



## Harshwardhan Gupta's Design Tips– 16

### Machine Safety-1

This Article is in two parts; the first dealing with machines, and the second with automobiles, as the latter are now very commonly used machines – though we often do not think of them as machines.

Industrial safety is a big issue now, and many progressive companies are addressing this issue with vigor. Signs like “292 (or whatever) days without accident” are a common sight now. There are safety teams, safety audits, etc., and machine guarding and operational safety are being given their due place in these factories. This is also good IR.

In the more invisible, mundane of factories, squalor and lack of safety still reign supreme – although there is increasing pressure from their multinational customers to clean up their act. This still leaves a vast number of those factories that supply to an unorganized sector, and here industrial safety is still an alien concept. Losing one's life and limb is an occupational hazard the workers are forced to live with. Their bosses are often willing to “make settlement” through whichever way costs them the least.

What can the machine designer do to contribute to machine safety in such circumstances? Little, but not so little either!

In a new design, when it comes to safety, deciding on what criteria would define a safe machine is the foremost task. Our laws on this point are very lax, varied, outdated, and most of all unclear and open to a vast range of interpretation. For a few specific machines (like boilers, lifts, etc.), the safety regulations are quite comprehensive, yet outdated and very poorly implemented. For example, in an ‘approved’ lift with the common ‘scissors type’ collapsible shutters, a child can put his hand through the shutters and get his arm torn off. “Parents should have taken care no?”

Some developed countries like Germany and the US have very sensible and comprehensive safety laws and codes like CE and OSHA, and very well-implemented too. Some others like the UK swing to the other extreme, and make the laws so stringent, amounting to this, that however hard one tries to injure oneself, one should not even end up injuring just his little finger. (Lesson for machine exporters here – be clear about which code to follow.)

In Design Tips 14, I had written about the concept of Maximum Credible Accident (MCA) in the context of over-designing of machine parts. Same concept is to be applied in machine safety too. The designer must take into account the MCA, and design for adequate prevention.

A big area of concern is electrical safety. In this area, ELCBs (earth-fault circuit breakers – things which put the power off the moment you get a shock) are a big help, but their use is not yet mandatory. Faulty old wiring, often chewed into by rats, combined with improper storage so often results in all sorts of accidents.

Another big area is fire safety, and except in a few well-designed factories, fire-safety, use of fire-retardant material, fire escapes, fire doors, etc., are merely topics of sterile debate. The most ill-placed and neglected piece of equipment in an average factory is the pathetic little fire-extinguisher. The use instructions on these are works of contemporary abstract art. Hardly any research has been done on their legibility, comprehension and effectiveness in an emergency. The other extreme is the sexy little domestic fire extinguisher – without any printed instructions whatsoever! I personally know of a case of incorrect (but well within the domain of commonsense) use, where the user got very badly burnt when she used it on an otherwise controllable frying-pan fire.

In factories, fire drills are being implemented sporadically, but only time will tell their effectiveness. Fire

departments do not have powers to enforce fire safety measures, and building / factory inspectors, who do have the power, do not have requisite specialized training – “Sir what to do, we are not having proper guidelines only we have written many times to superiors that public is demanding action nowadays!” They are exceptionally well-trained and creative in certain other kind of demanding... No further comments! “Collector blames systemic failure for tragedy, promises action against erring officials after proper inquiry” says a tiny news brief on page 12.

One can go on and on, but the machine designer, system designer, plant-layout designer, electrical system designer, building designer / architect... all must put themselves into the shoes of an accident victim and design against such things happening. There is one specific area I wish to elaborate on – and that is machine guarding and associated safety interlocks. A widespread belief still exists among designers that, “What’s the use? Users will dismantle and bypass them anyway, and cost will also increase no?” This defeatism must go now. There are ways to mechanically fit things in such a way that they cannot be tampered with. Even door switches can be made tamper proof. Further safety can be written into the PLC or other software, which can monitor the operation of the door switches and disable the machine if they are electrically bypassed.

Safety is a state of mind. Having said those six words so easily, one has to translate that into operational terms, beginning with the designer. The user must change his mindset too, and recognize the human cost of accidents. Putting up safety posters to educate and organizing safety seminars is necessary but not sufficient. Our very mindset must change.

A huge majority in India still persists with this fatalistic attitude – that one cannot change one’s Destiny! This is simply not true. Lives can be saved, and are being saved everyday in the World by design and more careful design, not by God’s wishes. Have you seen the car crashes in Formula One races shown on the TV? The zooming car crashes and explodes into a nitro-methane fireball, and a moment later; the driver just walks out of the flames and mangled metal – no injury!

God’s will? I don’t think so – every bit of that car was thoroughly and consciously designed in such a way that it would save the driver’s life in a massive crash at phenomenally high speeds!

“My upstairs neighbor that Ram Kumar you met no died last week in accident in his factory you know! Hospital they took him immediately within 1 hour. Doctors tried level best but no use. Tottal Sai Baba devotee he was you know, evvry year without fail visiting and morning evening pooja! I tell you God’s will nobbody can change! What safety audit safety training sir, all this safety shafety no any use when Time comes! Whatever you do, when Time comes you have to go sir, nobbody can save you sir, nobbody!”

*Yaar aaj-kal mera bhi bad-luck kharaab chal raha hai.*

*Next Month: Machine Safety-2*

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The author, Mr. Harshwardhan Gupta, is a graduate of I.I.T. Mumbai in mechanical engineering. He has been designing machines for the last 29 years, and has many World’s First and India’s First Machines to his credit. He is the founder of Neubauplan Machine Design Studio, an independent machine-design firm in 1981 in Pune. Comments, questions and suggestions for topics for future pieces can be sent to [neubauplan@eth.net](mailto:neubauplan@eth.net). Website [www.neubauplan.com](http://www.neubauplan.com).