INSTALLATION · COMMISSIONING · MAINTENANCE MANUAL

WDR / LDR Electric Boilers & Steam Generators

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This manual covers the safe operation and maintenance of Henan Yongxing Special Equipment Co., Ltd. electric steam boilers, electric hot-water boilers and electrode steam generators of the WDR, LDR, CLDR and ZWDR families. It is written for boiler operators, maintenance electricians and plant engineers who take responsibility for the unit after handover. It sets out site requirements, installation, commissioning, normal running, the electrical-safety maintenance schedule and fault finding. Where the element datasheet or the certified drawing supplied with a particular unit differs from this text, the unit-specific document takes precedence.

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Applies to WDR0.5-0.7 to WDR10-1.6; LDR, CLDR, ZWDR **Language** English

1. Scope and model coverage

All models use immersion resistance elements, or electrodes passing current through the boiler water on the ZWDR range. There is no burner, fuel train, flue or stack loss, hence 98–99% thermal efficiency. Heat is made inside the shell, so electrical protection, element condition and water quality replace combustion tuning as the maintenance focus.

Model	Capacity	Design pressure / temperature	Heat source	Typical duty
WDR0.5-0.7	0.5 t/h (350 kW)	0.7 MPa, 170 °C saturated	Resistance elements, 400 V	Laundry, small food plant, sterilising
WDR1-1.0	1 t/h (700 kW)	1.0 MPa, 184 °C	Resistance elements, 400 V	CIP supply, hospital, dairy
WDR2-1.25	2 t/h (1.4 MW)	1.25 MPa, 193 °C	Resistance elements, 400 V	Pharmaceutical, beverage, autoclave bank
WDR4-1.25	4 t/h (2.8 MW)	1.25 MPa, 193 °C	Resistance elements, 400/690 V	Process plant, campus standby

Model	Capacity	Design pressure / temperature	Heat source	Typical duty
WDR6-1.6	6 t/h (4.2 MW)	1.6 MPa, 204 °C	Resistance elements, 690 V	Continuous process steam
WDR10-1.6	10 t/h (7.0 MW)	1.6 MPa, 204 °C	Resistance or electrode, 6–10 kV	Large plant, grid balancing
LDR0.3-0.7 / CLDR0.35-95/70	0.3–0.35 MW hot water	0.7 MPa; atmospheric, 95/70 °C	Resistance elements, 400 V	Space heating, domestic hot water
ZWDR1.4-1.0	2 t/h (1.4 MW)	1.0 MPa, 184 °C	Electrode, 6 kV or 10 kV	Load following, renewable balancing

Excluded from this manual: the incoming transformer and site electrical works upstream of the boiler isolator, cable tray outside the skid, softener installation pipework, structural steel and the process plant fed by the boiler. Induction and electromagnetic units follow the same schedule with their coil cooling circuit added at the annual inspection. For capacity and steam-load matching, see the capacity selection guide and the electric boiler range.

2. Site and utility requirements before delivery

An electric boiler needs less space than a fuel-fired unit but more electrical discipline. Confirm the following before dispatch: a crowded room blocks element withdrawal and a marginal supply causes nuisance trips.

Item	Requirement	Tolerance / notes
Foundation or plinth	Reinforced concrete, 150 mm above floor, level and cured	Level within ±3 mm per metre; grout after alignment
Element-head clearance	Element bundle length plus 500 mm of free space	For bundle withdrawal, descaling and replacement
Side and rear clearance	800 mm to walls; 1,000 mm in front of the control panel	Panel door must open to its full swing
Boiler house ventilation	About 3 m³/h per kW, outside air, no recirculation	Holds the room ≤40 °C at a 10 K rise
Feed water	Hardness ≤0.03 mmol/L, pH 8.5–9.5, dissolved oxygen ≤0.1 mg/L	Softener sized for peak make-up plus 20%
Boiler water	pH 10–12; conductivity ≤4,000 µS/cm at 1.0 MPa, ≤3,000 µS/cm at 1.6 MPa	Blowdown rate fixed at commissioning
Electrical supply	400 V ±5%, 50 Hz, three-phase with neutral and PE	Voltage imbalance ≤2%; current imbalance ≤10%

