

Event Power in Depth

Module 5 gave you the basics. This module goes deeper: build a load sheet, stop multiplugs and couplers overloading, keep joints dry, size and run a 20, 30 or 50 kVA generator, balance three phases, understand earth leakage, and know exactly where crew stop and the electrician starts. Two live tools let you try the sums.

B&W Productions · Proper Planning, Prevents Poor Performance

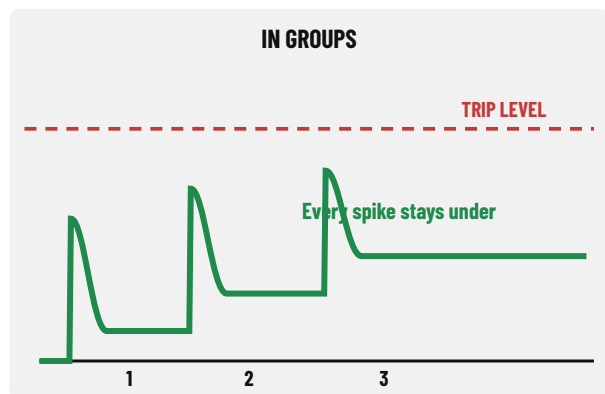
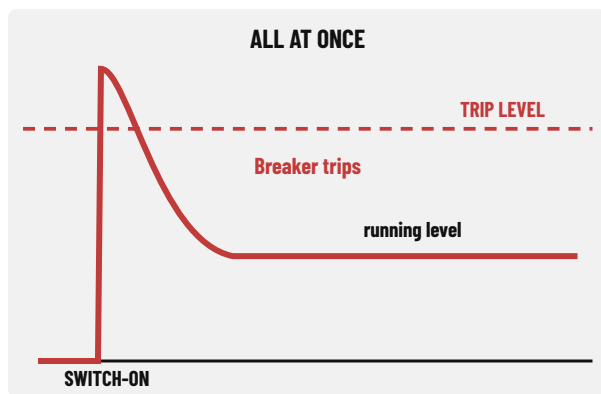


01 The load sheet: what your kit actually draws

Module 5 taught you $\text{amps} = \text{watts} \div 230$. This lesson is the next step: write down every item that will be plugged in, find its real draw, and work out the supply before you leave the warehouse. That list is the **load sheet**. A load sheet that is wrong by a few kilowatts is how a show goes dark at 20:00.

Running watts and inrush

Every item has two numbers. **Running watts** is what it draws once it has settled. **Inrush** is the surge at the moment of switch-on. Amplifiers, powered speakers and the motors in moving heads can pull several times their running current for a fraction of a second. A breaker sees that surge. Switch ten items on together and the surges stack on top of each other.



Same kit, same running level. Switched on all at once, the surges add up and cross the trip level. Switched on in groups with a few seconds between, each surge fades before the next starts.

POWER UP IN GROUPS

Biggest and most surge-prone first: amp racks and subs, then tops, then moving heads, then LED PARs, then catering. A few seconds between groups. Never throw every breaker at once.

Typical draws

These are planning ranges, not specs. Your own kit has a label or plate with the real number. **Check the label** and use that. When the label gives a maximum, remember most kit runs well below it, so the label is the safe side of the sum.

CATEGORY	TYPICAL RUNNING DRAW	SWITCH-ON SURGE	NOTE
Powered top	200 to 600 W	Noticeable	Draw climbs with volume. Label shows the maximum.
Powered sub	400 to 1 000 W	Noticeable	The biggest sound load per box.
Amp rack	500 to 2 000 W	High	Depends how hard it is driven. Use the plate.
LED PAR	40 to 150 W	Low	Many small loads add up fast.
Moving head	150 to 400 W (LED); 400 W up for lamp types	High	Motors reset all at once at power-up.
Haze or smoke machine	500 to 1 500 W	None (heater)	Heater load while warming up.
Tea urn	2 000 to 3 000 W	None (heater)	Steady and big. One urn is a whole 16 A circuit.
Laptop, DJ gear	100 to 400 W	Low	Small, but it must never lose power.

B&W habit: the PA (amp racks, tops and subs) goes on its own phase, lighting and effects on another, and catering and heaters on the third.

TRY IT: BUILD A LOAD SHEET

Pick a quantity for each item and the phase it plugs into. The tool adds it up and tells you the smallest supply that fits at 80%. Values are mid-range planning figures: replace them with the label on your own kit.

