DC SWITCHING DEVICES that can change the SUCCESS STORY

Steel, Rolling and Cement mills are among the biggest user of DC Motors & other DC loads today. Handling of DC loads itself is a big challenge, above that, the environmental conditions in these industries are so tough that it makes it all the more important to select the right product, which can perform well in these harsh conditions.

The contactors that are meant to handle AC loads can't be used in DC loads. One needs to choose specialized DC range of contactors for the handling of the DC loads. This article will help designers to know about significance of correct DC contactors selection in tough environments such as steel mills, cement mills, rolling mills, mining, railways, Solar plants, Wind turbines, DC power cranes & DC magnet cranes (Handling scrap in steel mills)

Some basics about Contactor:

Contactor is basically a switching device and is used for switching the loads where frequency of switching loads i.e. number of switching operations are very high. Any basic contactor will consist of fixed contacts, moving contacts, moving armature, moving core, fixed core and a coil. Moving contacts, armature and moving core are connected to each other, held off by using spring over the fixed core.

As soon as supply is given to the coil of the contactor, fixed core gets magnetised due to electromagnetic effect and it pulls the moving core, armature and hence, moving contacts towards the fixed contacts to close the contactor and power supply is fed to the load. As soon as supply is removed to coil, spring between the moving and fixed core forces the moving core to move away from fixed core and as a result, moving contacts moves away from fixed contacts and circuit will get disconnected. Graphical representation of contactor

Arc formation during opening of contacts in AC & DC switching

As the contacts starts opening, the air between the contacts acts as an insulator and dielectric strength of air causes the drop in the voltage. This drop in voltage increases the current momentarily, results in high temperature and causes the contact material to get melts and vaporize to form the arc. As the contacts continues to separate and dielectric of air medium increases, current flow drop rapidly and voltage increases as the current reaches close to zero. This increase in voltage will cause the ionization of surrounding air and causes the arc to sustain for long time. It is when contacts separated by a wide gap that dielectric strength of the air gap increases up to an extent that it overcome the ability of arc to sustain and hence, results on stop of current flow finally. So basically, how efficiently you are able to increase the dielectric strength of air gap, while opening of contacts in a contactor, is the one of the key issues while designing any contactor.

Arc quenching

DC current switching is more severe as compared to AC as it does not get benefit of current going through a zero, as in the case of sinusoidalcycle of AC current, which helps deterioration of arc in AC contactor. So extinguishing of arc in DC depends more on contactor mechanism and technology used in it to break the current flow.

A sustained arc increases the erosion of contact material and more likely to get the contact welded and it will put many things at risk.

Depending upon the rating of contactor, there are different methods, by which arc can be quenched in a DC contactor. Contactors upto 50A, 600VDC rating, an increased air gap (i.e. increased dielectric strength) can be achieved by having a 'strong spring' to open the contact. Here in this case, coil of contactor also has to be equally strong to keep the contactor in closed condition against spring pressure.

Above method of arc quenching is not sufficient for higher rating contactors, there is a need to use other methods of arc quenching. The most efficient one is 'Magnetic blow out' method. Here a stray magnetic field is created around the area of contacts where arc is formed & this magnetic field blows the arc into arc chutes. The arc chutes are designed in such a way that it breaks the arc paths by increasing the dielectric resistance. The arc chutes are held in its position by leaf spring which resists violent shock or vibration as mounted on equipment such as overhead cranes etc.

DC mill duty contactors, having two coils, normal closing coil & holdout coil are known as DC inductive time limit (Ltl) contactors. When closing coil is energised, the contactor will not pick up until the magnetism of holdout coil has decayed sufficientlyto permit the contactor to close. Ltl contactors are used for controlling the acceleration or plugging functions in hoist & travel applications.

DC contactors work in the most challenging environment and they are finding new application in wind and solar, acting as a main switch for solar panels to central inverter where they need to break DC current at high voltages.

DC switching is one of the most critical applications and there is a need to use tested products only that meet all the requirements of IEC standards. Any low cost contactor used here would carry the risk of contacts getting welded and putting the system & personal life at risk.

BCH DC contactors already proven for years in Steel, cement & crane applications.

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