INSTALLATION · COMMISSIONING · MAINTENANCE MANUAL

DZL / SZL Chain-grate Biomass & Coal Boilers

Document YX-MAN-BIO · Revision 1.0 · Issue 2026-11 · www.yxboiler.com · English

This manual covers the DZL and SZL travelling chain-grate families: single-drum DZL from 1 to 10 t/h, double-drum SZL from 10 to 30 t/h, steam at 1.0–2.5 MPa and hot water from 0.7 to 21 MW. It is written for boiler house operators, shift supervisors and maintenance technicians firing wood chips, pellets, rice husk, palm kernel shell or coal, and gives the checks, tolerances and combustion settings for safe, efficient service.

Document code YX-MAN-BIO **Revision** 1.0 **Issue date** 2026-11
Applies to DZL1-1.0 to SZL30-2.5; DZL/SZL 0.7-21 MW **Language** English

1. Scope and model coverage

The DZL is a single-drum, longitudinal chain-grate unit with a membrane water-wall furnace and a two-pass gas path. The SZL adds an upper drum and a convection bank behind the furnace, which carries the same grate principle from 10 to 30 t/h. Both share the fuel feeder, arch and secondary air, economiser, screw ash conveyor and either a cyclone or a baghouse. Ratings assume 20 °C feed water.

Model	Capacity	Design pressure / outlet	Fuel	Typical duty
DZL1-1.0	1 t/h	1.0 MPa, 180 °C	Wood chips, pellets, rice husk	Laundry, workshop steam
DZL2-1.25	2 t/h	1.25 MPa, 190 °C	Biomass, coal	Food processing, greenhouses
DZL4-1.25	4 t/h	1.25 MPa, 190 °C	Mixed biomass	Feed mill, dairy
DZL6-1.6	6 t/h	1.6 MPa, 201 °C	Pellets, palm kernel shell, coal	Textile, paper converting
DZL10-1.6	10 t/h	1.6 MPa, 201 °C	Wood chips, coal	Chemical plant, district heat
SZL10-1.6 / SZL15-1.6	10–15 t/h	1.6 MPa, 201 °C	Biomass, coal	Continuous process steam

Model	Capacity	Design pressure / outlet	Fuel	Typical duty
SZL20-2.5 / SZL30-2.5	20–30 t/h	2.5 MPa, 224 °C	Chips, palm kernel shell, coal	Steam host, large plant
DZL / SZL hot water	0.7–21 MW	1.6 MPa, 130/70 °C	Biomass, coal	District heating, drying

Excluded: site electrical work beyond the terminal box, the chimney and flue downstream of the outlet flange, fuel yard conveyors and the water-treatment plant. The full range is on the boiler range page; steam variants are described under biomass steam boilers.

2. Site and utility requirements before delivery

Sign off every item below before dispatch. A missing foundation sleeve or an undersized feed line delays commissioning far more than any boiler fault, because the boiler arrives tested. Confirm the steam balance on the capacity selection page first.

Item	Requirement	Tolerance / notes
Foundation and plinth	Reinforced concrete, cured 28 days	Level ±3 mm over 3 m; wet weight + 20%; sleeves per GA drawing
Front clearance	≥ 2.5 m at grate drive and ash end	Grate bars withdraw endwise
Side clearance	≥ 1.8 m access side, ≥ 1.0 m opposite	SZL needs the wide side for tube withdrawal
Ventilation	≥ 6 air changes per hour	Combustion air ducted from outside; fan inlet below 40 °C
Feed water	Hardness ≤ 0.03 mmol/L, pH 8.5–9.5	Oxygen ≤ 0.05 mg/L after the deaerator, required above 6 t/h
Boiler water	pH 10–12, conductivity ≤ 3000 µS/cm at 1.6 MPa	Confirm the band in GB/T 1576 for your pressure
Fuel	Moisture 10–35%, ash ≤ 15%	Particle ≤ 50 mm; fines under 3 mm below 30%
Draught	Furnace −20 to −50 Pa at rated load	Chimney ≥ 1.5 × building height; flue outlet above 130 °C
Electrical	380 V, 3 phase, 50 Hz, ±5%	Earthing ≤ 4 Ω; lockable isolator in sight
Drainage	Blowdown pit ≥ 2 m³ with quench	No drain passes under the foundation

Water treatment is not optional: the scale that spoils a gas boiler also drives ash into the convection bank on a solid-fuel unit. Where the site has no softener, fit one in the package, sized for 24 hours of make-up, with a feed pump matched to the boiler feed pump duty.