ITEM	PLANNING W EACH	QTY	PHASE
	400		
	600		
	1500		
	80		
	250		
	800		
	2000		
	200		

SUPPLY	WORKING LIMIT (80%)	RULE USED
16 A single-phase	12.8 A	Total amps
32 A single-phase	25.6 A	Total amps
32 A three-phase	25.6 A per phase	Worst phase
63 A three-phase	50.4 A per phase	Worst phase

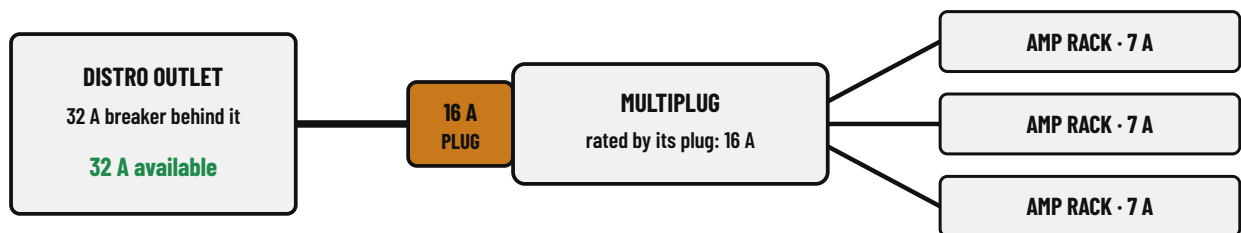
Example: 3 subs and 4 tops on L1 (14.8 A), 12 PARs and 6 moving heads on L2 (10.7 A), a haze machine, an urn and 2 laptops on L3 (13.9 A). Total 40.3 A, worst phase 14.8 A: fits a 32 A three-phase supply. The phases are within 30% of each other.

02 Sockets, multiplugs and couplers: not overloading



What not to do: a multiplug plugged into a multiplug, every socket full. The scorch mark is the warning you get before the fire.

Most overloads are not at the generator. They are at the last few metres, where one cheap multiplug feeds far more than it can carry. The rule is simple: **every joint in the chain is only as strong as its weakest part.**



21 A of kit through a 16 A plug: it heats, the 32 A breaker never notices

A breaker protects the cable behind it, not whatever is plugged in downstream. The plug on the multiplug is the limit, so the multiplug is a 16 A multiplug no matter how big the outlet is.

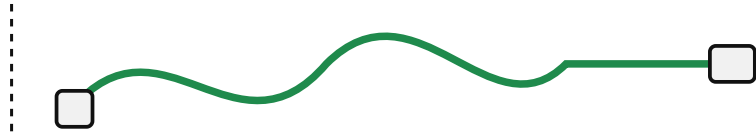
The rules

- **A multiplug is rated by its plug.** A 16 A multiplug in a 32 A distro outlet is still a 16 A multiplug. The 32 A breaker will not save it. Add up the amps on the multiplug (watts ÷ 230) and keep it under 12.8 A.
- **Never daisy-chain multiplugs.** A multiplug into a multiplug adds a joint and adds load to a plug that was never rated for it. Go back to the distro for another outlet.

- **Wall sockets share one circuit.** Four wall sockets in a hall may all sit on the same 16 A breaker. Ask the venue, or treat the whole wall as one circuit. Plugging a urn into the next socket does not give you a second 16 A.
- **Unwind a cable reel fully.** A coiled reel under load cannot lose its heat. Its rating when wound is much lower than when unwound. The label shows both numbers.
- **Heat at a plug means stop.** A plug or multiplug that is warm, discoloured or smells of hot plastic gets switched off, unplugged and tagged. Find out why before it goes back.



WOUND: heat is trapped, low rating



UNWOUND: heat escapes, full rating

Both reels hold the same cable. Only the unwound one can shed the heat it makes.

NO EXCEPTIONS

Never fit a bigger breaker or fuse to stop trips. The trip is telling you the load is too big for that circuit. Move load to another outlet or another phase.

03 The chain on site



Trailer generator, 63 A red outlet



63 A three-phase distro, 32 A outputs



63 A to 2 x 32 A splitter



32 A distro to 16 A outlets



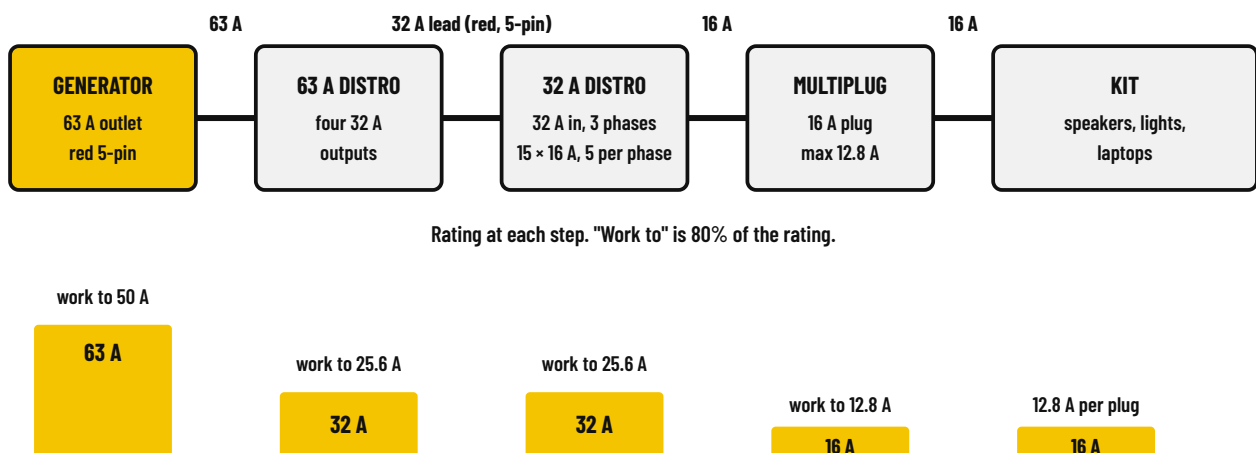
32 A to 3 x 16 A inline distro



Janus coupler, last metre

Typical event-power kit, from the generator to the last metre. Each step down has its own breaker. Product photos: manufacturers and hire companies; your own distros may look different, the rule is the same.

