INSTALLATION · COMMISSIONING · MAINTENANCE MANUAL

SZS D-type Water-tube Oil & Gas Boilers

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This manual covers the SZS series D-type double-drum water-tube boilers, fired on natural gas, LPG, light oil or heavy oil, in saturated steam ratings of 10 to 40 t/h at 1.6 and 2.5 MPa and in hot-water ratings of 7, 14 and 29 MW. It is written for the plant engineer, shift operator and maintenance technician who install, commission, run and inspect the unit. Every maintenance task carries a measurable acceptance limit, and values fixed by the ordered burner or water-treatment plant are flagged for confirmation against the site-specific manual.

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Applies to SZS10-1.6 to SZS40-2.5; SZS7 to SZS29 hot water **Language** English

1. Scope and model coverage

The SZS is a shop-assembled D-type boiler. Membrane water walls enclose the furnace on three sides; the fourth side is the convection bank between the drums, and gas leaves through the rear flue past the economiser and air preheater. The burner mounts on the front wall and fires horizontally along the furnace. A superheater can be fitted in the rear pass; this manual covers the saturated and hot-water variants, and superheated units follow the supplementary data sheet.

Model	Capacity	Design pressure and temperature	Fuel	Typical duty
SZS10-1.6	10 t/h	1.6 MPa, 204 °C saturated	Gas, LPG, light oil	Two-shift process steam
SZS15-1.6	15 t/h	1.6 MPa, 204 °C saturated	Gas, light or heavy oil	Continuous process steam
SZS20-2.5	20 t/h	2.5 MPa, 226 °C saturated	Gas, light oil	Process steam, small turbine supply
SZS25-2.5	25 t/h	2.5 MPa, 226 °C saturated	Gas, light or heavy oil	Base-load industrial steam

Model	Capacity	Design pressure and temperature	Fuel	Typical duty
SZS30-2.5	30 t/h	2.5 MPa, 226 °C saturated	Gas, light oil	District heat and process steam
SZS40-2.5	40 t/h	2.5 MPa, 226 °C saturated	Gas, light oil	Large plant base load
SZS7-1.0/95/70	7 MW	1.0 MPa, 95/70 °C	Gas, light oil	Low-temperature district heating
SZS14-1.6/130/70, SZS29-1.6/130/70	14 and 29 MW	1.6 MPa, 130/70 °C	Gas, light or heavy oil	Pressurised hot-water networks

Capacity follows the saturated-steam equivalence of about 0.7 MW per t/h: 10 t/h is about 7 MW and 40 t/h about 28 MW. Steam models are described on the SZS oil and gas steam boiler page, hot-water models on the hot-water boiler page. Excluded: civil works, chimney steelwork beyond the outlet flange, fuel storage, the water-treatment plant unless ordered with the boiler, and electrical work upstream of the panel terminals. Burner gas-train settings follow the burner manual.

2. Site and utility requirements before delivery

Confirm every item below before dispatch. A shortfall found after delivery moves cost and delay to the site, and rear clearance cannot be corrected once the house is built. Record the values on the readiness sheet and return a signed copy. If demand is not yet fixed, size against the load profile using the load-duration method on the capacity selection pages.

Item	Requirement	Tolerance and notes
Foundation and plinth	Reinforced concrete to the general arrangement, bolts cast in	Level ±3 mm, bolt centres ±2 mm, 25 mm grout
Burner front clearance	Space to swing the burner open and remove the nozzle	At least 1.5 m or burner length plus 0.5 m
Rear clearance	Access for economiser and preheater withdrawal	2.0 m behind the flue, 0.8 m at drum ends
Headroom	Above drum, safety valve discharge and lifting beam	1.0 m above the highest valve
Ventilation	Combustion and cooling air through two louvres	Free area ≥ 1.2 × burner air demand; room ≤ 45 °C
Feed water	Hardness ≤ 0.03 mmol/L, oxygen ≤ 0.05 mg/L, pH 8.8–9.3, iron ≤ 0.1 mg/L	Deaerator above 6 t/h; softener sized for make-up plus blowdown
Boiler water	pH 10–12, conductivity per drum pressure	≤ 4000 µS/cm at 1.6 MPa, ≤ 3000 µS/cm at 2.5 MPa

