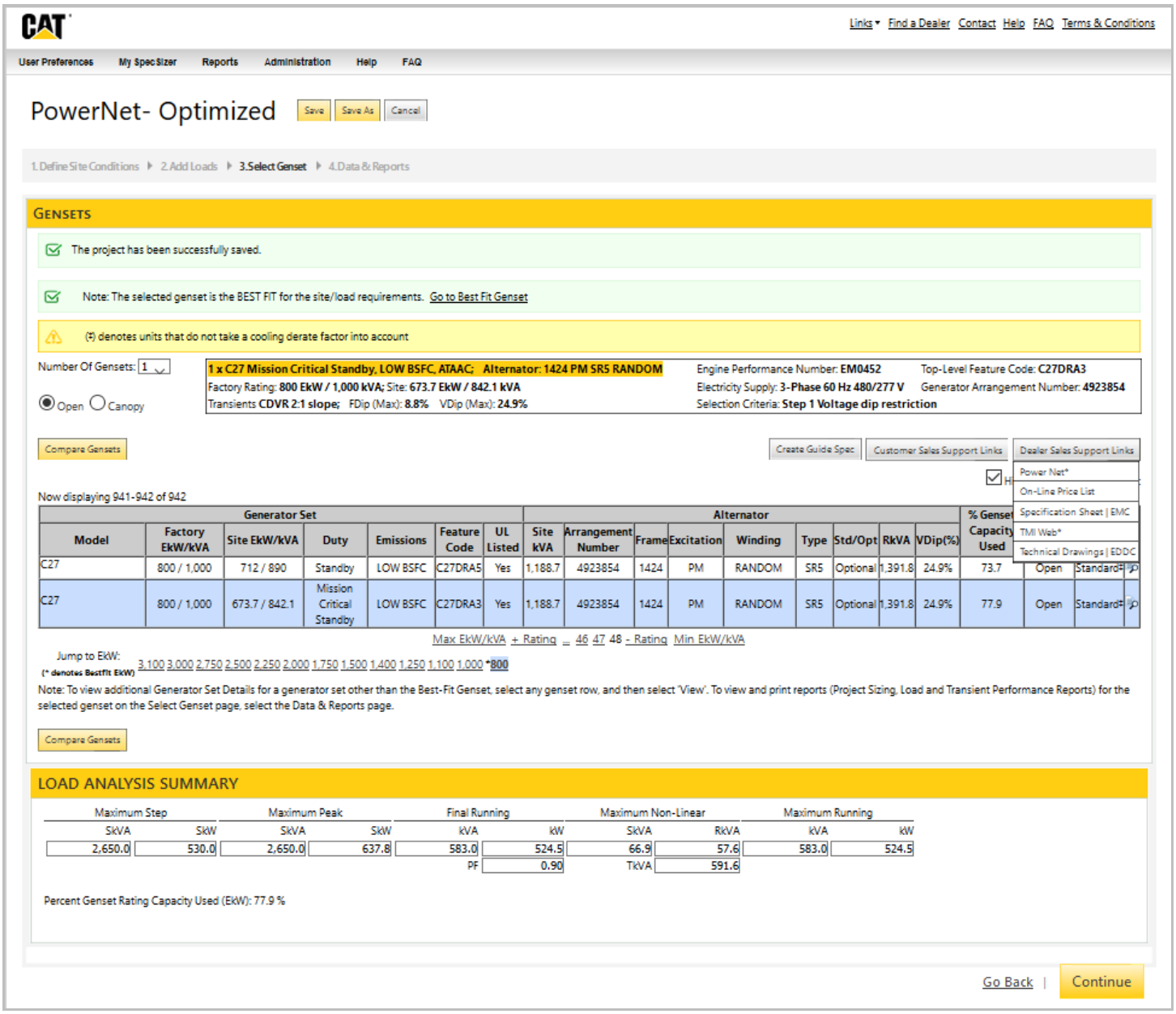
A Brief Guide to Interpreting a SpecSizer GenSet Sizing

SpecSizer sizes and recommends a “Best Fit” genset based on examining several parameters, then selecting a genset that satisfies all of them. While some of the math may be complex, the basic principals are straightforward.

