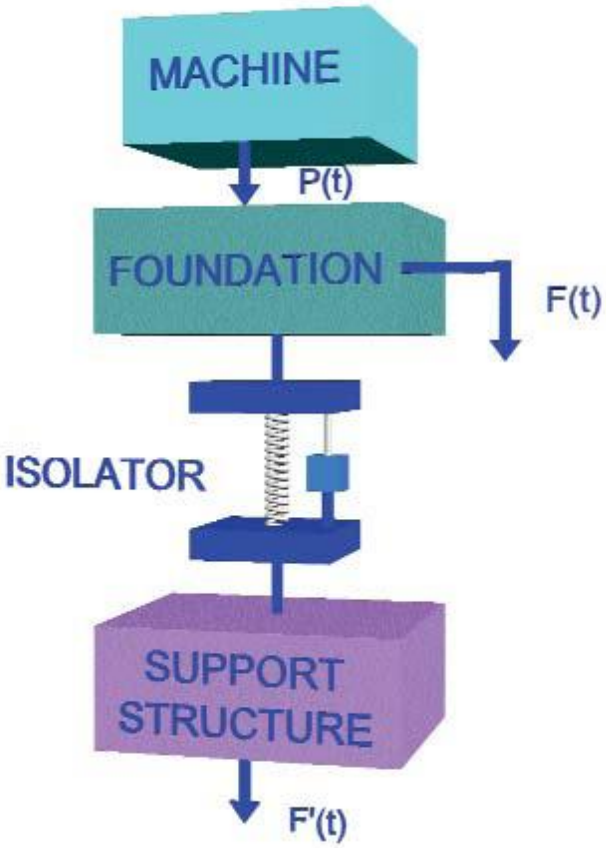
2. METHODOLOGY

We can eliminate the vibration using vibration isolation likes

1. Base isolators
2. Rubber pads

1 ISOLATION

The purpose of isolation is to control unwanted vibration so that its adverse effects are kept within acceptable limits.



(Fig: 22- Isolation)

2. FOUNDATION

When is a foundation (inertia block, reaction mass) required?

In certain applications, it is not desirable or feasible to mount a machine directly on vibration isolators. In order to resist to transmit amplitudes of vibration at the source or recipient, it becomes necessary to make the support structure independent (isolated) from the rest of the environment. This separation prevents vibration from being transmitted directly through the support structure.

2.1 FOUNDATION REQUIRING VIBRATION ISOLATORS

In certain applications, it is not desirable or feasible to mount a machine directly on vibration isolators. Direct installation of vibration isolators on a machine can cause bending, relative displacement and other problems, even when the floor is sufficiently rigid. For smaller machines, this can be remedied by securing the frame/bed to a rigid plate, thereby creating a rigid support structure, and then installing the isolators between the plate and the floor. For larger machines, the frame/bed is attached to a properly designed concrete foundation, which is then supported on the appropriate isolators for the application.

A concrete support structure (foundation, inertia block, reaction mass) is used to satisfy one or more of the following conditions:

1) Provide/improve structural stiffness for the machine/equipment being isolated.

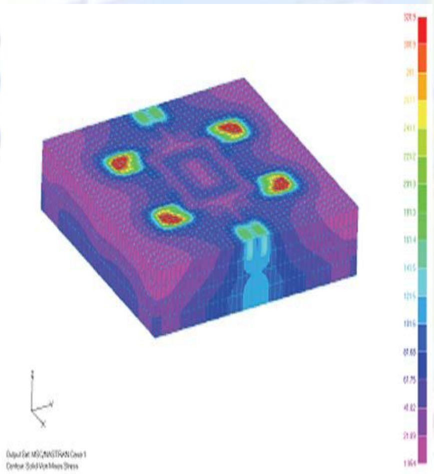
2) Increase stability on the vibration isolators by limiting dynamic deflection.

3. TREATMENT TECHNOLOGY FOR VIBRATION

2.2 FOUNDATION DESIGN

The function of a foundation is not only to support the weight of the machine/equipment, but also to keep the vibration levels and dynamic displacement of the isolation system within acceptable limits. Designing foundations supporting machines that can produce static and dynamic loads requires sound engineering procedures for a reliable result. An incorrectly designed foundation is extremely difficult to correct once installed.

Stresses are related to the geometry of the foundation and the distribution of loads and forces acting upon it. A stress analysis will indicate the magnitude of stress imposed by



(Fig: 23- Foundation stress analysis)

2.3 VIBRATION ISOLATORS

The purpose of an isolator is to decrease the amplitudes of forced, random and steady state vibrations being transmitted into a machine or equipment support foundation. Isolators exist in many forms, including rubber, mat materials, metal coils, air bags and pneumatic isolators. The type of isolator (performance) used as the solution for an application depends on the type of machine to be isolated, static load, dynamic deflection and damping properties of the isolator.