3. Installation sequence

The sequence assumes shop-assembled sections with the grate and arch either fitted or match-marked. Each step names the check that closes it; do not start the next until the check is recorded.

1. **Unload and inspect.** Crane rated at 1.25 × shipping weight, spreader beam on the lugs. Photograph transit damage and check the packing list against the drawing.
2. **Set and align on the plinth.** Fixed point at the front, sliding shoes behind. Level within 3 mm per metre both ways before grouting.
3. **Grout the base frame.** Non-shrink grout at least 25 mm thick, poured continuously. Re-check level after 24 hours; the frame must not rock.
4. **Assemble grate and side seals.** Bar gap 3–5 mm, seals touching the chain without loading it. Chain turns freely by hand through two revolutions.
5. **Erect arch and furnace walls.** 5 mm expansion gap per metre, formwork left 48 hours. No brick overhangs its neighbour by more than 2 mm.
6. **Fit economiser, air preheater and ducting.** 3 mm gaskets, flexible connections slack until the duct is supported. A 300 Pa air test shows no leak.
7. **Install dust collector and fans.** Impeller clearance 2–3 mm, free rotation by hand. Rotation matches the arrow; no isolator compressed over 10%.
8. **Connect feed, blowdown, drain and safety valve.** Every pipe supported independently. No load on a nozzle; the safety valve lever moves freely.
9. **Install feeder, hopper and distributor.** Distributor clearance 2–3 mm above the grate. Feeder turns without rubbing across the full bed width.
10. **Install ash handling.** Screw slope to drawing, no bearing in the ash stream. Screw turns by hand and the chute is clear.
11. **Fit instruments.** Gauge glasses with guards, transmitters, level electrodes, O2 probe. Every gauge readable from the operating floor.
12. **Complete wiring and interlocks.** Insulation ≥ 1 MΩ at 500 V, correct rotation on bump test, every interlock trips the right device.
13. **Fill, vent and test.** Fill at ≤ 10% of boiler volume per minute, vent until steady, then hydro test at 1.5 × design as in section 4.
14. **Insulate, clad and cold-commission.** Grate at minimum speed for 30 minutes. Chain tracks centrally, no bar climbs a sprocket, current within 10% of no-load.

Lifting and rigging

Lift only on the marked lugs, never on nozzles, headers or the grate frame. Use a spreader beam so slings stay vertical, fit tag lines at both ends, and keep everyone outside a radius of load height plus 2 m.

Expansion and anchor points

The boiler grows 12–18 mm along its length when hot. Keep one end fixed, let the other slide, and never weld a pipe or duct to the shell. Fit expansion joints in the flue and the feed line, and leave sliding surfaces clean and unpainted.

4. Commissioning and handover

Hydrostatic test. Test at 1.5 × design pressure — 1.5 MPa at 1.0 MPa design, 1.875 MPa at 1.25 MPa, 2.4 MPa at 1.6 MPa, 3.75 MPa at 2.5 MPa — and hold 30 minutes, in line with GB/T 16508 and TSG G0001 practice. Raise pressure at ≤ 0.3 MPa per minute with water at 20–50 °C. Acceptance: no gauge drop, no seepage, no permanent deformation. Third-party inspection can be arranged on request.

Fill and vent. Drain, flush and refill with softened, deaerated water to normal level. Vent all high points, then raise to working pressure and confirm the drum level holds within ±50 mm while the feed pump cycles.

Combustion set-up. Start with a 150 mm bed of dry fuel, light through the ignition arch and bring the grate to 3 m/h. Set primary and secondary air at 60/40 and trim until flue gas oxygen reads 5–7% dry (excess air 1.3–1.5) with CO below 250 ppm. Hold bed thickness at 120–200 mm, grate speed 3–10 m/h, and stack temperature at the baseline from the 4-hour run. Carbon in the discharged ash should stay below 8%.