Item	Requirement	Tolerance and notes
Fuel gas	20–35 kPa at the train inlet	+15% / −10%; calorific value within the burner data
Light oil	0.6–1.0 MPa at the burner, viscosity ≤ 5 mm²/s	Ring main with return; heavy oil heated to 90–110 °C
Flue and chimney	Balanced draft, furnace −20 to −50 Pa at full load	Stack sized by dispersion calculation
Electrical supply	380 V, three-phase, 50 Hz, neutral earthed	Voltage ±5%, earth resistance ≤ 4 Ω
Drainage and blowdown	Vented pit of at least 2 m³ with a cooling path	Discharge below 60 °C; blowdown line DN50 minimum

3. Installation sequence

The sequence assumes a cured plinth and a weather-tight house. Do not start piping until the boiler is grouted and the expansion indicators are set, ; later jacking destroys the zero reference.

1. Survey the plinth and mark the centre lines and bolt positions. Acceptance: level ±3 mm, diagonals equal within 5 mm.
2. Unload with a crane rated for the shipping weight, lifting only from the marked lugs. Acceptance: no casing or tube distortion.
3. Set the boiler on packers and align the drum axis. Acceptance: centre line ±2 mm in both directions.
4. Grout the base frame with non-shrink grout and cure before filling. Acceptance: no voids at the corners.
5. Fit the expansion indicators and set zero at 20 °C. Acceptance: pointer on zero, scale readable from the operating floor.
6. Assemble the rear flue, economiser and air preheater with new gaskets. Acceptance: 5 kPa air test with soap solution shows no bubbles.
7. Erect duct and chimney, then measure draft with the induced-draft fan running. Acceptance: −20 to −50 Pa at the furnace outlet.
8. Install the burner and check nozzle protrusion and throat clearance. Acceptance: protrusion ±2 mm, door swings 90° clear of the casing.
9. Pipe the feed line from deaerator through pump and economiser to the drum, with a non-return valve. Acceptance: no load on the drum nozzles.
10. Install the steam or hot-water header on spring hangers with a 1:100 fall. Acceptance: hangers carry the pipe weight, no cold pull at the flange.
11. Mount safety valves, pressure gauges with syphons, thermowells and level transmitters. Acceptance: gauge range 1.5–2 times design pressure.

12. Complete the electrical work to the panel terminals and earth the frame. Acceptance: insulation ≥ 1 MΩ at 500 V, earth ≤ 4 Ω.
13. Fill with treated water at 20–50 °C, vent the drum, raise to working pressure. Acceptance: no weeping at manholes or expanded joints.
14. Hydrostatic test at 1.5 times design, hold 30 minutes, drain and flush. Acceptance: no pressure drop and no permanent deformation.

Lifting and rigging

The shipping weight excludes water, refractory and burner. Use four-point lifting with the marked lugs and a spreader beam, and keep personnel out of the swing zone. Never lift by the membrane walls or sling from a drum nozzle; a deformed nozzle cannot be repaired to the pressure-part standard.

Expansion and anchor points

The front drum support is fixed and the rear support slides on stainless pads. Indicators are zeroed at 20 °C, and the chart gives the expected reading at each drum metal temperature, about 12 mm at full load on the 2.5 MPa units. Do not weld brackets or cladding to the casing or membrane wall, and keep the sliding pads free of grout and debris.

4. Commissioning and handover

Commissioning starts after the hydrostatic test and internal inspection. Fill with treated water at 20–50 °C, vent every high point, and confirm that the gauge glass and transmitter agree within 5 mm before lighting.

The hydrostatic test pressure is 1.5 times design: 2.4 MPa for the 1.6 MPa units and 3.75 MPa for the 2.5 MPa units. Hold for 30 minutes at a water temperature of 20–50 °C with a calibrated gauge on the drum and the safety valves gagged. Acceptance is no pressure drop, no weeping at any joint and no visible deformation, following the practice of GB/T 16508 and TSG G0001.

Set the burner at low fire, then high fire, on the fuel named in the order. For natural gas, target 3.0–3.5% oxygen at low fire and 3.0% at high fire, about 15–20% excess air and 9.5–10.5% carbon dioxide; carbon monoxide must stay below 50 ppm. Bring stack temperature within 20 °C of design at rated load and record every damper position on the commissioning curve; later maintenance is judged against it. The matched burner package manual governs gas-train pressures and scanner settings.

