INSTALLATION · COMMISSIONING · MAINTENANCE MANUAL

Burners, Softeners, Pumps & Control Cabinets

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

This manual covers the boiler-house auxiliaries supplied with YXBOILER packaged plants: gas, light-oil and dual-fuel burners from 0.5 to 20 MW, water softening plants, feed water and circulating pumps, control cabinets with PLC panels, and steam headers and distributors. It is written for the site engineer, commissioning technician and maintenance fitter who position, connect, adjust and service these items. Each section gives installation clearances, connection requirements, commissioning checks and maintenance rows with numeric acceptance values.

Document YX-MAN-AUX **Revision** 1.0 **Issue date** 2026-11
Applies to Burners, softeners, pumps, control cabinets, headers **Language** English

1. Scope and model coverage

Model or equipment line	Capacity range	Design pressure, temperature	Fuel or medium	Typical duty
YX-G gas burner train	0.5–20 MW	Furnace −20 to −50 Pa; ambient 0–50 °C	Natural gas, LPG	Single or dual boiler package
YX-O light-oil burner	0.5–14 MW	As above	Light diesel, 3–6 cSt at 20 °C	Sites without a gas supply
YX-DF dual-fuel burner	1–20 MW	As above	Gas and light oil	Interruptible gas contracts
YX-SF water softener	2–50 t/h	0.6 MPa, 5–45 °C	Raw water, hardness ≤ 450 mg/L	Make-up for 1–20 t/h boilers
YX-FP feed pump, YX-CP circulating pump	2–60 m³/h	1.6 MPa, 105 °C	Treated water	Boiler feed and hot-water loop
YX-CC control cabinet, PLC panel	Burner load up to 20 MW	400 V, IP54, 0–50 °C ambient	—	Boiler and burner control

Model or equipment line	Capacity range	Design pressure, temperature	Fuel or medium	Typical duty
Steam header and distributor	DN80–DN400	1.6 MPa, 204 °C	Saturated steam	Multi-boiler distribution

The scope ends at the terminal box, the burner gas flange and the header outlet flange. Excluded are the gas yard upstream of the manual isolation valve, fuel storage tanks and their bunding, chimney steel, civil works, and site electrical distribution beyond the cabinet. Burner capacity selection and the matching boiler are covered in the separate boiler manual and in the capacity selection pages; the full document set is listed in the manual library.

2. Site and utility requirements before delivery

Confirm every item below before the equipment leaves the factory. Missing clearances or a soft water supply are the two most common causes of delayed commissioning. Send the completed utility schedule with the order acknowledgement so the burner train and softener are set for site conditions.

Item	Requirement	Tolerance or note
Foundation and plinth	Concrete plinth 150 mm above floor, cured 28 days	Level ±2 mm/m; non-shrink grout 25 mm
Burner swing and tube access	Door swing plus 0.5 m clear; 1.2 m at hinge side	Rear tube removal per boiler manual
Softener access	0.8 m at valve face, 1.2 m headroom at resin port	Brine tank within 3 m of ejector
Pump access	0.8 m at non-drive end	Seal and bearing withdrawal
Boiler house ventilation	3 air changes/h plus combustion air	Non-closing louvres; 1.3 m³ air per m³ gas
Feed water quality	Hardness ≤0.03 mmol/L, pH 10–12, oxygen ≤0.1 mg/L	Deaerator when output exceeds 6 t/h; conductivity ≤3000 µS/cm at 1.0 MPa
Fuel supply	Gas 20–50 kPa; oil 0.3–0.6 MPa at train inlet	Stable within ±10%; no water or solids
Flue and chimney	Draught −20 to −50 Pa at furnace outlet	Stack height and materials to local code
Electrical supply and earthing	400 V ±10%, three-phase, 50 Hz; earth ≤4 Ω	PLC signal earth separate, ≤1 Ω
Drainage and blowdown pit	Pit sized for 10% of maximum evaporation	Discharge cooled to ≤60 °C