Power always steps down: big and protected at the source, smaller and protected again at every step. Know what each link is rated for and you know what it can carry. This is the chain you will build on most jobs.



Each step down has its own breaker. A link-out passes the same current on to the next box, so a second distro chained off the first still shares the first one's 32 A.

In the B&W kit: the generator's 63 A red five-pin outlet into a 63 A distro (one 63 A inlet, four 32 A three-phase outputs, an ammeter per phase on the front), red 32 A five-pin leads to the 32 A distros (a 32 A three-phase inlet, 15 plug-top outlets, five per phase, each with its own trip switch), multiplugs off those outlets, and Janus couplers on the last metre.

Adaptors: what is allowed

ALLOWED	NEVER
Bigger supply to a smaller one, when the smaller one has its own protection. A 32 A distro outlet down to a 16 A lead is the normal case.	A small plug into a bigger socket. A 16 A lead pushed into a 32 A feed with an adaptor carries 32 A in a 16 A cable.
A purpose-made adaptor that is the same make as the connectors, undamaged and tagged.	Home-made adaptors, cut-off plugs, "temporary" wiring, a plug with the pins bent to fit.
The lead whose plug matches the socket. Colour and pin count match, so it only fits where it belongs.	Forcing a plug that does not fit. If it does not fit, it is not meant to be used there.

READ THE CHAIN FROM THE KIT BACK

Add up the amps on each multiplug. Add the multiplugs on each 32 A distro. Add the 32 A distros on the 63 A distro. At every step the total must be under the rating, and under 80% of it.



Joint in a cover box, off the ground



IP44 coupler cover box



Clip-on cable joint cover

Every outdoor joint goes in a cover, and the cover goes up off the grass. Product photos: manufacturers.

Water and power kill. Rain, a leaking tent, a watered lawn or a cooler box of melting ice all find the joints in your chain. Plan for water before it arrives. The rating on a piece of kit tells you what it was built to survive.

IP ratings

IP 6 5

FIRST DIGIT: SOLIDS AND DUST

- 0 = no protection
- 4 = keeps out objects over 1 mm
- 5 = dust protected
- 6 = dust-tight

SECOND DIGIT: WATER

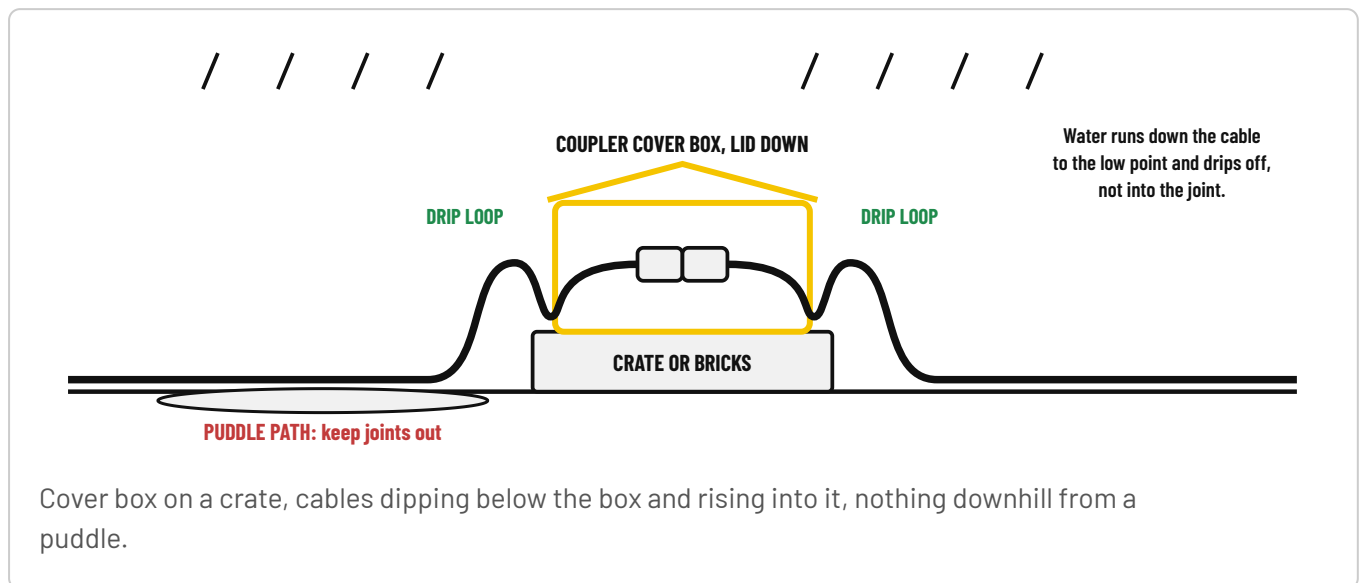
- 4 = splashes from any direction
- 5 = water jets
- 6 = powerful jets
- 7 = temporary immersion

Higher number, better protection. A rating only holds for a closed, fully connected item. An open socket or a plug half in is IP-nothing.