2.4 TRANSMISSIBILITY

The ratio of the vibration transmitted after isolation to the disturbing vibration is described as transmissibility and is expressed in its basic form in Equation (1).

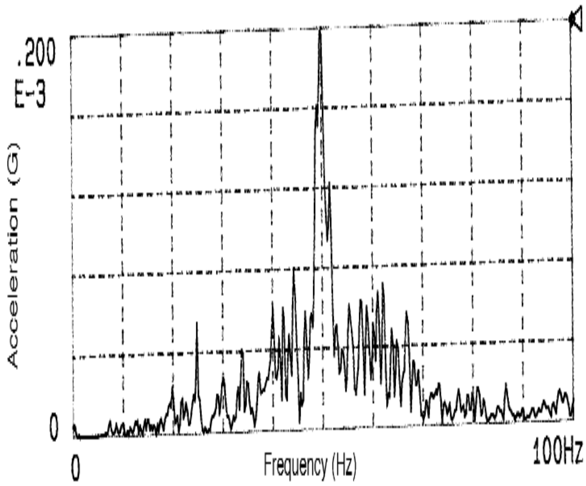
$$(1) \quad T = \frac{1}{(Fd/Fn)^2 - 1}$$

Where F_d is the disturbing frequency and Fn is the natural frequency of the isolator. When considering the property of damping, the equation is rewritten as Equation (2).

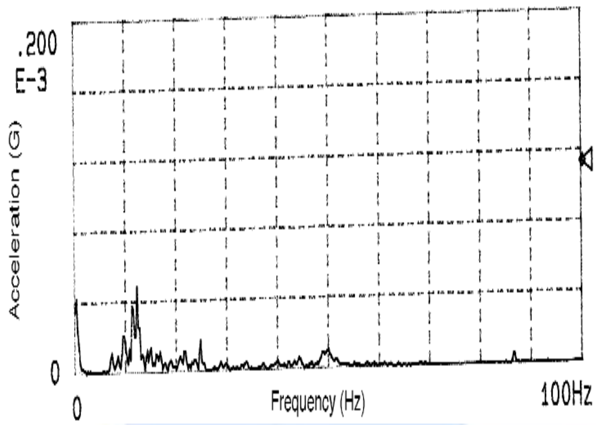
$$(2) \quad T = \sqrt{\frac{1 + (2\zeta Fd/Fn)^2}{(1-[Fd^2/Fn^2])^2 = (2\zeta[Fd/Fn])^2}}$$

2.5 CASE

Following are the results from two case studies with and without isolation material in use.



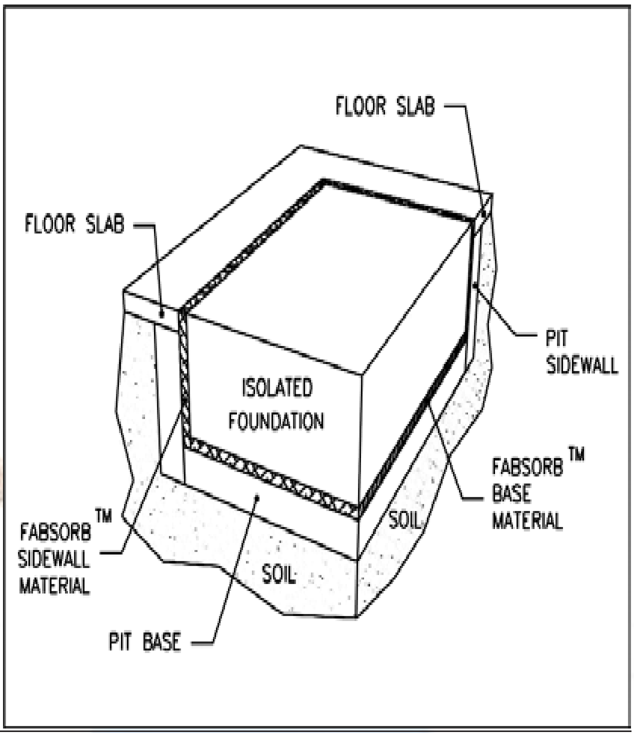
(Fig: 24- Random vibration input on shop floor)