3. Installation sequence

1. Unload and inspect. Check the packing list against the general arrangement drawing and confirm flange caps and blind plates are fitted. Photograph any impact damage before signing and record burner, pump and softener serial numbers.
2. Position the softener skid. Set it on the plinth with 0.8 m clear at the valve face and 1.2 m headroom at the resin port, level to ±2 mm/m, and anchor all four feet. Confirm the brine tank sits within 3 m of the ejector.
3. Grout the pump baseplates. Clean the concrete, shim to level and pour non-shrink grout; allow 24 h before tightening. The shaft must turn freely by hand with the coupling removed.
4. Fit the burner. Renew the furnace flange gasket, enter the burner tube square and tighten diagonally in three passes. Check that the burner door swings through its full arc without touching insulation or pipework.
5. Assemble the gas train. Install strainer, regulator, safety shut-off valves, leak-test valve and pressure switches in the drawing order, each pipe run independently supported. No pipe strain may remain on the burner flange.
6. Connect the oil line. Mount the oil pump, filter and heater on a supported frame, slope suction piping back to the tank and bleed all high points. Pressure-test the line at 1.5 × pump pressure for 10 min.
7. Pull the electrical cables. Separate power and signal trays by 200 mm, gland every entry and terminate to the numbered schedule. Check earth continuity from the cabinet to each skid before energising.
8. Connect instrument air. Supply dry air at 0.4–0.6 MPa through a filter regulator and set 0.4 MPa at the burner control valves.
9. Erect the steam header. Set anchors and sliding shoes, fit the expansion joint at the stated cold pull and slope 1:200 towards the traps. Never spring the header to close a flange gap.
10. Flush the water side. Bypass the softener, flush new pipework to drain until the water runs clear, then refit strainers. Never flush through the resin bed.
11. Pressure-test the header. Test at 1.5 × design pressure for 30 min; there must be no visible leak and no gauge pressure drop.
12. Commission the softener. Backwash, regenerate, rinse and test outlet hardness; repeat the cycle until hardness is ≤0.03 mmol/L.
13. Insulate the header. Apply insulation only after a successful test; surface temperature must remain below 50 °C in service.

Lifting and rigging

Burner fan sections, softener vessels and pump sets have marked lifting points. Use certified slings and shackles, never lift by the gas train, piping or terminal box, and keep personnel clear of suspended loads. Lower softener vessels slowly; resin and water weight can exceed the dry weight by 40%.

Expansion and anchor points

The header fixed point carries the full thermal thrust. Sliding shoes must move freely and the expansion joint must never be compressed to make a flange fit. Where the drawing shows a flexible connection at the burner, keep it free of torsional load.

4. Commissioning and handover

Hydro-test the header and softener vessels at 1.5 × design pressure, held for 30 min, following GB/T 16508 and TSG G0001 practice. A 0.6 MPa softener vessel is therefore tested at 0.9 MPa; the pump casing is tested by the maker and is not re-tested on site. Fill the system through the highest connection at no more than 0.2 MPa/min, venting the header and pump casing as water rises, and confirm all air vents are closed before pressure is raised.

Burner commissioning starts with the gas train leak test, then low-fire adjustment, then high fire. Set combustion with a calibrated analyser at low, mid and high fire and record every point. The target bands below apply to burners from 0.5 to 20 MW; the burner range pages give the model-specific nozzle and cam data.

1. Close the manual isolation valve and the burner gas valve, then vent the train to atmosphere through the test point.
2. Pressurise the train with air or nitrogen to 1.1 × maximum working pressure. A train working at 50 kPa is tested at 55 kPa.
3. Close the test valve, allow 1 min for stabilisation, then record the starting pressure.
4. Hold for 5 min. No pressure decay is acceptable; any fall indicates a seat, diaphragm or joint leak.
5. Bubble-test every joint and valve seat with an approved detector. Repair the fault and repeat the full 5 min test from step 2.
6. Reconnect, purge the train with fuel gas to the vent until the gas reading is stable, then check the purge point for leaks.

Leak test safety

Test with air or nitrogen, never with a flame. Post the test pressure and result on the commissioning sheet, and repeat the test after any gas train joint is broken.