RATING	MEANS	USE IT FOR
IP20	No water protection	Indoors, dry, under a roof only
IP44	Splash-proof	Covered outdoor use, a light drizzle on a covered stage
IP65	Dust-tight, water jets	Outdoor lights that get rained on
IP66	Dust-tight, powerful jets	Heavy rain and hosing down
IP67	Dust-tight, temporary immersion	Kit that may sit in a puddle for a short while

Joints are the weak point

A plug and socket joint is the least waterproof part of your chain, whatever the equipment says. **Janus rubber couplers are not waterproof.** They stop fingers touching live pins. They do not stop water running in.



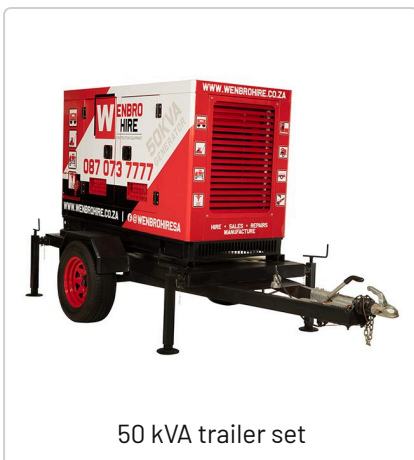
- **Cover box:** every joint outdoors goes in a coupler cover box with the lid closed.
- **Lift it:** joints sit on a crate or bricks, never on the ground.
- **Drip loops:** let each cable hang below the joint before it rises to it, so water drips off the low point.
- **Not in a puddle path:** look where rain will run. A slight slope moves water across your cable run.
- **Close the caps:** CEE caps shut on every unused socket.
- **Distros up:** on pallets or stands, lids closed, under cover.
- **Rain plan:** before the event, decide where distros and joints go if it rains, and who moves them.
- **Last resort only:** a plastic bag taped over a joint keeps off splashes for a short while and traps condensation. It is not a fix.

At B&W the Janus couplers on the last metre are rubber like any other: they get a cover box, a crate and a drip loop, and they are never left in a wet path.

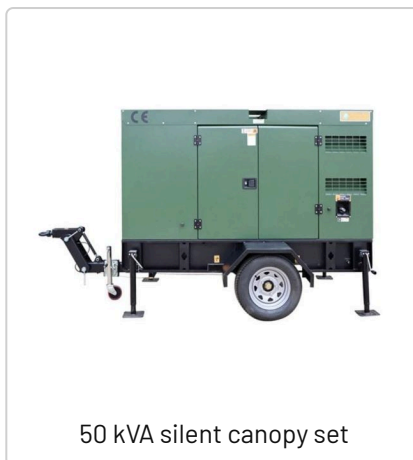
IF A JOINT HAS BEEN UNDER WATER

Switch off at the source. Do not touch it while it is live. Tag it. A qualified electrician checks it before it is used again, even if it looks dry.

05 Generator sizes: 20, 30 and 50 kVA



50 kVA trailer set



50 kVA silent canopy set

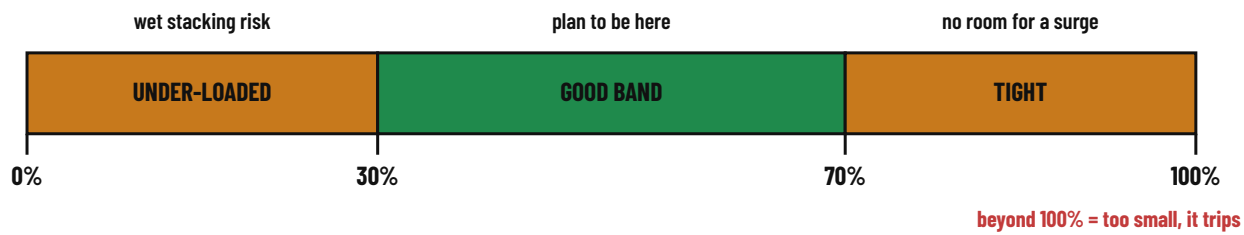
Typical 50 kVA event generators. A 20 or 30 kVA looks the same, only smaller. Product photos: SA hire and sales companies.

A generator sets the ceiling for the whole event. Pick one too small and the show trips. Pick one far too big and the engine suffers. The numbers below get you close; the plate and the hire company give the exact figures.

- **kVA × 0.8 = kW.** A 20 kVA set gives 16 kW. A 30 kVA gives 24 kW. A 50 kVA gives 40 kW.
- **Plan to use about 70%.** That leaves room for surges, a late-added urn and a hot day.
- **The Highveld takes power away.** At about 1 500 to 1 800 m the engine breathes thinner air. Budget roughly 10% less than the rating, and more in summer heat. This is a rule of thumb: the manufacturer's derating table is the real number.
- **Never run a diesel below about 30% load for long.** A lightly loaded diesel does not get hot enough, so unburnt fuel and soot build up in the exhaust. That is **wet stacking**: black smoke, soot, lost power and a ruined engine over time.

