

PODCAST EPISODE TRANSCRIPTION

Episode Summary:

In this episode Tom Bailey and Jim Jacoby (VP of Technology at Tri-Sen) discuss the usefulness of dedicated surge detection as part of a compressor controls solution.

Tom [[00:20]]: Hi, and welcome to the Turbo Machinery Controls podcast, where we will be informally discussing turbomachinery controls and turbine safety-related questions and topics. Opinions expressed here are our own and not necessarily those of Tri-Sen. I'm Tom, and I'm with Jim Jacoby, vice president of technology here at Tri-Sen.

Jim [[00:38]]: Hey Tom.

Tom [[00:39]]: Hey Jim.

In this episode, we're going to be talking about a question that came up from a customer. They understand API670, and what, what they asked was; 'okay, forget about that for just a second [API670], do I really need surge detection?'

So what do you think, Jim?

Jim [[01:04]]: Yeah, that actually is a pretty good question. The answer is it depends.

Surge detection is not all that new. Probably the first surge detection was an operator running into the control room yelling, "Hey, we're surging the compressor." As early as the eighties, John Gaston at Dresser-Ran came up with a design that he patented that detected a surge in axial compressors. And it was effectively measuring using two thermocouples. One was a bare thermocouple, and the other one was in a thermowell. He could tell if he got a real quick change in the inlet temperature that he just swallowed a bunch of discharge gas. So he had a surge event, and because axial compressors are so sensitive to a surge, they use that as a method to react either by throwing the surge valves open or tripping the machine. Now moving beyond an axial, you start thinking about, well, what about a centrifugal.

Tom [[02:17]]: Sorry, sorry, let me interrupt just real quickly before we move on; what is it about the axial [compressor] that makes it so susceptible?

Jim [[02:23]]: Okay. So, you know, an axial looks more like a steam turbine rotor. It has a bunch of bare blades that are protruding radially from a hub. And each of those blades has a resonant frequency that is not that different from some of the forcing function frequencies that can pass through the aerodynamics of that rotor.

So if you surge the machine, you have an axial movement that can excite that long, thin blade that's standing up off the rotor. It doesn't take much to snap them off. And if one of those [blades] breaks loose, then it goes through and wipes out the whole compressor. On a centrifugal [compressor], on the other hand, the blades are between a hub and a cover that significantly stiffens that blade. So it's not something that's going to be easily excited or stressed by an axial displacement of the rotor.

Tom [[03:25]]: I guess we should say quickly that when we're talking about surge detection.. so if it happened [blade broke loose] on the very first time, there is nothing a surge detector could do about that anyway. For an axial compressor, if you surged and the blades snapped off because of the vibration, that would be that. The surge detection doesn't prevent that. It just alerts you that you have had a surge [event]. So the thing about [an axial compressor], is it's sensitive [to surge] and cannot really withstand them very often, I guess, is the point

Jim [[03:53]]: That's right.

One surge... if it breaks after one surge it, was not a very good compressor. But if you repeatedly surge it, you create the stresses and frequencies that are going to cause that blade to snap off. But again, that's an axial machine.

And in our world, the API world, we typically only see axial machines on the air blowers for a cat cracker. That's about it. Beyond that, they are pretty common for the low-pressure section of a mixed refrigerant machine and in the biggest newest L&G plants, but you do not see them otherwise in the petrochemical world.. they are there for air service.

Acrylic acid plants, nitric acid plants, you will see them. So, you know, in the API world, do you need surge detection? Yes. On axial compressors. Definitely. The consequences of surging those things repeatedly are just too expensive.



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Now on a centrifugal, that's another thing. To me, it's gingerbread because nobody's going to trip their centrifugal compressor just because they surged once or twice. Now, if you have got repeated surges, you know, maybe the valve is stuck and you cannot get out of surge, you should trip, but do you need to have a separate system to do that? And anything that is going to trip a compressor in a refinery or petrochemical plant needs to have redundancy anyway.

You're never are going to trip a machine with a simplex device, a simplex input. So API says, "well, gee, if you are going to make everything redundant, you do not need the separate system." Put in a redundant system for your anti-surge, and you get a robust anti-surge controller that will tell you when it's not able to keep you out of surge. And then it can trip the machine based on repetitive surges.

A common way that is done is, for instance, maybe five surges in 20 seconds or 15 seconds, something like that. So if you surge two or three times and it clears itself, or the valve gets open enough to get you away [from surge], then you know, it was unfortunate, but it is not going to wreck your machine from a few occasional surges, and you do not wreck your process either.

Tom [[06:29]]: So great to summarize then axial definitely API says definitely, but also it just makes good sense. It sort of depends on a centrifugal compressor. API does give you some latitude with the implementation.

Jim [[06:45]]: Yeah. And as I said, you know, the problem for axials has been there forever from the beginning and, and the, the people that make those machines had been working on trying to come up with a good way to, to protect them.

You know, basically like the one that John Gaston came up with. And that is primarily what the API recommends as well. So you do not necessarily have to have a separate surge detection system. You can do it with a redundant anti-surge control.

Tom [[07:17]]: Yeah. Right. And so at that point, it becomes a kind of interesting, like what is surge detection, you know, because part of surge control is detecting surge.

So that is it for this episode. Drop us an email at turbomachinerycontrols@tri-sen.com and let us know what you've got on your mind. Thanks for listening. We'll see you next time.

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