Item	Requirement	Tolerance / notes
Cable and breaker	Cable rated ≥1.25 × full-load current; breaker 1.15–1.25 × FLC	Voltage drop ≤3% at the terminal box
Earthing	PE conductor to shell, panel and pipework	Earth resistance <4 Ω, measured and recorded
Drainage and blowdown pit	At least 1 m³, with cooling before discharge	Blowdown water below 60 °C at the outlet
Ambient conditions	5–40 °C, relative humidity ≤85%, non-condensing	Fit a panel heater where frost is possible

A 700 kW unit on 400 V draws about 1,010 A full load, so the feed is a busbar or parallel-cable installation, not a small single feeder. Confirm transformer spare capacity before ordering. Demand charges usually decide the operating pattern more than the boiler does; the energy consumption notes explain how to read them together. For site energy management see ISO 50001; for electric process heat benchmarks, the US Department of Energy pages are a useful reference.

3. Installation sequence

1. Unload on the lifting lugs only, set the unit on the plinth and check the nameplate against the order. Acceptance: element head and terminal box undistorted, no impact damage.
2. Level on packers and grout the saddles. Acceptance: no rocking, level within ±3 mm per metre in both directions.
3. Bond the shell to earth before any other connection. Acceptance: below 4 Ω on a fall-of-potential test.
4. Connect feed water, main steam, safety valve, drain and blowdown branches. Acceptance: non-return arrows match flow, each branch supported independently of the shell.
5. Fit the safety valve direct on its nozzle with no isolating valve between boiler and valve. Acceptance: lever free, set pressure stamped and not above design pressure.
6. Fill with softened water and vent the shell. Acceptance: steady level in the gauge glass, vents closed only after water appears.
7. Megger the element bank before first energising. Acceptance: at least 50 MΩ at 500 V DC with the terminal links removed.
8. Terminate the power cables and torque the lugs to the section 6.2 values; check phase sequence and gland tightness. Acceptance: clockwise L1-L2-L3 on a rotation meter.
9. Check the panel against the drawing: breaker rating, fuses, step outputs, transmitter ranges. Acceptance: every core numbered and matching the schematic.
10. Hydraulic test at 1.5 times design pressure for 30 minutes. Acceptance: no leak at any joint, no pressure drop beyond gauge error.

11. Flush the feed line, refill and commission the softener. Acceptance: outlet hardness ≤0.03 mmol/L, no resin carry-over.
12. Function-test the interlocks with elements isolated, then start on stage 1 and raise load step by step. Acceptance: every simulated fault trips and latches, phase current within 10% of rated.
13. Pressure-test and blow through the steam line to the plant. Acceptance: no weep at flanges after cooling, clean steam at the first sample point.

Lifting and rigging

Never lift by the element head, terminal box or panel; the shell is top-heavy. Use certified slings on the four lifting lugs, keep a 3 m exclusion zone and never stand under a suspended load. On WDR6 and WDR10 the element head alone weighs more than 400 kg and needs a lifting beam for withdrawal.

Expansion and anchor points

Anchor at the fixed saddle only and let the other saddle slide. Connect the steam line through an expansion loop or braided flexible section; never use the shell as a pipe anchor. Carbon steel grows about 1.2 mm per metre between 20 °C and 184 °C, so a restrained 12 m run will crack a nozzle weld.

4. Commissioning and handover

Commissioning has three parts: mechanical and electrical checks, a hydrostatic test, and a witnessed interlock and load test. Work in that order and record every reading; these become the maintenance baseline. Before energising, megger each element group at 500 V DC, fill and vent, confirm the low-water cut-out is in circuit and set the step controller to zero output.

Hydrostatic test pressure is 1.5 times design — 1.05 MPa for a 0.7 MPa shell, 1.5 MPa at 1.0 MPa, 1.875 MPa at 1.25 MPa, 2.4 MPa at 1.6 MPa. Hold 30 minutes after stabilisation with the safety valve blanked and the element head in place. Acceptance: no leak, no permanent deformation, no pressure loss beyond gauge error. Testing follows GB/T 16508 and TSG G0001 practice; third-party inspection is available on request.