Interlock	Simulated condition	Expected result
Extra-low water level	Drain the float chamber until the LL electrode is dry	Burner trips within 3 s, alarm sounds, reset blocked until level returns
High water level	Raise level above the HH electrode	Feed pump stops, alarm sounds, burner stays on

Interlock	Simulated condition	Expected result
Flame failure	Close the manual gas cock at low fire	Main valve closes within 3 s, post-purge runs, lockout without auto-restart
Low gas pressure	Drop train pressure below 50% of set point	Burner trips, alarm latched, purge before restart
High gas pressure	Raise pressure above 110% of set point	Burner trips, alarm latched, relief not lifted
High steam pressure	Lower the pressure switch set point below working pressure	Trip at set pressure plus 0.05 MPa; safety valve must not lift
Combustion air failure	Stop the forced-draft fan at low fire	Trip within 2 s, damper closes, alarm sounds
Low feed-water pressure	Throttle the feed valve below 80% of set point	Burner trips, standby pump starts where fitted

Run 4 hours at 50–75% load, then 24 hours at normal plant load, logging level, steam pressure and temperature, feed-water and stack temperature, oxygen, carbon monoxide and draft hourly. Acceptance: no unexplained trip, stack temperature stable within 10 °C, level held within ±10 mm on automatic control, no leaks. Handover documents are the as-built arrangement, pressure-part material certificates, hydrostatic record, safety valve setting record, interlock test sheet, burner commissioning curve, wiring diagram and this manual.

5. Normal operation

Start-up from cold. Confirm normal level, open vent and burner off. Purge for 5 minutes at 25% air flow, five volume changes. Light at minimum fire, hold until 0.2 MPa, then close the vent. Raise pressure at no more than 0.03 MPa per minute and keep the drum top-to-bottom difference below 40 K; working pressure takes 2–3 hours. Load at no more than 10% of capacity per minute.

Start-up from hot standby. With the drum at 0.3–0.5 MPa and level at −50 mm, purge for 5 minutes, light and raise load at 10% per minute, keeping drum metal rise below 1.0 °C per minute. After 8 hours on standby, check the gauge glass before purging; a leaking non-return valve can fill the drum.

Parameter	Normal band	Action if outside
Drum water level	±10 mm of the normal line	Compare with gauge glass, blow down, check transmitter
Steam pressure	1.6 ± 0.05 MPa or 2.5 ± 0.08 MPa	Check modulation and pressure transmitter
Steam temperature	Saturation ±5 °C (204 or 226 °C)	Check for carryover

Parameter	Normal band	Action if outside
Feed water after economiser	At least 40 K below saturation	Check economiser fouling and deaerator
Stack temperature	Within 20 °C of the clean baseline	Blow soot, check for scale
Oxygen at outlet	3.0–3.5%	Trim air damper, check analyser
Carbon monoxide	≤ 50 ppm	Check nozzle, flame shape and excess air
Furnace draft	−20 to −50 Pa	Check ID fan, damper and flue blockage
Drum metal difference	≤ 40 K top to bottom	Reduce firing rate, extend warm-up

Normal shutdown. Reduce to 20% load at 10% per minute, purge 5 minutes, close the main valve and stop the burner. Run the fan 10 minutes to clear the furnace and flue, then close the air damper. Top up to normal level because the water shrinks as it cools, and blow down only below 0.2 MPa.

Emergency shutdown. Press the emergency stop, which closes the main fuel valve and trips the burner. Keep the fan running if unburnt fuel is suspected, and do not open the furnace until a 5-minute purge is complete. Never dump water from a hot boiler or lift a safety valve by hand to speed up pressure reduction. Record the cause, pressure and level.

Lay-up over 30 days. Wet lay-up: fill completely with condensate or demineralised water dosed to pH 10.5–11.5 with 200 mg/L oxygen scavenger, blanket with nitrogen at 0.05–0.1 MPa, and check chemistry weekly. Dry lay-up: drain and dry, place 1.0 kg of desiccant per cubic metre of water volume in trays on the drum, seal the manholes and keep relative humidity below 40%, renewing the desiccant monthly.

6. Maintenance schedule

Intervals assume gas or light oil, treated water and 6,000 base-load hours a year; halve them for heavy oil or more than two starts a day. The energy consumption pages give the baseline stack temperature and efficiency; the US Department of Energy steam resources give a wider audit benchmark.