Combustion parameter at high fire	Gas firing	Light-oil firing
Oxygen, O2	3–5%	4–6%
Carbon monoxide, CO	<50 ppm	<50 ppm
Excess air	15–25%	20–35%
Stack temperature	140–170 °C	170–200 °C
Carbon dioxide, CO2	9.5–10.5%	11–12.5%
Flame scanner signal	60–100%; flame-off <10%	60–100%; flame-off <10%

On oil firing, set the electrode gap to 2.5–3.5 mm, keep the nozzle face flush to 2 mm proud of the diffuser, and set oil pump pressure to 1.2–1.6 MPa with filter differential below 0.05 MPa. Replace a nozzle that has been cleaned twice; eroded orifices cannot be restored by wire brushing. Record stack temperature at each load step as the baseline for later trend checks.

Prove every safety interlock by simulation before handover, using the test column, test valves and simulator points. Record the actual trip time and the reset action.

Interlock	Simulated condition	Expected result
Low water level	Lower the test column electrode or float	Burner trips within 5 s, alarm sounds, restart blocked until reset
Flame failure	Close the manual cock for 3 s	Fuel valves close within 1 s, lockout, post-purge 60 s
Gas pressure low or high	Open or close the pressure switch test valve	Trip at setpoint, repeatability within ±5%
Combustion air low	Throttle the air switch impulse line	Trip before the fuel valve opens
High stack temperature	Simulate 30 °C above setpoint	Alarm at first stage, trip at second stage
Emergency stop	Press the mushroom head	All fuel valves close, fan stops, alarm latches
Boiler limit control	Lower the pressure or temperature setpoint	Burner stops at setpoint and restarts on demand

Run a 4 h trial at 50–100% load, logging hourly, then a 24 h continuous run at site load. Handover documents are the general arrangement drawing, wiring diagram, gas train drawing, pressure test certificates, interlock test record, combustion report, softener commissioning sheet, this manual and the spare parts list.

5. Normal operation

Start-up from cold. Confirm softener outlet hardness and brine tank level, open the feed pump suction valve and start the feed pump with discharge set 0.2 MPa above boiler pressure. Start the fan, open the damper to 25% and purge for 60 s. Prove the flame scanner, light the burner at low fire and confirm the flame signal exceeds 60%. Raise load in 10% steps every 5 min, watching O2, CO and stack temperature. Bring the header to setpoint, then open the main stop valve slowly with all traps draining.

Start-up from hot standby. Keep the header warm at 0.3–0.5 MPa with traps open and the burner cycling on low fire. Before restarting, purge for 60 s, check that the scanner sees no flame, and confirm the drum level is between the normal water level marks. Do not bank the burner with fuel in the furnace.

Parameter	Normal band	Check frequency
Header pressure	1.0 ± 0.05 MPa	Hourly
Burner O2	3–5% gas, 4–6% oil	Each shift
Stack temperature	Baseline +30 °C maximum	Hourly
Flame signal	>60%, steady	Each shift
Pump discharge pressure	1.2–1.4 MPa	Hourly
Pump bearing temperature	<70 °C	Each shift
Softener outlet hardness	≤0.03 mmol/L	Daily
Cabinet internal temperature	<40 °C and <15 K above ambient	Daily
Steam trap discharge	Intermittent, no live steam	Daily

Normal shutdown. Reduce load to low fire, run for 5 min to purge the furnace, stop the burner and allow the 60 s post-purge before stopping the fan. Close the main stop valve, drain the traps and keep the feed pump running until the level is stable. **Emergency shutdown.** Press the emergency stop, close the main stop valve and do not restart until the cause is found and the interlock circuit is proved.

Lay-up over 30 days. For wet lay-up, drain and refill with treated water at pH 10–12, add oxygen scavenger and circulate weekly. For dry lay-up, drain completely, dry the interior with warm air and place desiccant in the header; seal all openings and record the date. Softener resin stays wet; keep the brine tank covered and regenerate monthly.