SET	KW (KVA × 0.8)	ON THE HIGHVELD (ABOUT -10%)	PLAN FOR 70% OF THAT	UNDER-LOADED BELOW 30%
20 kVA	16 kW	14.4 kW	10.1 kW	4.3 kW
30 kVA	24 kW	21.6 kW	15.1 kW	6.5 kW
50 kVA	40 kW	36 kW	25.2 kW	10.8 kW

B&W has 20, 30 and 50 kVA generators, each as a single-phase or a three-phase unit. Read the plate on the set in front of you before you plan the load.



Percent of the generator's available kW after derating. Aim for the green band. If the load is below it, hire the next size down.

TRY IT: SIZE A GENERATOR

Rated kW = kVA × 0.8. Highveld takes off about 10%, a hot day about another 5% (rule of thumb: use the maker's table). Plan for 70% of what is left. Under 30%, a diesel is at risk of wet stacking. Example: 30 kVA, three-phase, Highveld, 12 kW load: 24 kW rated, 21.6 kW usable, 56% loaded: good band.

06 Single-phase vs three-phase generators

The same kVA can be delivered two ways. A single-phase set gives you one supply. A three-phase set gives you three. Which you have changes how you plan the load.

SINGLE-PHASE SET

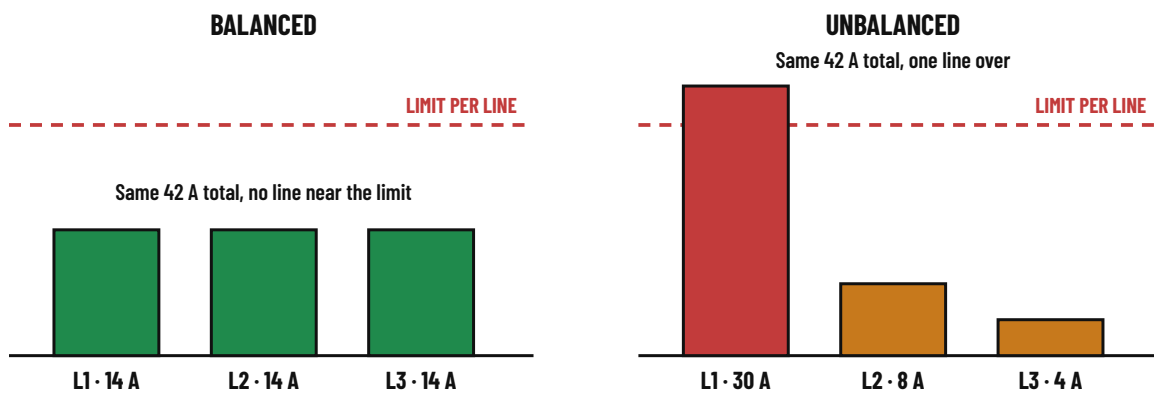
One 230 V supply. All the load is on one line, so the total amps are the line amps. Simple, and fine when the total load is small. The distro just splits that one line into outlets.

THREE-PHASE SET

Three 230 V lines (L1, L2, L3) and 400 V between any two of them. Each line carries a third of the set. You must spread the load across the three lines.

Why balance matters

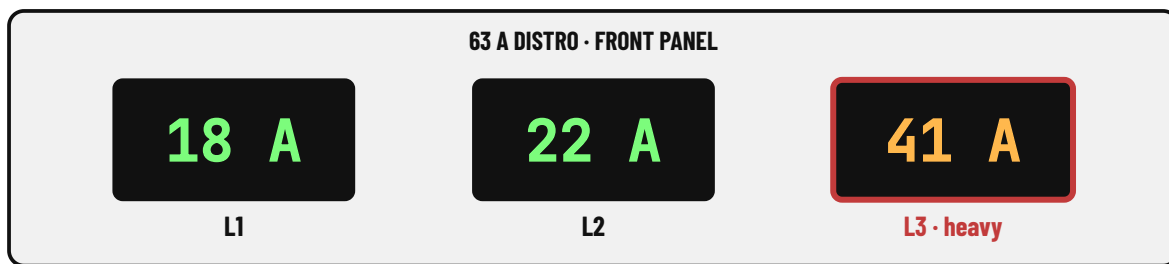
On a three-phase set each line can only give about a third of the rating. A 30 kVA set gives roughly 10 kVA per line. Overload one line and it sags or trips while the other two have room to spare. The set looks half empty and still fails. A badly unbalanced load also makes the voltage on the loaded line drop, and that is when amplifiers clip early and lights flicker.



Both cases carry 42 A in total. Only the balanced one works. The imbalance figure is the difference between the heaviest and lightest line, as a share of the heaviest.

Reading the three ammeters

A three-phase distro with meters on the front shows one reading per phase: L1, L2 and L3. Each meter shows the amps that phase is carrying right now. That is your load sheet, live.



Total 81 A. Every phase is under 63 A, but L3 carries half the load. Move something off L3 onto L1.

Read the meters with the full show running: the PA at show level, all the lights on, the urns boiling. A quiet soundcheck reading is not the real number.