Run the interlock tests with the main breaker open and elements isolated, using the test keys or a simulated signal.

Interlock	Simulated condition	Expected result
Low-water cut-out	Open the test valve or lower the float chamber until the level falls below the cut-out line	All element stages trip within 5 s, alarm sounds, reset is manual only
High-water alarm	Raise the level above the high-level mark	Alarm at the high mark, feed pump stops, elements continue

Interlock	Simulated condition	Expected result
High-pressure limiter	Lower the set point 0.1 MPa below the safety valve setting and raise pressure	Elements trip at the set point; the safety valve must not lift
Over-temperature cut-out	Lower the outlet limit set point or use the test key	Trip before the outlet exceeds design temperature by 10 K
Safety valve	Raise pressure with stages on and the outlet closed	Lifts at or below design pressure; accumulation ≤10% of set pressure
Earth-fault relay	Inject test current at the relay rated residual current	Trips within 0.3 s; no reclose without manual reset
Phase failure / under-voltage	Open one phase at the isolator, then attempt a start	Start inhibited; phase-failure relay flags the lost phase
Panel access interlock	Attempt to close the isolator with the panel door open	Isolator cannot be closed, or the main contactor drops
Emergency stop	Press the E-stop button	All stages off within 1 s, alarm latched, manual reset required

The 4-hour trial proves the unit; the 24-hour run proves the site. Record pressure, level, feedwater temperature, current per phase, panel temperature and make-up water every 30 minutes for 4 hours, then every 2 hours. Acceptance for both: no unplanned trip, imbalance below 10%, insulation resistance unchanged, make-up water below 2% of evaporation. Hand over the O&M manual, P&ID, schematics, element datasheet, hydro and interlock certificates, water treatment report, spares list, training record and declaration of conformity.

5. Normal operation

Start-up from cold. Check the level and the softener, then crack the main steam stop valve to warm the line. Close the isolator, release the E-stop and reset any latched interlock. Start the feed pump and confirm the level holds. Enable stage 1 and let the controller call for stage 2; on a cold shell the first stage may run for minutes before pressure moves. Watch the ammeter during the first 10 minutes — a cracked sheath shows as a current imbalance long before it trips.

Start-up from hot standby. A unit held 0.2–0.3 MPa below set point needs no warm-up. Confirm the level, release the standby lockout and let the controller restore stages in sequence. Never enable all stages at once; the inrush is exactly what the step-loading logic exists to prevent.

Running log. Log these each shift; two consecutive readings outside the band are an anomaly, not a rounding error.

- Steam pressure: set point ±0.05 MPa.
- Steam temperature: within 5 K of saturation temperature at the logged pressure.
- Feedwater temperature: 20–105 °C, steady.

- Current per phase: within 10% of rated, and within 10% of each other.
- Boiler water conductivity: ≤4,000 µS/cm at 1.0 MPa, ≤3,000 µS/cm at 1.6 MPa.
- Feedwater hardness: ≤0.03 mmol/L after the softener.
- Panel internal temperature: ≤ ambient + 10 K, never above 50 °C.
- Casing surface temperature: ≤45 °C; terminal box ≤ ambient + 15 K.
- Earth-leakage standing current: below 30% of the relay setting.

Normal shutdown. Reduce the set point in steps so the controller drops stages in reverse order, stop the feed pump at normal level and close the main steam stop valve. Isolate and lock off, and record the level. Do not open the element head until the shell is below 60 °C.

Emergency shutdown. Press the E-stop, close the main steam stop valve and open the isolator. Do not restore the level if the low-water cut-out has operated — a dry element bank may be above 400 °C and cold water can split the sheath. Megger the elements and record the event before any restart.

Lay-up over 30 days. Wet lay-up: drain, flush, refill with deaerated water at pH 10–12 plus oxygen scavenger, blanket with nitrogen at 0.02–0.05 MPa and circulate monthly. Dry lay-up: drain, dry the interior, place 1 kg of silica gel per m³ of shell volume in trays and blank all connections. On electrode units always drain and dry the electrode chamber; standing water drifts in conductivity and the unit will not load correctly on restart.