Interlock	Simulated condition	Expected result
Extra-low water level	Open the electrode chamber test drain	Feeder and grate stop, FD and ID fans trip, alarm, no auto-restart
High water level	Raise level to +80 mm	Alarm, feed valve closes, boiler stays online
High steam pressure	Lower the trip set point	Alarm, feeder stops at set + 0.05 MPa
Flame failure	Cover the flame scanner	Feeder stops within 5 s, grate at creep speed, purge before restart
Low combustion air	Close the FD damper below 300 Pa	Feeder stops, alarm, no grate reversal
ID fan failure	Trip the ID contactor	FD and feeder stop, furnace goes negative, alarm
High stack temperature	Set trip 30 °C below reading	Alarm and load reduction, no trip below 250 °C

Trial runs. Record 4 hours at rated load and 24 hours at the normal load, usually 70–85%. Log steam pressure and temperature, drum level, O2 and CO, bed thickness, grate speed, furnace draught, stack temperature, fan currents and ash carbon hourly. Pass criteria: no interlock trip, stack drift under 30 °C, input-output efficiency within 80–86%.

Handover documents. GA and foundation drawings, material certificates, weld records, hydro test report, safety valve setting report, interlock record, combustion set-up sheet, this manual with the site spare parts list, and the training record. Keep the trial-run energy baseline in the log book; expected consumption at your load is on the energy consumption page, and the wider benchmarks published by the US Department of Energy are a useful cross-check.

5. Normal operation

Start-up from cold. Confirm the bed is clear, the grate turns freely and the ash pit is empty. Fill to normal level, open the air vent, purge the furnace and flue with the ID fan for 5 minutes. Light the ignition arch, start the feeder at minimum and hold the grate at 2–3 m/h until the bed burns across its full width. Raise load in 20% steps every 15 minutes.

Start-up from hot standby. With the bed alive above 400 °C, purge for 3 minutes, restart the feeder at minimum and raise the grate speed with load. Warm the FD air gradually; cold air on a hot arch spalls the brick.

Running log. Record these values every two hours and act on any reading outside its band rather than logging it twice.

Parameter	Normal band	Action if outside
Steam pressure	Design ± 0.05 MPa	Check feed and firing rate; verify the gauge
Drum level	Centre ± 50 mm	Blow the glass through; check feed valve and pump
Flue gas oxygen	5–7% dry	Trim secondary air; check seal leakage
Carbon monoxide	≤ 250 ppm	Add secondary air or cut load; check fuel moisture
Bed thickness	120–200 mm	Adjust grate speed; thin beds burn bars
Furnace draught	−20 to −50 Pa	Check ID damper, flue and baghouse differential
Stack temperature	Baseline + 30 °C	Soot-blow, then clean the economiser at the next stop

Normal shutdown. Reduce to 50%, stop the feeder, burn the bed down at minimum grate speed and keep the ID fan until the furnace is below 200 °C. Close the dampers and blow down at the end of the shift, not during cooldown.

Emergency shutdown. Press the emergency stop for a lost drum level, a pressure-part leak, a grate jam that stalls the drive, or fire in the fuel yard. The stop cuts feeder, grate and both fans. Keep the feed pump available, do not re-enter the furnace, and purge before any restart.

Lay-up over 30 days. Wet lay-up: fill with water at pH 10–11 plus oxygen scavenger, cap all connections, check the level weekly. Dry lay-up: drain, dry with warm air, place 1 kg quicklime per cubic metre of water volume in trays on the drum, and seal every opening. Clean the grate, empty the ash pit and hopper, and grease exposed linkages either way.

6. Maintenance schedule

The schedule follows the failure modes of a travelling grate: bar and link wear, chain tension, seal leakage, feeder and distributor wear, ash handling and the refractory arch. Intervals assume continuous biomass duty; on coal, keep the daily and monthly items and shorten the quarterly interval to 2000 fired hours. Generic procedures are in the manual library.