Details about the program selected row in the upper Generator and Alternator Selection grid should be compared to the calculated load summary values in the “Load Analysis Summary” at the bottom of the screen.



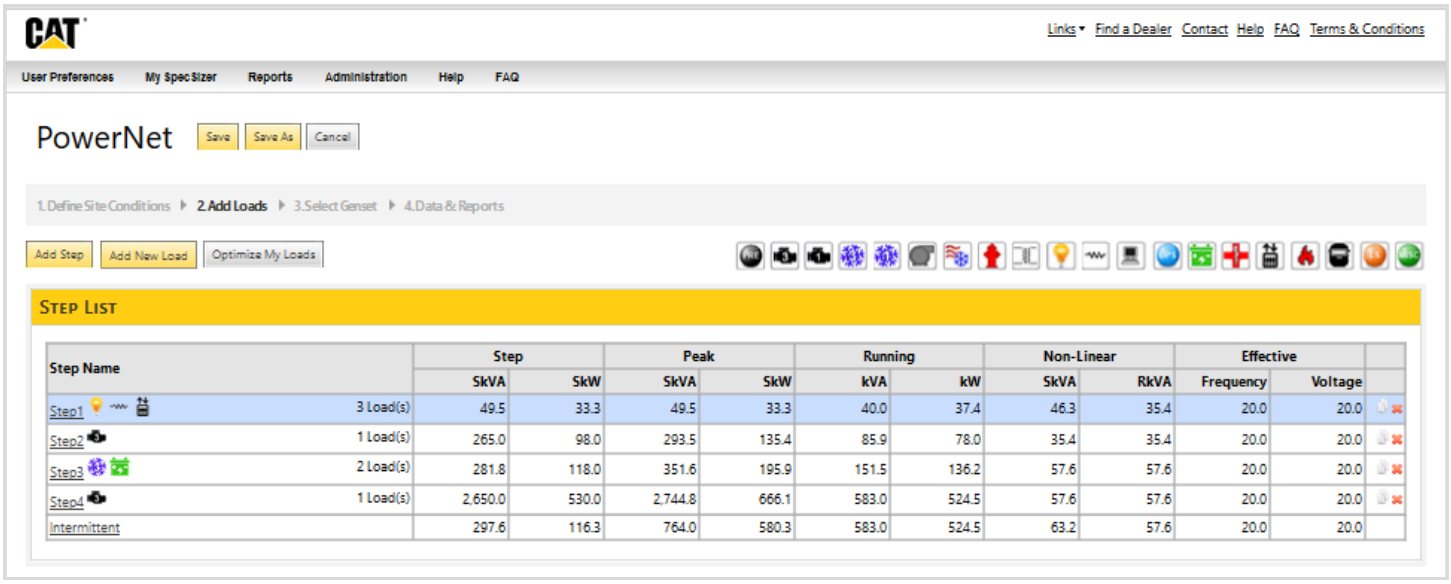
Note the columns above for Generator Set, for EkW/kVA. The leftmost column, labeled “Factory EkW/kVA”, displays the advertised genset ratings found in TMI, Price Lists, or on Spec Sheets.

The adjacent column labeled “Site EkW/kVA”, displays the “available” genset rating based upon site conditions set by the user for their project on SpecSizer’s “Define Site conditions” page. For this example, the program

selected C27 genset derated from 800/1000 EkW/kVA to 673.7/842.1 EkW/kVA based upon altitude and/or ambient restrictions. Important: rating selections MUST be made from the "Site EkW/kVA" column, not the "Factory EkW/kVA" column. At times, both column values may be equal.

ENGINE:
As an absolute minimum, the "Generator Set **Site EkW**" must equal or exceed "**Final Running kW**" (displayed in the LOAD ANALYSIS SUMMARY). Another key requirement is the engine must meet any required emissions (U.S. EPA, EU, China or India) certifications.

Next, the engine EkW must be large enough to start the Maximum **"Peak SkW"**. For a single-step site (i.e the "Add Loads" page is only one load step), the Peak SkW is the Step SkW. In a multiple load step scenario, the Peak SkW is the summation of the Running kW through the current step, plus the Step SkW of the next load step. Depending on the load arrangement, the Maximum **"Peak SkW**" will typically - but not always - occur during the last load step of the load scenario. Regardless, the "**Maximum Peak SkW"** is the highest Peak SkW, no matter which load step in which it occurs.