- **Each phase on its own:** stay under 80% of the breaker. On a 63 A distro that is about 50 A per phase.
- **Phases against each other:** aim to keep the three readings close. If one reads more than about double the lightest, move a load across.
- **When to read:** after each area is switched on, at full show level, and again when the catering heats up.
- **Moving a load:** unplug the item from a socket on the heavy phase and plug it into a socket on the light phase. On a 32 A distro the outlets are already grouped by phase, so this is a plug swap, not a wiring job.

On the B&W 63 A distro the three meters are on the front. Read them after each area comes on. The B&W 32 A distros have no meters, but their 15 outlets are grouped five per phase with a trip switch each, so you balance by choosing which group an item plugs into. Remember the sum: five 16 A outlets on one phase still share that phase's 32 A. Five urns on one phase will trip it.

A sensible split

- **Phase 1: sound.** Amp racks, powered tops and subs, mixer, DJ.
- **Phase 2: lighting and effects.** LED PARs, moving heads, haze.
- **Phase 3: catering and heaters.** Urns, slush machines, fridges. Heaters are the biggest and steadiest loads.

Keeping sound on its own line also keeps lighting dimmers and heater switching away from the audio. Label each outlet with its line (for example "L2 · lights").

WHEN SINGLE-PHASE IS ENOUGH

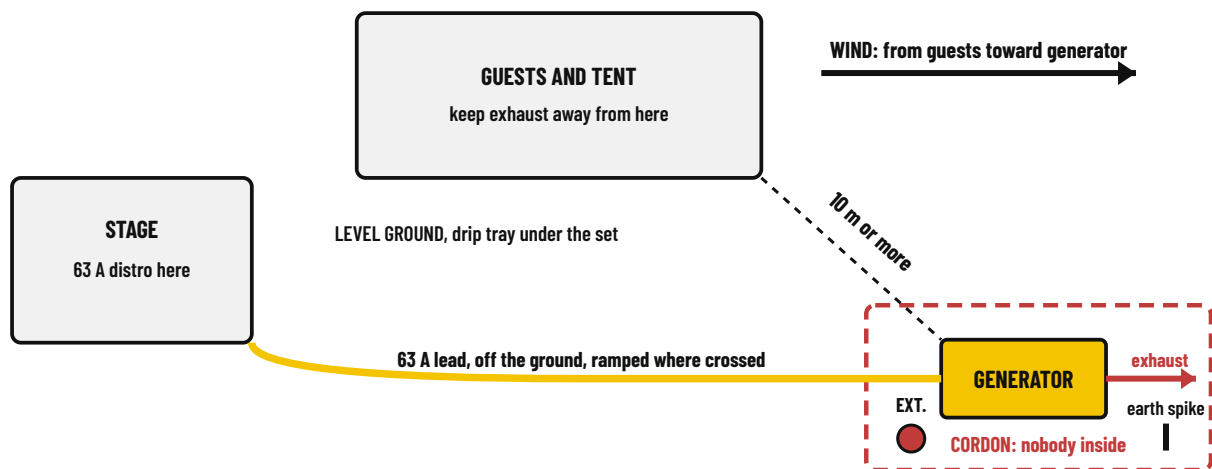
A small PA, a few lights and a laptop: total under about 10 A and nothing heavy like an urn on it. If you need to ask whether single-phase is enough, run the load sheet from Lesson 1. If the total is over 25.6 A, you want three-phase.

07 Running a generator on site



The earth spike and its lead are the electrician's job. Crew never pull it out, move it or park on it.

A generator is a running engine in a public space. It makes noise, heat and a poisonous gas. Most trouble comes from where it stands and how it is started and stopped.



Downwind, away from guests and tents, on level ground, in the open. Not under an awning, not in a container, not beside an air intake.

CARBON MONOXIDE

Exhaust has carbon monoxide: you cannot smell it and it kills. Never run a generator in a closed space, a tent, a container or a garage, and never where the exhaust can blow into one.

Placement

- **Level ground**, with a drip tray. A tilted set can starve of oil or fuel.
- **10 m from guests** for noise and fumes. More if the site allows.
- **Exhaust downwind** and pointing away from tents, guests and the stage.
- **Cordon it**. Barrier tape or fencing, a sign, nobody inside who is not on the power crew. The engine and exhaust are hot.
- **Earth spike**: the electrician installs and checks it. Crew never remove or move it.
- **Extinguisher** (CO2 or dry powder) on a stand beside it, in reach without walking through the cordon.

On a B&W job the electrician decides where the generator stands and earths it. Crew cordon it, fuel it and watch it.

