

Testing inrush on Engel MT45 12V portable fridge/freezer
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Current probe is Fluke Y8100
Oscilloscope is Tektronix TDS2014B

Scope setup as follows.

- Channel 1 is a current probe, range is set to the 20A maximum value. Output is 100mV/A so full 2V signal would represent 20 amps.
- Channel 2 is the voltage at the battery terminals.

Current measurement location is taken at battery end of cable.

Figure 1 shows voltage and current powering on the fridge. So there's an inrush that's probably a control circuit or inverter capacitors charging. It's 15 minor ticks so 3 divisions at 200mV/division. That 600mV peak represents a 6A initial inrush. It lasts about 3 time divisions at 25 milliseconds per division, so about 75ms before dropping back to nearly zero current drawn.

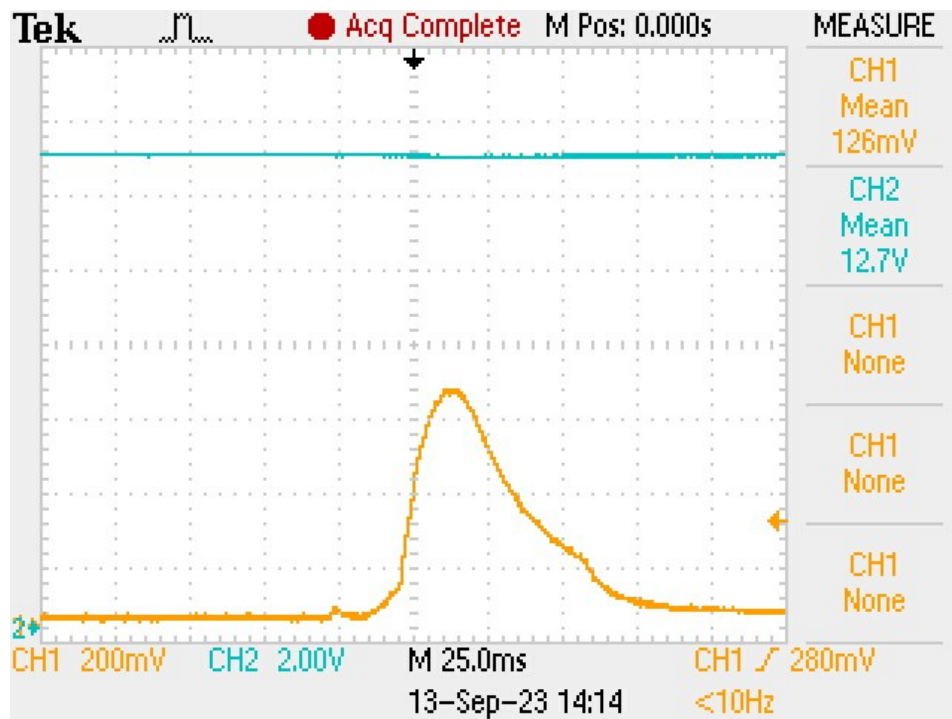


Figure 1: Powering On Fridge

Figure 2 shows inrush as the compressor starts. That shows a peak of 1.26V and lasts about one division plus a tick or two before settling to the running current. So that's an inrush of 12.6A for, let's say, 35ms.

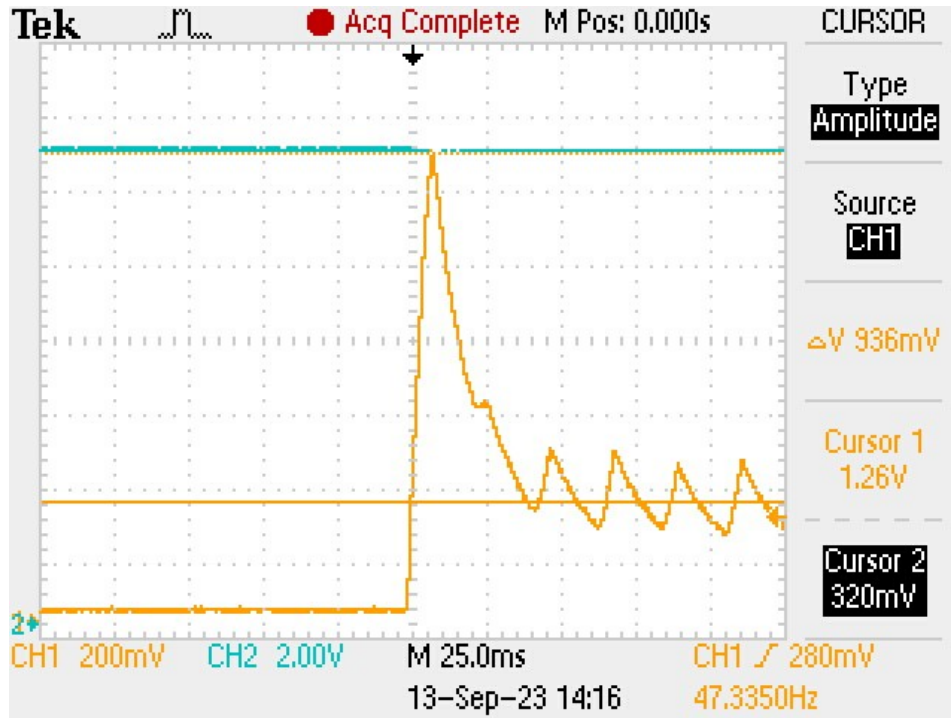


Figure 2: Compressor Start

Figure 3 shows running voltage and current, mean is 273mV indicates 2.73A with a 47Hz ripple. I didn't have min/max measurement on but we can approximate just by sight that the ripple is varying between about 2.5A and 3A to arrive at that mean.