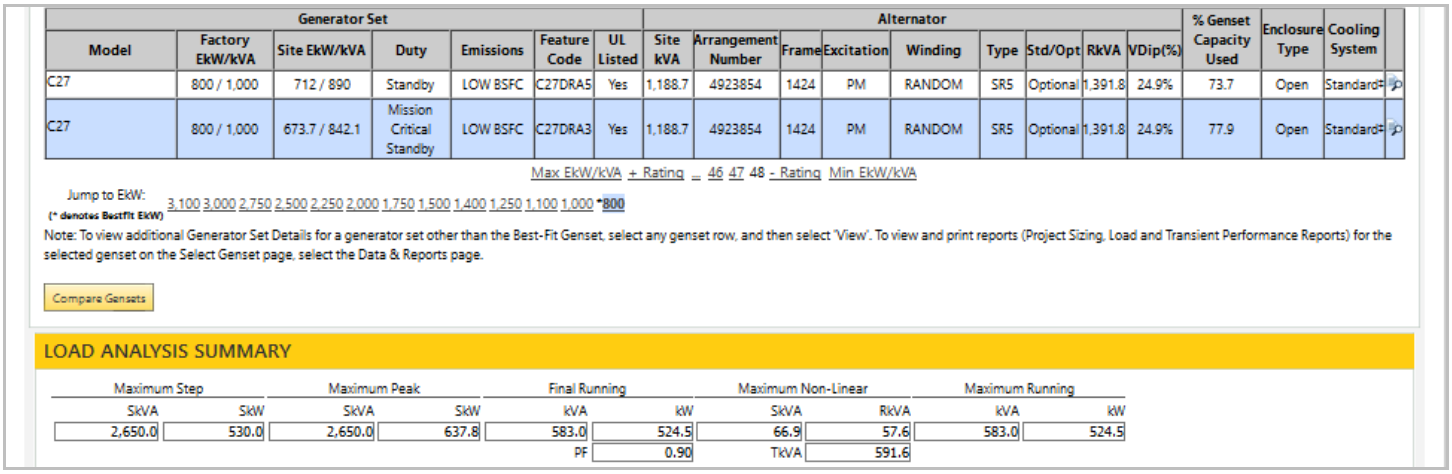
Step Name		Step		Peak		Running		Non-Linear		Effective		
		SkVA	SkW	SkVA	SkW	kVA	kW	SkVA	RkVA	Frequency	Voltage	
Step1	3 Load(s)	49.5	33.3	49.5	33.3	40.0	37.4	46.3	35.4	20.0	20.0	
Step2	1 Load(s)	265.0	98.0	293.5	135.4	85.9	78.0	35.4	35.4	20.0	20.0	
Step3	2 Load(s)	281.8	118.0	351.6	195.9	151.5	136.2	57.6	57.6	20.0	20.0	
Step4	1 Load(s)	2,650.0	530.0	2,744.8	666.1	583.0	524.5	57.6	57.6	20.0	20.0	
Intermittent		297.6	116.3	764.0	580.3	583.0	524.5	63.2	57.6	20.0	20.0	

This is the final engine criterion, unless the user selects "Frequency Limited" sizing for "Sizing Method" on the "Define Site Conditions" page. In this case, SpecSizer will select an engine that can accept the largest **Step SkW** that will not exceed approximately a 10% frequency dip. This is an internal calculation, not visible to the user, based upon data imported into SpecSizer from actual factory genset transient response tests for each genset model. CAUTION: Single-step, Frequency Limited sizing typically results in a much larger EkW/kVA rated genset selection. Not all loads are typically restricted to such rigid frequency dip requirements.

ALTERNATOR:
Alternator selections differ from engine selections in that the results of undersizing aren't always immediately apparent. Undersizing an engine can result in an inability to reach rated speed, or even stall a genset. On the other hand, undersizing (and overheating) an alternator may not be discovered until the insulation prematurely fails, possibly thousands of hours later.