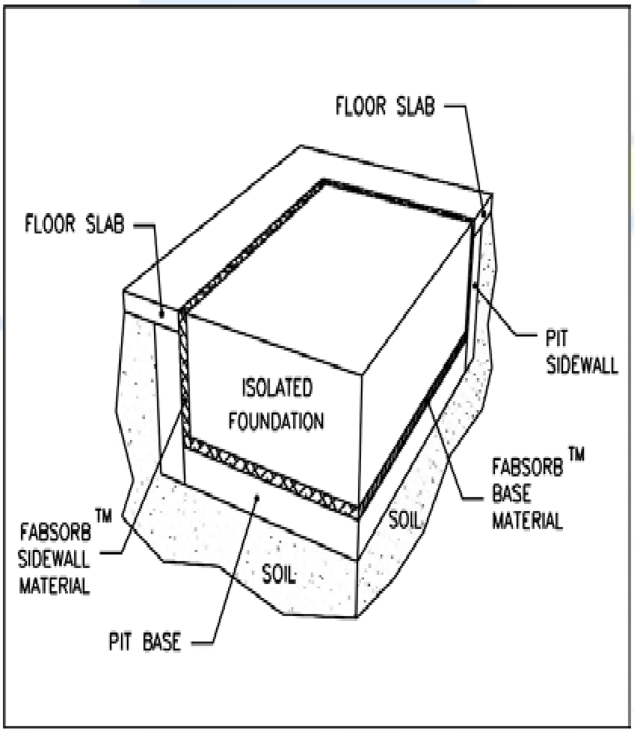


(Fig: 25- Isolated response on foundation isolated material under 5psi load)

(Fig: 27- Isolators positioned on pit floor prior to forming the foundation above)

2.6 Installation method





(Fig: 28-Installation method)

Installation site is excavated to specified depth and grade. Pit is formed and poured. Base and sidewall panels are installed in pit. Foundation is poured.

5. VIBRATION CALCULATION

A pilger mill of mass 1 ton with external force acting on pilger mill is consider as 2500 N at 1500 rpm. To reduce the effect of vibration, isolators of rubber are used having a static deflection of 2 mm with an elastic damping factor 0.2.

- Calculation:-

  m = 1 ton = 1000 kg

  F_0 = 2500 N

  N = 1500 rpm

$W = \frac{2\pi N}{60} = \frac{2\pi \text{ X } 1500}{60}$ = 157.007 rad/sec

X_{st} = 2 mm = 2 x 10^{-3} m

ζ = 0.2

Stiffness of spring,

$K = \frac{F}{\delta} = \frac{mg}{Xst} = \frac{1000 \text{ x } 9.81}{2 \text{ x } 10E-3}$

$= 4.90 \text{ x } 10^6$ N/m

Now,

$\omega_n = \sqrt{\frac{k}{m}} = \sqrt{\frac{4.90 \text{ X } 10E6}{1000}}$

= 70.03 rad / sec

$\frac{\omega}{\omega n} = \frac{157.07}{70.03} = 2.24$

Transmissibility,

$$T_r = \frac{\sqrt{1+\left(2\zeta\frac{\omega}{\omega n}\right)^2}}{\sqrt{\left[1-\left(\frac{\omega}{\omega n}\right)^2\right]^2+\left[2\zeta\frac{\omega}{\omega n}\right]^2}}$$

$$= \frac{\sqrt{1+(2\times0.2\times2.24)^2}}{\sqrt{[1-(2.24)^2]^2+[2\times0.2\times2.24]^2}} \qquad =0.3259$$

Force transmitted to foundation,

$= \frac{F0-Ft}{F0}$

$= \frac{2500-814.75}{2500}$

=0.6741

= 67.41 %

Amplitude of Vibration,

$$X = \frac{F0/K}{\sqrt{\left[1-\left(\frac{\omega}{\omega n}\right)^2\right]^2+\left[2\zeta\frac{\omega}{\omega n}\right]^2}} \qquad = \frac{2500/4.90\times10E6}{\sqrt{[1-(2.24)^2]^2+[2\times0.2\times2.24]^2}} = \frac{0.00051}{4.116}$$

$= 1.24 \times 10^{-4}$ m

= 0.124 mm

6..REFERENCES

- B.L.Juneja,"Fundamentals of Metal Forming Processes ", new age international publishers, 2007 First edition.
- P.C.Sharma" a textbook of production engineering "S.chand publication, 1982, First edition.
- j. park, a, s. s. kim, "optimum design of a pilger mill process for wire forming using cad/cae"material science forum vols (475-479),p3275-3278.
- Rigor, Matsegorin, Alexander semodev,"optimization of procedure of tubular cladding pressure tubes", Transactions of the17thinternational conference on structural mechanics in reactor Technology, Smirt 17, (2003).
- S.muot, hacquin, p.Montmitonner" a fully 3d finite simulation of cold pilgering"journal of material processing technology, 60(1996)505-512.
- Dynamics of machinery by F.B.Sayyad