

# Application and Use of Mild Steel Cylinder for Production of Quality Poster Paper

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## Abstract:

In India, many mills are producing quality poster paper, some using MS MG cylinders in place of conventional CI MG cylinder. Their product quality is equivalent to those using CI MG cylinder, or even better in some cases. The object of this work is to show how an MS MG cylinder can be used for the production of quality poster paper, and better quality equipment manufacture is possible today. An MS MG costs very less compared to a CI one, and can produce same paper without any difficulty.

## Introduction:

Conventionally, CI MG cylinders are considered must for production of poster paper. But a close analysis of properties of mild steel and gray cast iron indicates the possibility of using mild steel cylinders for this purpose. The following points justify the same-

1. Microscopically, the mild steel surface is much smoother than the paper surface, and hence use of mild steel cylinder should not create any problem. Cast iron surface is relatively smoother than that of mild steel, but its smoothness increase does not yield significantly in gloss while producing quality paper.
2. The specific heat of gray cast iron ( $0.130 \text{ Kcal/Kg}^{\circ}\text{C}$ ) is higher than mild steel ( $0.114 \text{ Kcal/Kg}^{\circ}\text{C}$ ), that is why, it takes longer times to heat up and cool down of the cylinder. Quick speed & hence draw changes, and control of moisture in mild steel cylinder is much better than in case of cast iron cylinders.

3. Manufacturing of a cast iron cylinder takes nearly 4-6 months, against 45-60 days required for fabrication of a mild steel MG cylinder.
4. Improper casting of a MG cylinder means a rejection of material and time involved, while raw material including MS plates, welding rods, shaft/journal etc., welding rods used etc. can be tested prior to fabrication to ensure the product of high quality.
5. Even after usage for some years, if a minor problem appears, it can be easily repaired and production can be continued, which is not the case with CI cylinders.
6. Relatively higher wear and tear rates of mild steel are not of so much significance as an ordinary mild steel MG cylinder can easily give a life of ten years and more, after which it can be replaced, within a week.
7. Thermal conductivity of mild steel ( $40 \text{ Kcal/m.Hr.}^{\circ}\text{C}$ ) is around 15% lower than that of cast iron ( $48 \text{ Kcal/m.Hr.}^{\circ}\text{C}$ ), but its impact on overall heat transfer coefficient will be to the tune of 5-6% only, as other resistances to heat flow e.g. condensate layer, paper web etc. do add to the overall system resistance, thereby production rate reduction will be less. Furthermore, by using steam of slightly higher pressure, this loss of production can be compensated.
8. Relatively softer nature of mild steel makes it possible to grind MG cylinder within 3-4 days, against 7-10 days required for CI MG cylinder.
9. Finally, an MS MG cylinder can be made available in less than one fourth of the cost of a CI MG cylinder.

MG Poster paper is now being made on Indian Machines using Mild Steel MG Cylinder. Having a close look on the paper produced by such machine will reveal that the paper is of even better glaze than the conventional CI MG cylinders.

### **Quality Control & Assurance for Mild Steel MG Cylinders:**

It is important to know how product quality can be maintained during manufacturing of an engineering product of significant interest. Papermakers usually take nip impressions during change of touch roll, to ensure that the nip is uniform and hence paper quality would be acceptable at each cross direction position of the machine. Some papermakers even compare the nip impression with cardiograph of a heart patient.

If we look at the properties of steel, we find a typical graph indicating properties of metal as a function of curing temperature and composition. A typical graph is being given in figure 1.