6.1 Daily (each shift)

Task	What to check / acceptance	Tool or reference	Who
Inspect the fire bed	Even across the width, no holes or black patches; flame clear of the arch	Observation port	Operator
Ash and slag discharge	Free flow, no clinker bridge; slag box emptied before the chute mouth	Visual, rake	Operator
Water level	Within ±50 mm of centre; glass blown through once per shift	Gauge glass	Operator
Fuel feed	Hopper ≥ 30% full, no bridging; feeder current within 10% of baseline	Ammeter	Operator
O2 and CO	O2 5–7%, CO ≤ 250 ppm; note drift over the shift	Flue analyser	Operator
Stack temperature	Within 30 °C of baseline for the load	Panel indicator	Operator
Fan bearings	≤ 70 °C, oil at the mark, no abnormal noise	Thermometer	Operator
Grate drive	Oil level correct, chain even, no bar climbing a sprocket	Dipstick, visual	Operator
Baghouse differential	800–1500 Pa; ash discharge working, no dust at stack	Differential gauge	Operator

6.2 Monthly

Task	What to check / acceptance	Tool or reference	Who
Grate bars and links	Bar thickness loss ≤ 30%; no cracked heads; pin wear ≤ 2 mm	Vernier, wear chart	Fitter
Chain tension and alignment	Sag 10–20 mm, side clearance 5–10 mm, chain central on both sprockets	Tape, straight edge	Fitter
Air chamber and grate seal	No leakage at side seals or division plates; seal strips touch without lifting the chain	Feeler gauge	Fitter

Task	What to check / acceptance	Tool or reference	Who
Refractory arch	Cracks ≤ 2 mm monitored; over 5 mm or loose brick repaired before next fire	Crack gauge, hammer	Refractory technician
Soot blower	Full cycle at 0.8–1.0 MPa; lance retracts fully; no tube erosion	Pressure gauge	Operator
Economiser	Gas resistance rise ≤ 200 Pa since last clean; fins free of bridging	Draught gauge	Fitter
Fan impellers	Blade thickness loss ≤ 1/3, no weld-toe cracks, ash removed	UT gauge	Fitter
Safety valve lift	Lever lifts freely, reseats without leak at working pressure	Lever, soap test	Shift supervisor
Instrument comparison	Gauge within 1.5% of master; thermocouple within 5 °C; O2 probe within 0.5%	Master gauge, calibrator	Instrument technician

6.3 Quarterly / semi-annual

Task	What to check / acceptance	Tool or reference	Who
Grate drive and reducer	Oil changed at 2000 h; sprocket wear ≤ 3 mm; chain elongation ≤ 2% in 10 pitches	Oil sample, vernier	Fitter
Arch and wall survey	No spalling over 25 mm; anchors sound; arch free of sag	Hammer, boroscope	Refractory technician
Dust collector internals	Bags replaced as a set at 5% breakage; cyclone liner wear ≤ 3 mm	Differential log, UT	Maintenance technician
Water-side check	Sludge ≤ 2 mm, no scale by scraping, no pitting at the water line	Borescope, manhole	Boiler inspector
Combustion tuning	O2 5–7% and CO ≤ 250 ppm at three loads; no CO spike on load change	Flue analyser	Commissioning engineer
Ash conveyor	Flight wear ≤ 30%, hanger bearings free, pit ash below 500 mm	Vernier	Fitter
Interlock simulation	Every interlock tested once per quarter; terminal torque checked on 10% of terminals	Interlock sheet	Electrician

6.4 Annual shutdown inspection

Task	What to check / acceptance	Tool or reference	Who
Internal pressure parts	No cracks at tube-to-drum welds; wall ≥ 90% nominal; drum internals clean	Borescope, UT, MPI	Boiler inspector
Hydrostatic test	1.5 × design held 30 minutes, no drop, no seepage	Test pump, master gauge	Boiler inspector
Full grate strip-down	Bars under 70% thickness replaced; links and pins renewed as sets; chain re-tensioned	Wear chart	Fitter
Arch rebuild	Crown and ignition arch replaced where cracked over 5 mm; half the anchors renewed	Refractory drawing	Refractory technician
Thermal efficiency test	80–86% input-output; gas loss within 2 points of baseline; ash carbon ≤ 8%	Test kit per GB/T 10184	Service engineer
Economiser and preheater	Clean inside and out, wall ≥ 90% nominal, resistance back to clean value	Air lance, UT	Fitter
Safety valve calibration	Set ≤ design, reseat within 5%, accumulation ≤ 10% of set	Test bench	Valve service
Fan overhaul	Bearings at 12 000 h or above 4.5 mm/s RMS; impeller balanced, coupling aligned	Vibration meter	Fitter
Ductwork and stack test	Expansion joints sound, duct ≥ 90% thickness, opacity test passed	UT, opacity check	Maintenance technician

Records

Retain log sheets, interlock tests, water results and inspection reports for three years, and the last two annual efficiency tests for the life of the boiler. A reading outside its band for three consecutive shifts is an anomaly: raise it to the planner the same day and record the action against the log entry. Energy reporting follows the structure of ISO 50001 if the site is certified.