6. Maintenance schedule

The four schedules below cover every auxiliary in this manual; model-specific service data for the water softening plant, feed water pumps and control cabinet is published with each model. A task is complete only when the measured value is written on the log sheet with the date and initials. Vibration readings are compared with the ISO 10816 zone A/B limits for the machine class.

6.1 Daily, each shift

Task	What to check and acceptance	Tool or reference	Who
Softener outlet hardness	≤0.03 mmol/L; regenerate immediately if above	Titration kit	Shift operator
Brine tank	Salt at least 200 mm above the grid, no crust or bridging	Visual dip	Shift operator
Feed and circulating pumps	Bearing <70 °C, vibration ≤4.5 mm/s, seal leak ≤5 drops/min	IR thermometer, vibration pen	Shift operator
Burner flame	Signal >60%, stable, no pulsation or roar	Panel display	Shift operator
Combustion readings	O2, CO and stack temperature inside the section 4 bands	Flue gas analyser	Shift operator
Control cabinet	No alarm, fans running, filter clean, internal <40 °C	Visual, thermometer	Shift operator
Steam header traps	Intermittent discharge, no continuous live steam	Listening rod, IR	Shift operator
Gas train	Inlet 20–50 kPa, no smell, joints tight	Manometer, detector	Shift operator
Oil system	Pressure 1.2–1.6 MPa, filter differential <0.05 MPa	Gauges	Shift operator

6.2 Monthly

Task	What to check and acceptance	Tool or reference	Who
Burner nozzle and electrodes	Clean, no carbon; electrode gap 2.5–3.5 mm; nozzle not eroded	Feeler gauge, nozzle gauge	Fitter
Flame scanner	Lens clean, signal >60%, flame-off <10%	Lint-free cloth, panel	Fitter
Gas train valve tightness	No bubble at any seat or joint over 1 min	Leak detector	Fitter
Pump coupling alignment	Offset ≤0.05 mm, angular ≤0.05 mm per 100 mm	Dial gauge or laser	Fitter
Softener backwash	Bed expansion 50–70%, no resin carry-over	Sight glass, flow meter	Fitter
Cabinet thermal scan	No hot spot more than 15 K above ambient	IR camera	Electrician
Terminal torque check	M4 1.2 N·m, M6 4.5 N·m, or drawing value	Torque wrench	Electrician

Task	What to check and acceptance	Tool or reference	Who
Header insulation	Surface <50 °C, no gaps at flanges or supports	IR thermometer	Fitter
Strainers	Pump suction and trap strainers clean, no perforation	Spanner, light	Fitter

6.3 Quarterly or semi-annual

Task	What to check and acceptance	Tool or reference	Who
Full gas train leak test	1.1 × working pressure, 5 min hold, no decay	Test kit, calibrated gauge	Fitter and electrician
Combustion re-check	All points inside section 4 bands; analyser zeroed	Flue gas analyser	Commissioning technician
Pump seal and bearings	Seal faces clean, grease per schedule, bearing <70 °C	Hand tools, grease gun	Fitter
Softener capacity test	Measured capacity ≥80% of design; resin sample examined	Test kit, sample jar	Service technician
Earth continuity and insulation	≤0.1 Ω to each skid; >1 MΩ at 500 V	Earth tester, megger	Electrician
Sensor calibration	Pressure transmitter ±0.5% FS, RTD ±1 °C, level electrode trips at the marked level	Calibrator, test column	Instrument technician
Steam trap overhaul	Replace any trap passing live steam; renew gaskets	Trap spares	Fitter

6.4 Annual shutdown inspection

Task	What to check and acceptance	Tool or reference	Who
Burner overhaul	Nozzle, electrodes, diffuser and fan bearings renewed as needed; leak test after assembly	Burner kit, drawing	Service technician
Gas train valve overhaul	Seats, diaphragms and springs replaced; set pressures verified	Valve kit, pressure gauge	Service technician
Pump overhaul	Bearings and seal renewed; wear ring clearance ≤0.3 mm	Pump kit, feeler gauge	Fitter
Softener resin and valves	Resin replaced if capacity <80%; lining sound; valve seats renewed	Resin, valve kit	Service technician