I haven't done anything in depth to understand the ripple. I'm running from a big battery so it's not a power supply artifact. Must be something to do with the fridge. Whether it's the compressor itself, a control circuit or inverter I can't really say. When I measure the sound 47Hz is peak audio frequency (42dB is the SPL at about a foot away, if anyone's interested) so I assume that's the compressor speed.

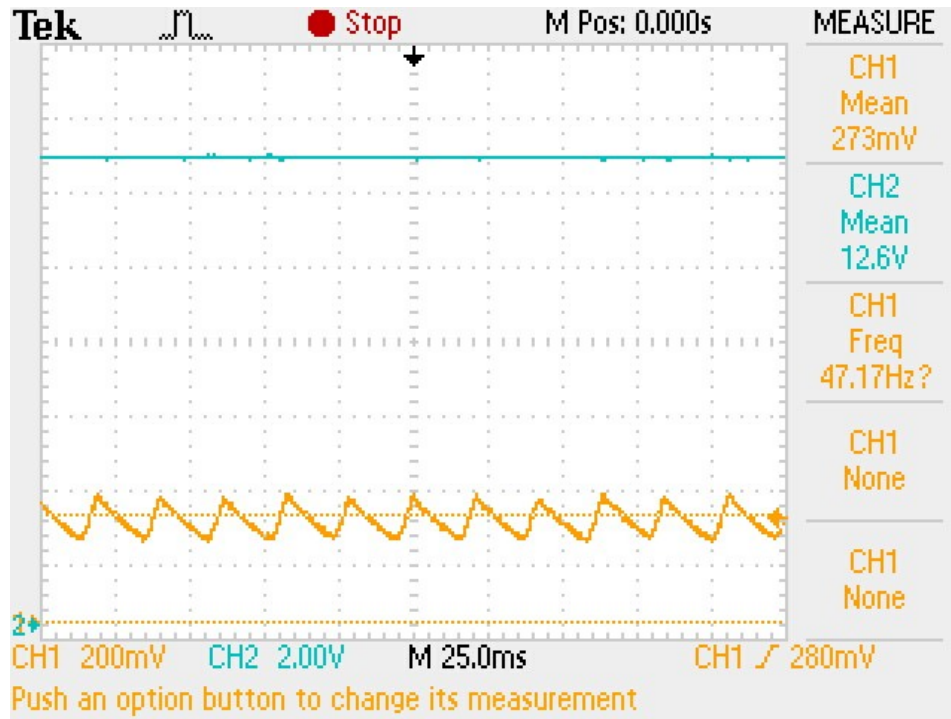


Figure 3: Compressor Running

Looks like there is significant inrush with the Engel fridges. The choice of a 15A fuse doesn't seem off. You could go down one step to a 10A but then you may have to be careful with the time-current game. The time is short enough that a fast acting probably will be fine since the inrushes all seem to be less than 100ms. You'd have to start worrying at about 1 second, at least with an ATC fast type.

Time-Current Characteristic Curves

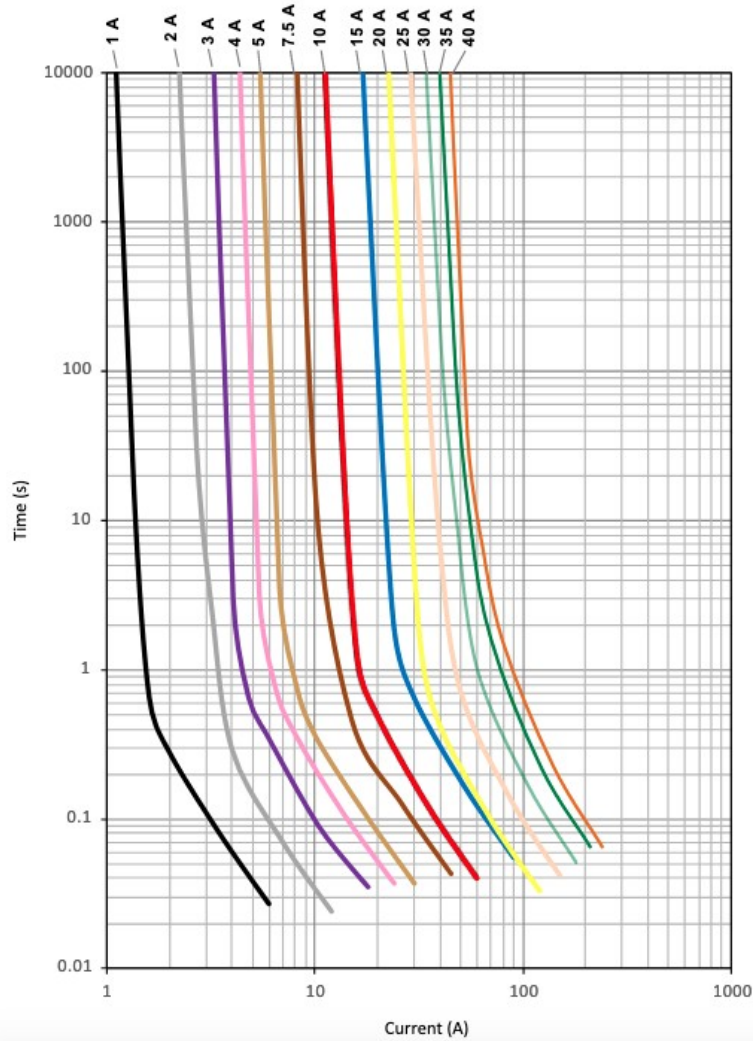


Figure 4: ATC Fuse Curves

However, the argument I've made a couple of times that each time the compressor kicks on the inrush may cause an instantaneous voltage drop I think could be valid still.