6. Maintenance schedule

Every task below starts with: isolate, lock off, tag, prove dead and discharge the element circuit. No panel door is opened on load. Intervals assume ≤0.03 mmol/L hardness and a single-shift plant; on hard water with three shifts, move every water-side interval up one band.

6.1 Daily (each shift)

Task	What to check / acceptance	Tool or reference	Who
Log running parameters	Pressure, temperature, level and current within the bands in section 5	Panel instruments, shift log	Operator
Blow down the gauge glass and level column	Returns quickly and settles at the same level; no blockage	Drain valve, sight glass	Operator
Bottom blowdown by conductivity	Conductivity back within limit; blowdown valve closes tight, no passing	Conductivity meter, blowdown valve	Operator
Read current on all three phases	Within 10% of rated and of each other	Panel ammeter or clamp meter	Operator
Check feedwater hardness	≤0.03 mmol/L; softener in service, brine tank charged	Hardness test kit	Operator

Task	What to check / acceptance	Tool or reference	Who
Walk the panel and terminal box; read the event log	No hot-insulation smell, no discoloured terminals, fan running, filters clear, no unexplained trip	Visual, infra-red thermometer, HMI log	Operator
Check feed pumps and standby changeover	Starts on low level; no abnormal noise or leak	Test switch, ear	Operator

6.2 Monthly

Task	What to check / acceptance	Tool or reference	Who
Element insulation resistance test	≥1 MΩ at 500 V DC per group, links removed, shell drained below the head	500 V insulation tester	Electrician
Contactor inspection	Erosion below 1 mm, no silver migration or arcing tracks, arc chutes clean	Visual, contact gauge	Electrician
Thermal scan of power terminations	Terminals ≤65 °C, phase-to-phase difference ≤10 K, no hot joint	Infra-red camera under load	Electrician
Torque check of element terminals	M8 12 N·m, M10 24 N·m, M12 42 N·m; no loose or bright strand	Calibrated torque wrench	Electrician
SCR or power controller check (if fitted)	Heatsink below 70 °C, fan free, no gate fault, output balanced across phases	Clamp meter, controller diagnostics	Electrician
Low-water cut-out test	Trips within 5 s when the chamber is drained; manual reset only	Chamber drain valve	Operator and electrician
Safety valve manual lift	Lever lifts freely and reseats without weeping	Lifting lever, hearing and sight	Operator
Water quality review	Hardness and conductivity trends flat; blowdown rate still adequate	Log review, test kit	Plant engineer

6.3 Quarterly / semi-annual

Task	What to check / acceptance	Tool or reference	Who
Scale inspection on the element bundle	Scale below 0.2 mm; clean at 0.5 mm; replace the set above 1 mm	Bundle withdrawal, scale gauge	Maintenance fitter
Earth continuity and resistance	PE and all bonded parts continuous; earth resistance <4 Ω	Earth tester, continuity meter	Electrician
Earth-leakage relay trip test	Trips at rated residual current within 0.3 s, both settings if adjustable	Relay test key or injection set	Electrician

Task	What to check / acceptance	Tool or reference	Who
Breaker and isolator inspection	No contact pitting, mechanism free, incoming lugs at panel torque	Torque wrench, visual	Electrician
Pressure gauge and transmitter calibration	Gauge within 1.6% of span against a master; transmitter repeatable within 1% at three points	Master gauge, hand pump	Instrument technician
Step-load and maximum-demand review	Stages sequence correctly; peak demand within the contracted maximum; tariff windows respected	Panel trend, utility bill	Plant engineer

6.4 Annual shutdown inspection

Task	What to check / acceptance	Tool or reference	Who
Internal inspection of shell and element head	No pitting below 90% of wall thickness, no sludge, gasket faces clean	Borescope, ultrasonic thickness gauge	Inspector
Hydrostatic test	1.5 × design pressure held 30 min, no leak or permanent deformation	Test pump, calibrated gauge	Inspector
Element replacement or descale	Insulation ≥1 MΩ, scale below 0.2 mm, new flange gasket and head insulation; torque per section 6.2	Element kit, torque wrench, megger	Electrician
Safety valve set-pressure test	Lifts at or below design pressure, reseats tight, lead seal fitted	Bench test rig, certificate	Valve technician
Full interlock retest	All nine tests in section 4 pass with the elements isolated	Commissioning sheet	Commissioning engineer
Power connection re-torque	Every lug and busbar bolt at drawing torque; no discolouration	Torque wrench, thermal scan	Electrician
Contactor and breaker renewal by cycle count	Replace contactors above 100,000 operations; breaker tested or renewed per maker	Operation counter, test set	Electrician
Recommissioning run	4 h run at three load steps, insulation stable, no trip	Commissioning sheet	Commissioning engineer