6.1 Daily (each shift)

Task	What to check / acceptance	Tool or reference	Who
Drum level	Gauge glass within ±10 mm of the transmitter; blow the glass until clear	Gauge glass, trend	Operator
Pressure and temperature	Within the section 5 band; within 5 °C of saturation	Panel, calibrated gauge	Operator

Task	What to check / acceptance	Tool or reference	Who
Burner and gas train	Flame stable; scanner signal ≥ 60% of commissioning value; gas 20–35 kPa	Scanner display, gauge	Operator
Oxygen and stack temperature	O2 3.0–3.5%; stack within 20 °C of baseline	Analyser, thermocouple	Operator
Soot blowers	Rear bank and economiser blowers once per shift on oil, once per 8 h on gas above 80% load; steam 0.8–1.0 MPa	Blower control	Operator
Bottom blowdown	10–15 s; conductivity ≤ 4000 µS/cm (1.6 MPa) or 3000 µS/cm (2.5 MPa)	Valve, conductivity meter	Operator
Feed pump and deaerator	Current within 10% of commissioning; deaerator 104 ± 2 °C; oxygen ≤ 0.05 mg/L	Ammeter, DO meter	Operator
Expansion indicators	Reading within ±2 mm of the chart value for the drum temperature	Indicator, chart	Operator
Leaks and casing	No steam, water or gas leak; casing ≤ ambient plus 25 K	Visual, IR thermometer	Operator

6.2 Monthly

Task	What to check / acceptance	Tool or reference	Who
Level transmitter calibration	Five points at 0/25/50/75/100%; error ≤ ±5 mm; contacts at ±50 and ±75 mm	Calibrator, sight glass	Instrument technician
Safety valve manual lift	Lift at 75% of set pressure or above; reseats without wire drawing	Lever, pressure gauge	Shift engineer
Flame scanner and igniter	Lens clean, signal ≥ 60%, spark gap 2.5 ± 0.2 mm	Scanner test, feeler gauge	Technician
Air preheater cold end	Metal ≥ 130 °C on oil and ≥ 90 °C on gas; drain flowing; no acid smear	Thermocouple, sight glass	Technician
Feed-water analysis	Hardness ≤ 0.03 mmol/L, iron ≤ 0.1 mg/L, pH 8.8–9.3; softener cycle verified	Lab kit, softener log	Chemist
Burner linkage	Damper positions match the curve at low, mid and high fire; backlash ≤ 2°	Curve sheet, protractor	Technician
Alarm annunciation	Every alarm tested; horn and beacon operate	Test list	Instrument technician
Soot blower travel	Full stroke without sticking; nozzles aligned within ±3 mm	Manual stroke, drawing	Fitter

6.3 Quarterly and semi-annual

Task	What to check / acceptance	Tool or reference	Who
Water-side inspection (semi-annual)	Open handholes; scale ≤ 0.5 mm, no sludge blanket in the lower drum	Boroscope, scraper	Boiler engineer
Steam purity	Steam conductivity ≤ 1 µS/cm above feed water	Sample cooler, meter	Chemist
Flue-gas analysis	CO ≤ 50 ppm, excess air 15–20%, NOx within permit	Flue analyser	Technician
Casing and refractory survey	No hot spot above ambient plus 25 K; front-wall cracks ≤ 3 mm	IR camera, crack gauge	Boiler engineer
Electrical inspection	Insulation ≥ 1 MΩ at 500 V, earth ≤ 4 Ω, currents balanced within 5%	Insulation and earth testers	Electrician
Drum supports (semi-annual)	Sliding pads free, anchor nuts tight, 3 mm clearance at guides	Torque wrench, feeler	Fitter
Air preheater tightness	Gas-to-air leakage ≤ 5% by oxygen rise across the unit	O2 readings	Technician

6.4 Annual shutdown inspection

Task	What to check / acceptance	Tool or reference	Who
Drum internals and steam-water separator	Open both manholes, clean internals, inspect separator vanes, baffles, feed pipe and blowdown pipe for cracks or distortion; gaps ±1 mm of drawing; renew manhole gaskets	Boroscope, drawing, gaskets	Service engineer
Tube wall thickness survey	Ultrasonic survey of water walls, convection bank and economiser; full survey every 3 years, 10% spot check between, concentrated on the burner zone; alarm at 90% of nominal (4.5 mm), replace below 80% (4.0 mm)	UT gauge, tube chart	NDT inspector
Hydrostatic test where due	1.5 × design (2.4 or 3.75 MPa) for 30 minutes; no drop, no weeping	Test pump, master gauge	Engineer and inspector
Safety valve overhaul	Strip and lap seats, bench-set to ≤ design pressure on a certified gauge, accumulation ≤ 10%, re-seal and record	Bench rig, master gauge	Service engineer
Soot blower overhaul	Lance straight within 2 mm, nozzles clear, chain tension correct, limit switches working	Straight edge, chain gauge	Fitter
Air preheater cold end	Clean elements; wall loss ≤ 30%, replace beyond; check expansion plates	Thickness gauge	Fitter

