PROBLEMS FROM THE PLANT

Exercise your engineering wits by submitting answers to this question, fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

How Is Slipring-Motor Resistance Calculated?

We have a 150-hp 440-v 3-phase slipring conveyor motor that has caused us to change hookup twice. It is apparent that the wrong secondary grid resistors have been shipped with this installation. We have about doubled the size of the bank, but still don't get proper speed regulation. We operate it from a 12-step drum-type controller on the secondary. It is started and stopped with start-stop pushbuttons through a magnetic contactor in the stator circuit. The primary current is 176 amp and the secondary current 190. The speed is 1150 rpm.

On the first test, under no load the rotor started at about 1000 rpm. The grids were then rearranged and some added, to give about double resistance. On the second test under full load the starting speed was still high as it was over 800 rpm.

I would appreciate it if some POWER readers would give me a formula or other definite information that I can use to determine the correct cross section and resistance of the grids for the 12-step controller. I want a resistance that gives maximum safe starting torque and equal acceleration up to full short circuit of the rotor.—*JHV*

Readers' Answers

How Can I Stop Belt Slippage on Flywheel?

(This question is from Oct issue with best answers from readers.)

We have trouble with slippage of a belt that drives an ac generator from a steam engine. The unit, an 18x42-in. 400-hp corliss with a 15-ft. flywheel, has a 28-in. face. The engine runs about 102 rpm and drives a 275-kw 60-cps ac generator through a 34-in. pulley. Generator speed is 514 rpm. Belt is 28 in. wide, of 3-ply leather. Center-to-center distance from generator pulley to engine flywheel is 20 ft, 8 in. A heavily weighted idler at the generator gives a good belt wrap on its paper pulley. Usually the generator runs synchronized with an outside power source.

Trouble is that when we carry a heavy load of about 250 kw on the generator the belt slips on the engine flywheel, as the polished condition of the metal flywheel face shows. Slippage heats the belt noticeably and is shortening its life considerably.

I have heard that a rider belt, about half the width of the main belt and riding on top of it, greatly helps this condition. Do POWER *readers agree or have they a better solution?—IM*

Change Tension And Adjust Idler

Assuming average alternator and belt efficiencies I find that about 380 hp is transmitted for 250 kw. A 24-in. triple-ply heavy-leather belt should transmit 400 hp continuously without undue wear. Excessive load does not cause excessive slip.

I will pass over expensive solutions, such as facing the flywheel or mounting the alternator on a pivoted base so reaction torque increases belt tension with load. We can still make improvements by relocating the idler or increasing belt tension, or by doing both.

At present the idler is in position *B*, see sketch below. This gives good belt wrap on the small pulley. Actually, the coefficient of friction *f* times the angle of wrap need be only the same for each pulley. Since *f* for paper is 1½ times *f* for iron, the angle of wrap on the flywheel should be 1½ times that on the paper pulley. It is about this without any idler at all. The ratio is now 214 to 146 deg. Hence, if the idler is used to increase angle of wrap, it would be far better mounted at *C* where it gives 270 deg on the flywheel and 180 deg on the generator pulley.

The given speeds indicate 4.8% slip. A trial check shows that belt tension must be low. This can be increased by increasing the load on the idler, whether in position *B* or *C*, or by shortening the belt and forcing idler to position *A*. The vector diagrams on the sketch below indicate how much this increases belt tension without increasing idler bearing loads.

It is unusual to operate a belt wider than 26 in. on a 28-in. pulley face. Working along the edges of a 28-in.