7. Troubleshooting

Symptom	Likely cause	Check	Remedy
Clinker on the grate	Bed above ash fusion, uneven primary air	Hot spots, zone air pressure, ash fusion	Bed to 120–150 mm, raise grate speed, balance zone dampers
Black smoke, high CO	Low secondary air, wet fuel, overload	O2, fuel moisture, damper position	Open secondary air, cut load 10%, dry fuel to 10–30%

Symptom	Likely cause	Check	Remedy
Grate bars burning	Thin bed, air leak under the grate	Bed depth, seal condition, ash colour	Restore 150 mm bed, reseal side and division plates
Pressure falls at fixed firing	Fouled surface, wet fuel, bed hole	Stack temperature, economiser resistance	Soot-blow, clean economiser, repair the bed
Stack temperature rising	Convection fouling, excess air drift	Rise against baseline, O2 trend	Soot-blow in sequence, trim excess air to 1.3–1.5
High flue resistance	Blocked economiser or blinded bags	Component differentials	Clean; replace bags above 1800 Pa
Fan vibration	Impeller erosion, bearing wear, misalignment	Vibration, bearing heat, coupling	Clean and balance, replace bearings, re-align
Grate stalls	Clinker jam, chain too tight, blocked ash screw	Drive current, chain sag, pit level	Clear the jam, set sag 10–20 mm, clear the conveyor
Level unstable in the glass	Blocked connection, faulty electrode, valve hunting	Glass blow-through, electrode signal	Rod out connections, recalibrate, tune the feed valve

Clinker diagnosis

Clinker shows where the bed went wrong. Fused slag near the ignition arch means the bed is thin and zone air too high: restore 150 mm and close the first damper. Slag at the ash end means the grate is too slow for the ash load or the fuel ash fusion is low: raise speed to 6–8 m/h and blend. Hard black clinker with visible carbon means air starvation, not excess heat: add air, clear the air chamber, and check feeder output.

8. Spare parts and service

Keep first-year spares on site; a missing grate bar is a day at reduced load. Quantities assume one boiler at 6000 fired hours per year.

Item	Quantity	Note
Grate bars	5%, minimum 20	One drawing number only; mixed types do not track
Links and pins	20 pitches	Replace as sets, never singly
Side seal strips	1 set	Renew whenever the grate is stripped
Distributor vanes	1 set	Set to 2–3 mm clearance
Feeder screw or belt	1	Ship with coupling and bearings
Arch bricks	10% of count	Same grade as original

Item	Quantity	Note
Soot blower elements	2	One per lance type
Baghouse bags	10% of count	Same fabric and finish
Fan bearings, gauge glass, electrodes	1 set / 2 each	Record bearing numbers at commissioning

Consumables: grate grease, reducer oil, gland packing, safety valve gaskets, calibration gas and probe filters. Order by model, serial, drawing and item number, and photograph the nameplate. Coal-fired versions of the same shells are under coal steam boilers; where the site treats its own water, order a water softener with the boiler rather than after the first scale incident.

Service contact. Henan Yongxing Special Equipment Co., Ltd. handles warranty and paid service for these models. Response targets: remote diagnosis within 24 hours of a logged fault, site attendance within 48 hours domestically and 72 hours elsewhere, written fault report within five working days. Have the serial number and last efficiency test ready.

9. Document control

Rev	Date	Change
A	2026-11	First issue for DZL and SZL chain-grate families
B	—	Combustion bands and clinker diagnosis added
C	—	Maintenance intervals aligned to biomass duty

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This manual covers the family, not your unit. Send us the serial number and fuel analysis and we will issue the site-specific manual with the drawings, settings and spare parts list that match your boiler.

Request the site-specific manual