Task	What to check / acceptance	Tool or reference	Who
Refractory and front wall	Cracks ≤ 3 mm, no spalling at the throat; patch with matching castable	Hammer test, castable	Refractory mason
Expansion indicators and drum supports	Record cold reading, compare with the last hot reading, reset zero if within ±1 mm of chart; rollers free	Indicator, chart	Boiler engineer
Deaerator and feed system	Internals clean, nozzles clear, oxygen ≤ 0.05 mg/L after restart, safety valve free	Inspection cover, DO meter	Boiler engineer

Records

Keep the shift log, water-analysis sheet, interlock test sheet and inspection reports for at least 3 years, and the tube survey for the life of the boiler. Escalate any reading beyond an acceptance limit on the same shift; a repeated minor deviation is a trend, and a trend precedes a tube failure.

7. Troubleshooting

Symptom	Likely cause	Check	Remedy
Pressure falls at constant load	Fouled tubes, wrong air/fuel ratio	Stack temperature, O2, burner position	Blow soot, trim ratio, check modulation signal
Stack temperature 30 °C above baseline	Soot on the bank, water-side scale	O2 before and after the bank, water side	Operate blowers, descale, reseat baffles
Wet steam or carryover	High solids, damaged separator, high level	Steam conductivity, internals, level trend	More blowdown, repair separator, lower level
Low-water trip on start-up	Transmitter drift, closed feed valve, air lock	Glass against transmitter, pump pressure	Recalibrate, open valve, vent feed line
Burner lockout during a run	Dirty scanner, gas pressure excursion	Scanner signal, train pressure, flame shape	Clean scanner, reset after full purge
Make-up rises and pressure drops	Tube or expanded-joint leak	Water balance, hydro test, UT survey	Isolate, locate by section, replace or re-expand
Acid smell at the preheater	Cold end below dew point at low load	Cold-end temperature, drain flow	Raise inlet air temperature, keep load above 30%
High carbon monoxide	Lean flame, dirty nozzle, closed secondary air	O2 and CO together, nozzle condition	Clean nozzle, open secondary air, re-trim

Symptom	Likely cause	Check	Remedy
Safety valve weeps	Seat damage, debris, set pressure low	Setting record, seat condition	Lap or replace seat, bench-set and re-seal

8. Spare parts and service

Hold the following for the first year; add a second set if there is no standby unit.

Item	Quantity	Notes
Manhole and handhole gaskets	Two full sets	Graphite or spiral-wound; never reuse a compressed gasket
Gauge glass and packing	Two sets	Match glass length to the fitting
Level electrodes	One set	Same model, calibration sheet kept
Burner nozzle and electrodes	One set	Size per burner data sheet
Flame scanner	One	Interchangeable with the fitted unit
Gas train filter element	Two	Renew at each annual shutdown
Soot blower nozzles	Four	Match the lance thread
Refractory castable	50 kg	Same grade as the front wall, stored dry

Stock descaler, oxygen scavenger, softener salt and anti-seize compound. Order by model, serial number, drawing number and position number; a nameplate photograph shortens the check. The feed-water pump and control cabinet are listed separately when supplied as part of the package. Henan Yongxing Special Equipment Co., Ltd. acknowledges parts enquiries within one working day, dispatches stock items within two, and puts an engineer on site within five working days for a pressure-part or control fault; emergency cover is on the number in the order confirmation.

9. Document control

Revision	Date	Change
A	2019-06	First issue, SZS10 to SZS40
B	2022-03	Added hot-water models, O2 trim and the 3-year ultrasonic survey
C	2025-11	Revised maintenance tables, valve re-sealing and lay-up limits

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page before relying on a printed copy, and compare the revision letter with the table above; earlier revisions remain in the manual library. The boiler is designed and built to GB/T 16508 and TSG G0001, with third-party inspection available on request; no other certification is implied.

Burner settings, water limits and chimney draught are fixed per order, so ask for the site-specific manual with your serial number before the first annual inspection. Send the serial number, model and a nameplate photograph through the contact page for the matching document and current spare-parts list.

Request the site-specific manual