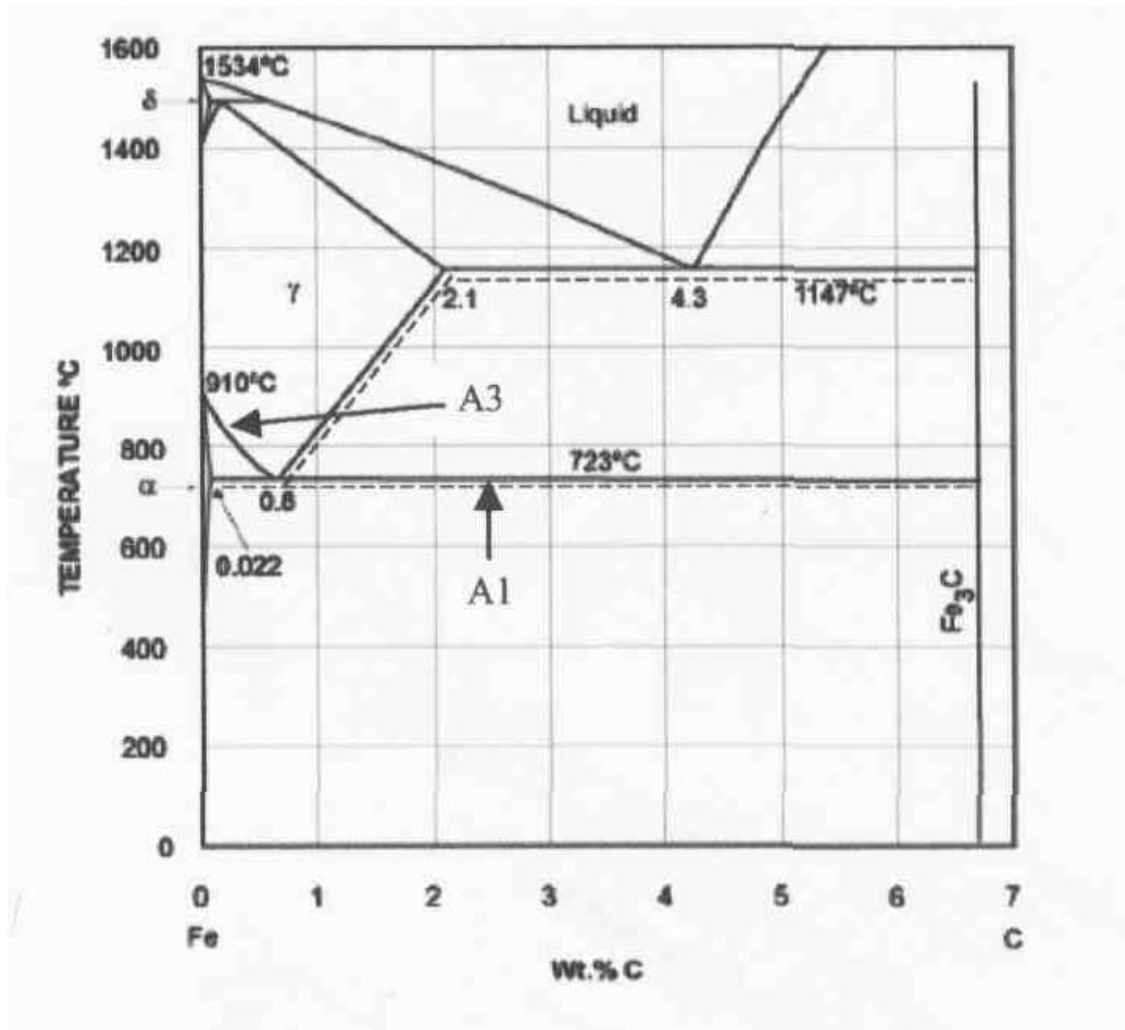


FIGURE-1: Change in type of steel at different temperature and carbon percentage.

In the figure given above, only a function of carbon and temperature has been given. When other elements, e.g. Ni, Cr, Si, S, Cu etc. add to it the graph takes place a very complex form. This illustrates that the property variation in CI MG cylinders are easily possible. For casting of steel, a uniform product mix is prepared, melt, and poured in moulds. As a significant quantity of metal is required, the pouring takes a lot of time, and hence there remain chances of temperature and hence material properties variation at different locations. On the other hand, the plates used for fabrication of MG cylinder are made by furnaces which make only MS plates, and thus are able to produce plates of excellent quality. Furthermore, plates received by the manufacturer can be tested for composition as well as for chemical and mechanical properties. As plates used for manufacture are generally more than two inch thick, use of ultrasound can be easily made to determine whether the plate is free from inside air bubble etc. Ultrasonic testing is not possible with CI MG cylinders, and hence often it is assumed that the shell is free from defects. When such an MG is used, we play gamble. We may get good productivity or sometimes, there may be troubles.

For such circumstances, some papermakers make use of surface temperature profiling under operating conditions, but the 100 dollar question remains the same- what to do with the MG cylinder if there is a defect?

Well, having got the plates tested as indicated above, there comes the job of plate cutting in proper size to suit MG requirements. We have sophisticated plate cutting machines which work without producing excess heat so that the plate properties do not alter. Then comes the job of welding. Today, you can virtually find electrodes to suit any chemical composition of the base material. All the welding required is done by government approved boiler grade welders, thus ensuring a weld free from any blowhole. To further ensure that the welding had been completely free from any blowhole etc., all welding joints are X-ray tested.

Being an MS structure, fitment of siphon pipes, catcher trays etc., is easy job. All siphon pipes are well designed for uninterrupted condensate flow, and provided with flanged joints, for an easy replacement if required in future. The pipes used are seamless class A pipes, though in many installations, ERW "C" class pipes are working satisfactorily.

Finally, after fitting of journals, a hydraulic test is made at 1.5 times the working pressure to ensure all weld joints free from leak. Having done that, the MG is subjected to stress relieving (SR) process, where it is allowed to stay at  $620 \pm 20$  deg. C temperature for four hours, and then the temperature is gradually reduced. The object of SR is to eliminate the possibility of any welding stresses, that may be residing in the equipment since earlier stages of manufacturing, removed away.

After SR, if required, MG can be spray coated with a metal of higher hardness, to improve its wear resistance, and longer service duration between two grindings. Well-equipped workshops, and well-qualified and experienced operators are the key of excellence in MG manufacturing.

### **Conclusion:**

The above discussion indicates that it is even better to have a new machine installed with MS MG cylinder in place of a CI one. On machines with old CI cylinders, next replacement should be with an MS MG cylinder.