Task	What to check and acceptance	Tool or reference	Who
PLC battery and cabinet	Battery >2.8 V, replace every 3–5 years; contactors clean; all terminals torqued	Multimeter, torque wrench	Electrician
Safety and relief valves	Set pressure ≤ design, accumulation ≤10%, clean reseat	Test bench	Authorised test house
Header inspection	Supports, expansion joint, insulation and wall thickness at bends	UT gauge, visual	Inspector
Instrument loop check	Sensor to PLC, alarm and trip proved end to end	Loop simulator	Instrument technician

Records

Retain log sheets for three years. Any reading outside the stated band is an anomaly: record it, tag the equipment and escalate to the site engineer the same shift. Do not adjust a safety device to clear an alarm.

7. Troubleshooting

Symptom	Likely cause	Check	Remedy
Burner locks out at start	No flame signal, air in gas line, wrong electrode gap	Scanner display, purge, gap	Purge longer, reset gap to 2.5–3.5 mm
Flame signal falls during run	Dirty scanner lens, unstable fuel pressure, wrong nozzle	Lens, inlet pressure, nozzle size	Clean lens, stabilise pressure, fit correct nozzle
CO above 50 ppm	Insufficient air, carboned nozzle, diffuser set too deep	O2, nozzle, diffuser position	Clean nozzle, reset combustion to section 4
Stack temperature rising	Excess air or fouled heating surface	O2 trend, boiler baseline	Reset air, clean boiler tubes
Softener hardness breakthrough	Resin exhausted, brine failure, channelling	Brine level, salt dose, backwash flow	Regenerate, inspect and clean resin bed
Softener pressure drop high	Fouled bed, blocked strainer	Inlet and outlet gauges, strainer	Backwash, clean strainer, replace resin if compacted
Pump vibration	Misalignment, cavitation, worn bearing	Alignment, suction pressure, bearing sound	Realign, raise suction head, replace bearing
Mechanical seal leak	Dry running, no flush, worn faces	Flush flow, seal area	Restore flush, replace seal

Symptom	Likely cause	Check	Remedy
Cabinet over temperature	Fan failed, filter blocked, high ambient	Fan, filter, thermal scan	Replace fan, clean filter, shade the cabinet
Steam trap passing steam	Failed trap, dirt on seat	Ultrasonic or IR check	Replace trap, blow down strainer

8. Spare parts and service

Hold the following first-year spares on site. Items marked as consumables should be replaced at the interval shown rather than stocked indefinitely.

- **Burner:** two nozzle sets, two electrode pairs, one flame scanner, two flange gasket sets, one fan bearing set, one gas train diaphragm and spring set, four filter elements.
- **Softener:** resin for 10% of bed volume, one brine valve repair kit, one ejector, gasket set, hardness test reagents.
- **Pumps:** two mechanical seals, two bearing sets, two coupling elements, gasket set.
- **Cabinet:** two PLC batteries, one contactor coil, fuse set, four filter mats, one spare pressure transmitter and one RTD.
- **Header:** two steam traps, gasket set, one insulation section per 10 m.

Order by model, serial number and drawing number, quoting the item position on the drawing. Consumables are the nozzle, electrodes, filter elements, resin, seals, gaskets and PLC battery. Service response is one working day for acknowledgement and a site visit within five working days for a stoppage; emergency cover is quoted separately. Contact the service desk through the contact page with the serial number and a photograph of the nameplate.

9. Document control

Revision	Date	Change
1.0	2026-11	First issue for the auxiliary equipment family.

This file is hash-verified. The SHA-256 digest of the published PDF is listed on the verification page, and any printed copy is uncontrolled unless the digest matches. Check the digest shown at the manual verification page before using this document for commissioning or maintenance. Report any mismatch to Henan Yongxing Special Equipment Co., Ltd..

Need the site-specific manual with your burner, softener, pump and cabinet serial numbers, factory setpoints and wiring schedule? Send the nameplate photograph and order number through the contact form.

Request the site-specific auxiliary manual