Fuel at a glance

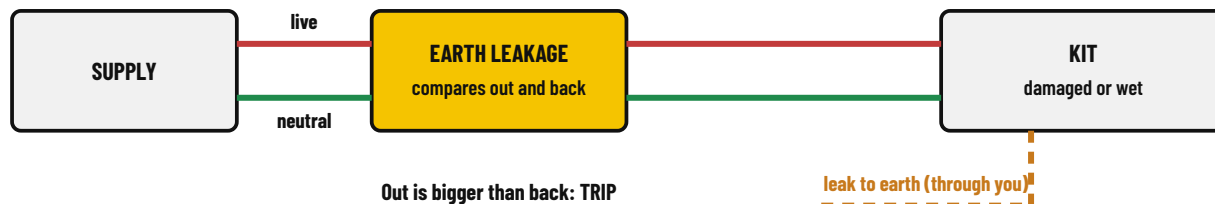
A diesel set at a decent load uses roughly 0.3 litres per kWh of load. The set's own data plate or the hire company gives the real figure. Example: a 15 kW load for 10 hours is about $15 \times 10 \times 0.3 = 45$ litres. Add a 25% reserve and fill to at least that before the event starts. **Refuel only when the set is stopped and cool**. Fuel on a hot exhaust is a fire. Never let it run dry: it also stalls the engine and can need bleeding.

Start-up and shutdown

1. Check fuel, oil and coolant. Confirm the earth spike is in place.
2. Main breaker **off**. Start the engine with no load. Let it warm up for a few minutes.
3. Switch on in groups (Lesson 1): main breaker, then distros, then kit in the order you planned.
4. Check the percentage load stays in the good band (Lesson 5).
5. Shutdown: kit off, distros off, main breaker off. Let the engine run unloaded for a few minutes to cool, then stop it. Never stop a diesel under load.

08 Earth leakage and protection

Two different devices protect you, and they trip for different reasons. Knowing which one tripped tells you where to look.



The earth leakage unit compares the current going out with the current coming back. A difference of 30 mA or more means current is going somewhere it should not, and it cuts the circuit in a fraction of a second.

	BREAKER (MCB)	EARTH LEAKAGE (RCD)
Trips on	Too much current: overload or short circuit	Current leaking to earth, often through a person or water
Protects	The cable and kit from overheating	People from shock
Typical trip level	Its rating: 16 A, 32 A, 63 A	30 mA on the 16 A outlets
Usual cause	Too much on one outlet, a damaged lead	Wet plug, damaged lead, faulty kit

On B&W distros every outlet group has its own trip switch. Know which switch feeds which outlets before the show, and test the earth leakage button where the distro has one. A distro with no earth leakage on its 16 A outlets goes to the crew chief before anything is plugged in.

Test, then trust

- **Test button before the event.** With the distro live, press the TEST button on each earth leakage unit. It must trip. Reset it. If it does not trip, the unit is faulty: out of service.
- **Nuisance trips.** The trip may be real. Find the faulty item one at a time: switch off, unplug everything on that outlet, reset, then plug items back in one by one. When it trips again, you have found it. Swap that lead or item.
- **Never bypass or tape a breaker.** Not to finish the sound check, not "just for the first set". A tripped device is doing its job.

A TRIP IS INFORMATION

Reset once. If it trips again, find the cause. If you cannot find it, switch off and call the engineer or the electrician.

Who does what, legally

Event power is covered by law in South Africa. The rule on site is short: crew plug in, electricians wire in.

CREW

Place distros. Lay leads. Plug into the right socket, switch on in groups, watch for heat, trips and damage, and report faults. Fill and watch the generator.

REGISTERED ELECTRICIAN

Anything wired: tails, a distribution board, a generator hook-up that is not a plug, the earth spike, repairs inside a plug or distro. They also sign for the installation.

- **Certificate of compliance.** Under the Electrical Installation Regulations, an electrical installation must have a certificate of compliance. A temporary event installation is still an installation. The electrician who did the wiring issues the certificate.
- **SANS 10142-1.** This is the wiring code that installations are tested against. You do not need to know it. You need to know it exists and that only a qualified person works to it.
- **Damaged equipment** is tagged and goes out of service. Nobody repairs it on site.

WHY THE LINE MATTERS

If you wire in and something goes wrong, you may be personally liable, and insurance may not cover it. If you plug in and report a fault, you have done your job.

10 Pre-show power checklist and fault table

Run this list for every event. Tick each item as you check it. It takes ten minutes and finds most problems before the guests arrive.

1

☐ **LOAD SHEET DONE**

Every item listed, watts and amps worked out, supply chosen at 80%, phases within 30% of each other.

2

☐ **GENERATOR SIZED AND PLACED**

Right size for the load in the good band (30 to 70%), level ground, 10 m from guests, exhaust downwind, cordon up, extinguisher beside it.

3

☐ **FUEL**

Enough for the whole event plus a reserve. Refuel plan agreed: stopped and cool only.

4

☐ **EARTH SPIKE CONFIRMED**

Installed and checked by the electrician. Not touched by crew.

5

☐ **ALL LEADS INSPECTED**

No cuts, crushed sections, bent pins or loose glands. Damaged ones tagged out.

6

☐ **MULTIPLUGS CHECKED**

Each under 12.8 A, none chained, reels fully unwound.

7

☐ **JOINTS PROTECTED**

Cover boxes on, lifted off the ground, drip loops, away from puddle paths, CEE caps closed on unused sockets.

8

☐ **EARTH LEAKAGE TESTED**

TEST button on every unit trips and resets.

9

☐ **OUTLETS LABELLED BY PHASE**

L1 sound, L2 lighting and effects, L3 catering and heaters.

10

☐ **POWER UP IN GROUPS**

Generator no load, main, distros, then kit: amp racks and subs, tops, moving heads, PARs, catering. Percentage load checked at the end.