As an absolute minimum, the alternator must be large enough to carry the calculated load and site running kVA. Thus, the selected Generator Set "**Site kVA**" must equal or exceed the "**Final Running kVA**" displayed in

the LOAD ANALYSIS SUMMARY. In line with industry standards, the Generator Set Site kVA is the kVA available at 0.8 power factor. Thus, the Generator Set **Site kVA** is equal to the Generator Set **Site EkW** divided by 0.8 PF, and represents a minimum kVA for that GenSet package. For the example genset shown, for 0.8 power factor, 671.7 EkW / 0.8 PF = 842.1 kVA. And for minimum required Generator Set **Site kVA**, 842.1 Site kVA exceeds 583.0 Final Running kVA.



Generator Set							Alternator											
Model	Factory EkW/kVA	Site EkW/kVA	Duty	Emissions	Feature Code	UL Listed	Site kVA	Arrangement Number	Frame	Excitation	Winding	Type	Std/Opt	RkVA	VDip(%)	% Genset Capacity Used	Enclosure Type	Cooling System
C27	800 / 1,000	712 / 890	Standby	LOW BSFC	C27DRA5	Yes	1,188.7	4923854	1424	PM	RANDOM	SR5	Optional	1,391.8	24.9%	73.7	Open	Standard
C27	800 / 1,000	673.7 / 842.1	Mission Critical Standby	LOW BSFC	C27DRA3	Yes	1,188.7	4923854	1424	PM	RANDOM	SR5	Optional	1,391.8	24.9%	77.9	Open	Standard

Max EkW/kVA + Rating _ 46 47 48 - Rating Min EkW/kVA

Jump to EkW: (* denotes Bestfit EkW) 3,100 3,000 2,750 2,500 2,250 2,000 1,750 1,500 1,400 1,250 1,100 1,000 *800

Note: To view additional Generator Set Details for a generator set other than the Best-Fit Genset, select any genset row, and then select 'View'. To view and print reports (Project Sizing, Load and Transient Performance Reports) for the selected genset on the Select Genset page, select the Data & Reports page.

Compare Gensets

LOAD ANALYSIS SUMMARY

Maximum Step		Maximum Peak		Final Running		Maximum Non-Linear		Maximum Running	
SkVA	SkW	SkVA	SkW	kVA	kW	SkVA	RkVA	kVA	kW
2,650.0	530.0	2,650.0	637.8	583.0	524.5	66.9	57.6	583.0	524.5
				PF	0.90	TkVA	591.6		

Caterpillar gensets are available with one or more oversize alternators to account for low power factors, unbalanced loads, non-linear loads, or restrictive voltage dips. Thus the "Select Genset" page's column "**Alternator Site kVA**" represents the kVA of the associated Alternator, derated if necessary for site ambient conditions or voltage selection. It will often exceed, but never be less than the **Generator Set Site kVA**. For the above example, 1,188.7 Alternator Site kVA > = 890 Generator Set kVA.

As mentioned above, the alternator must also have sufficient capacity for any unbalanced load. SpecSizer will balance single-phase loads as equally as possible, but will scale the final running kVA as necessary to account for the most heavily loaded phase.

Another factor requiring alternator capacity is non-linear load. Examples include battery chargers, fluorescent lights, UPS, VSD/VFD motors, etc. The "**Final Running kVA**" represents the calculated RkVA of all connected loads. The **"Maximum Non-Linear RkVA"** represents the calculated RkVA of all connected non-linear loads, but does not include any oversizing allowance.

The **"Maximum Non-Linear TkVA"** (Total kVA) includes the calculated kVA of all connected linear and non-linear loads, but also includes an allowance for the severity of each of the non-linear loads in the load scenario. Thus, the last kVA computation selects an **"Alternator Site kVA"** that equals or exceeds the **"Maximum Non-Linear TkVA"**. In effect, the TkVA is the Final Running kVA increased for the non-linear loads' harmonics and distortion.

The final analysis for an acceptable alternator is the transient effect of voltage dip. Each load step (if more than one) may have a different voltage dip, which equals and is limited to the largest load Vdip of that load step. For example, Gas discharge lights are limited to a maximum load Vdip of 25% to avoid extinguishing. Therefore, the selected GenSet should not have a voltage dip in any step that exceeds the voltage dip limit for that step.

In summary, the "Best Fit" GenSet is the smallest GenSet that meets all the above criteria.