Records

Retain log sheets, insulation values, torque records and interlock certificates for three years, with the last two years kept at the boiler. Escalate the same day: two earth-leakage trips in a month, insulation halving between tests, imbalance above 10%, or scale at 0.5 mm before the scheduled interval.

7. Troubleshooting

Symptom	Likely cause	Check	Remedy
No heat, no current, panel alive	Isolator open, main breaker tripped, interlock not reset	Isolator, breaker handle, alarm list	Find the cause, reset, close the isolator
Trips immediately on start	Low water, phase failure, earth fault, element sheath failure	Fault code, level gauge, megger each group	Restore level, repair the supply, replace the faulty element
One stage will not load	Contactor coil open, control fuse blown, SCR fault, step disabled	Coil voltage, fuse continuity, controller status	Replace coil or fuse, restore the step enable
Current imbalance above 10%	Open-circuit element, loose terminal, cable fault	Clamp each phase and each group, torque check	Replace the element, re-terminate and re-torque
Frequent earth-leakage trips	Moisture in the terminal box, degraded insulation, chafed cable	Insulation test, box condition, cable route	Dry and clean the box, replace the element, reroute the cable
Foaming and wet steam	High TDS or alkalinity, oil contamination, level too high	Conductivity, alkalinity, gauge glass	Blow down, skim, find and stop the contamination
Slow pressure recovery	Scale on elements, supply voltage sag, stages locked out by demand limit	Scale inspection, voltage log, demand controller	Descale, correct the supply, review the demand limit
Element sheath bulged or split	Scale, repeated low-water operation, thermal fatigue	Visual inspection, megger, event log	Replace the element set and correct water treatment and level control
Electrode unit output unstable	Conductivity outside the band, level control hunting	Conductivity against the datasheet band, level probe calibration	Adjust blowdown or dosing; calibrate or clean the level probe
Contactor buzz or chatter	Shaded pole ring broken, coil voltage low, loose lamination	Coil voltage, visual on the magnet face	Replace the contactor; do not shim a worn magnet

8. Spare parts and service

Hold the following for the first year. Element sets are the long-lead item; waiting for a failure costs several days of steam.

Item	Recommended quantity	Notes
Heating element, matched to model and voltage	10% of installed count, minimum two	Order by element drawing number, not by kW alone
Element flange gasket and head gasket	Two sets	Graphite or spiral-wound as originally fitted
Contactor, one per frame size used	One each	Same coil voltage as the panel
Control and power fuses	Two of each rating	List the ratings on the panel door
Thermocouple or RTD	Two	Match the controller input type
Level electrode or float switch	One	Include the chamber gasket
Safety valve	One	Same set pressure and capacity, certified
Softener resin	25 L	Plus a brine valve diaphragm
SCR module or thyristor pair (if fitted)	One set	Include the thermal pad

Keep contact cleaner, lugs, insulation tape, terminal blocks, desiccant and a descaling agent on the shelf. Order with model, serial and drawing number; a nameplate photograph prevents most wrong-part shipments. The softener range and feed pump sets are matched to these boilers, and a control cabinet upgrade covers step loading and demand control. Service response: acknowledgement within one working day, remote diagnosis within two, parts in 5–10 working days, site attendance per the service agreement.

9. Document control

Revision	Date	Change
A	2024-03	First issue covering WDR, LDR, CLDR and ZWDR families
B	2025-06	Added electrode conductivity limits, step-loading and demand review tasks
1.0	2026-11	Current issue for this site; element torque table aligned to supplier datasheet

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This manual covers the family; the site version adds your serial number, element configuration, panel drawings and commissioning settings. Request it with the serial number from the nameplate:

contact the factory.