If it is wrong

SYMPTOM	MOST LIKELY	CHECK
Breaker trips at switch-on, holds when you try again	Surges stacked: too much switched on at once	Power up in groups; biggest first
Breaker trips after a while under load	Overload on that outlet	Add up the amps on that outlet; move kit to another outlet or phase
Earth leakage trips as soon as one outlet is switched on	Wet or damaged lead or kit on that outlet	Unplug everything on it, reset, plug back in one by one
Earth leakage trips when rain starts	Water in a joint	Cover boxes, lifted joints, drip loops; dry and electrician-check any joint that was wet
Plug or multiplug warm	Overloaded or loose	Switch off, unplug, tag, shed load
One phase dead, others fine	Phase breaker tripped or unbalanced overload	Check that phase's breaker and load; rebalance
Lights dim and amps clip as the urn boils	Voltage sag on a loaded phase	Move the urn to its own phase; check generator percentage
Black smoke, soot, power seems low	Wet stacking: generator under-loaded	Add load or swap to a smaller set
Generator hunts, surges or stalls	Overloaded, switched on too fast, or low on fuel	Shed load, restart in groups, check fuel

THE WHOLE MODULE IN ONE LINE

Sum the load, spread the phases, stay under 80%, keep joints dry, switch on in groups, and let the electrician do the wiring.

Check what you learnt

Ten questions. Circle one answer for each. The answer key is on the last page. Pass mark: 8 out of 10.

1. A multiplug with a 16 A plug is plugged into a 32 A distro outlet. What is its limit?

- ☐ A 32 A, because the outlet is 32 A
- ☐ B 16 A, because the plug is the weak link
- ☐ C 24 A, halfway between
- ☐ D Whatever the breaker allows

2. What does inrush mean?

- ☐ A The steady watts a unit draws once settled
- ☐ B The water getting into a joint
- ☐ C The voltage drop on a long lead
- ☐ D The surge at switch-on, which can be several times the running current

3. In the B&W chain, what comes straight after the generator's 63 A outlet?

- ☐ A A 63 A distro with four 32 A outputs
- ☐ B A multiplug
- ☐ C A 32 A distro
- ☐ D The kit

4. In the site power chain, what comes straight after the generator's 63 A outlet?

- ☐ A They are waterproof to IP67
- ☐ B They keep out rain if the lid is shut
- ☐ C They are not waterproof, so they need a cover box and lifting off the ground
- ☐ D They can sit in a puddle path

5. A 30 kVA generator on the Highveld: roughly how many kW should you plan to use?

☐ **A** About 24 kW

☐ **B** About 15 kW

☐ **C** About 21.6 kW

☐ **D** About 6.5 kW

6. Why should a diesel generator not run below about 30% load for long?

☐ **A** It uses too much fuel

☐ **B** The breakers trip

☐ **C** It gets too hot

☐ **D** Wet stacking: soot and unburnt fuel build up and power is lost

7. On a three-phase generator, which split is the sensible default?

☐ **A** Everything on L1

☐ **B** Heaters and sound together on L2

☐ **C** Sound on one phase, lighting on another, catering and heaters on the third

☐ **D** Lighting on all three, sound on none

8. Where does the generator stand?

☐ **A** Level, in the open, about 10 m from guests, exhaust downwind and away from tents

☐ **B** In a closed container to keep the rain off

☐ **C** Next to the tent wall for a short lead

☐ **D** Under the stage canopy

9. What does a 30 mA earth leakage unit do?

- ☐ **A** Trips when the current is too high
 - ☐ **B** Stops surges
 - ☐ **C** Replaces the breaker
 - ☐ **D** Trips when current leaks to earth, such as through a person or water
-

10. A generator hook-up that is not a plug needs...

- ☐ **A** A senior crew member
- ☐ **B** A registered electrician and a certificate of compliance
- ☐ **C** No one, if it is only for one day
- ☐ **D** The venue manager's approval

Answer key

1. **B.** A multiplug is rated by its plug. The 32 A breaker behind the outlet does not protect a 16 A plug.
2. **D.** Amps, subs and moving heads pull a surge for a moment at switch-on. Power up in groups so the surges do not stack.
3. **A.** Generator 63 A red 5-pin, then the 63 A distro, 32 A lead, 32 A distro, multiplug, kit.
4. **C.** Rubber couplers stop fingers, not water. Use a cover box, a crate or bricks, and drip loops.
5. **B.** $30 \times 0.8 = 24$ kW. Highveld takes off about 10% (21.6 kW). Plan for 70% of that: about 15 kW.
6. **D.** A lightly loaded diesel runs too cool. Soot and unburnt fuel clog the exhaust and wear the engine.
7. **C.** Spread the load. Heaters are the biggest steady loads, so they get their own phase.
8. **A.** Exhaust contains carbon monoxide, which you cannot smell. Never run a generator in a closed space.
9. **D.** It compares current out and back. A leak of about 30 mA cuts the circuit. A breaker trips on overload instead.
10. **B.** Crew plug in. Wired work is for a registered electrician, and a temporary installation still needs a certificate of compliance.

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