

QUALITY CONTROL SYSTEM DESCRIPTION

INTRODUCTION

Boilte's quality control system is not a final inspection of the finished product — it is a comprehensive quality management process at every stage: from incoming material inspection to final hydraulic tests. We eliminate the very possibility of defects occurring, rather than merely detecting them at the end of production.

Our system is based on the principle of "reinforcement at critical points" and meets the requirements of international standards (ISO 9001, ASME, PED, EN), but is 30-50% stricter than industry norms.

SECTION 1. QUALITY CONTROL STAGES

1.1. Incoming Inspection (Incoming Material Control)

Objective: To eliminate the use of substandard raw materials and components.

No.	Controlled Parameter	Control Method	Scope of Control
1	Chemical composition of steel	Spectrometric analysis (PMI — Positive Material Identification)	100% of critical material batches
2	Mechanical properties (tensile strength, yield strength, impact toughness)	Mechanical testing on witness samples	100% of batches
3	Internal defects (delaminations, cracks, porosity)	Ultrasonic testing (UT) of rolled products	100% of sheets and pipes
4	Geometric parameters (wall thickness, diameter, ovality)	Micrometry, measuring instruments	3-5 points on each unit
5	Origin verification	Certificate verification (MTC — Mill Test Certificate) per EN 10204 type 3.1/3.2	100% of batches

Special Attention: For heating surface pipes operating under pressure, 100% ultrasonic testing is performed with a calibration notch depth of 5% of wall thickness (but not less than 0.3 mm and not more than 1.5 mm).

1.2. In-Process (Step-by-Step) Inspection

Objective: Quality control at each stage of production before final assembly.

No.	Production Stage	Controlled Parameter	Control Method	Scope of Control
1	Marking and cutting	Geometry of blanks	Dimensional inspection	100%
2	Bending and forming	Bend radii, ovality	Templates, measuring instruments	100%
3	Welding (edge preparation)	Groove angle, gap, blunt edge	Visual inspection (VT)	100%
4	Welding (weld execution)	Welding parameters (current, voltage, speed)	Equipment monitoring	100%
5	Weld inspection (after welding)	Surface defects (cracks, porosity, undercuts, lack of fusion)	Visual inspection (VT), Penetrant testing (PT), Magnetic particle testing (MT)	100% of pressure-retaining welds
6	Weld inspection (internal defects)	Volumetric and planar defects	Radiographic testing (RT) / Ultrasonic testing (UT)	100% of butt welds on drums and headers

No.	Production Stage	Controlled Parameter	Control Method	Scope of Control
7	Heat treatment (stress relief)	Temperature, holding time, heating/cooling rate	Recording in heat treatment charts	100% of components with wall thickness > 20 mm
8	Post-heat treatment inspection	Recurrence of defects	MT, PT, UT (depending on material)	100% of critical welds

1.3. Non-Destructive Testing (NDT) Methods

Boilte employs a full range of Non-Destructive Testing (NDT) methods in accordance with international standards and internal BCDS requirements, which are stricter than industry norms:

NDT Method	Abbreviation	Detectable Defects	Application
Visual Inspection	VT	Surface defects (undercuts, porosity, cracks, lack of fusion)	100% of welds
Penetrant Testing	PT (DPI)	Surface cracks, porosity (for non-ferrous metals, austenitic steel)	Selectively on critical components
Magnetic Particle Testing	MT (MPI)	Surface and subsurface cracks (for ferromagnetic steels)	100% of welds on ferromagnetic materials
Ultrasonic Testing	UT	Internal defects (delaminations, cracks, lack of fusion)	100% of butt welds on drums and headers; 100% of rolled products for delaminations
Radiographic Testing	RT	Volumetric defects (porosity, slag inclusions)	100% of butt welds on drums and headers; 10-20% of tube panel welds (in areas intersecting bends)

Additional NDT Methods at Boilte:

Method	Application
Thickness Measurement	Monitoring wall thickness of pipes and sheets during operation
Hardness Testing	Monitoring weld hardness after heat treatment (for alloy steels)

1.4. Finished Equipment Testing

Objective: Verification of performance, strength, and tightness of equipment before shipment.

No.	Test Type	Parameters	Standard
1	Hydraulic Tests	Pressure: $1.8 \times P_{\text{working}}$ (versus $1.43 \times P_{\text{working}}$ per EN). Holding time increased by 50%	Hydraulic Test Report
2	Pneumatic Tests (for critical components)	Pressure: $1.1 \times P_{\text{working}}$ (when hydraulic testing is not possible)	Pneumatic Test Report
3	Functional Tests	Verification of automation, burner, pumps, sensors	Commissioning Report
4	Thermographic Inspection	Uniformity of heating, quality of thermal insulation	Thermographic Report
5	Tightness Tests	Absence of leaks in the gas path	Pressure Test Report

SECTION 2. CERTIFICATION AND STANDARDS

2.1. International Certificates

Boilte holds a full package of permits and certifications confirming product quality and safety:

Certificate	Standard	Scope
ISO 9001	Quality Management System	Design and manufacturing of boilers
ISO 14001	Environmental Management System	Environmental impact management
ISO 45001	Occupational Health and Safety Management System	Personnel and production safety
ASME	American Society of Mechanical Engineers	Manufacturing of pressure vessels
PED 2014/68/EU	European Pressure Equipment Directive	Supply to the European market
TÜV	German Certification	Confirmation of safety and quality

2.2. Boilte Internal Standards (BCDS)

In addition to external certifications, Boilte applies its own Boilte Core Design Standard (BCDS), which is 30-50% stricter than EN 12952/12953 requirements:

Parameter	EN Requirement	BCDS Requirement
Safety factor for tensile strength	≥ 2.7	≥ 3.2
Safety factor for yield strength	≥ 1.5	≥ 1.8
Corrosion allowance	0.5-1.0 mm	1.5-3.0 mm (depending on zone)
Weld inspection scope (drums)	Selective (10-25%)	100% (RT + UT)

SECTION 3. QUALITY DOCUMENTATION

Each Boilte boiler is accompanied by a complete package of technical documentation, including:

No.	Document	Format
1	Boiler Passport with serial number	PDF (original paper)
2	Material Certificates (MTC per EN 10204 type 3.1/3.2)	PDF
3	Component Certificates (burners, valves, instrumentation)	PDF
4	NDT Test Reports (RT, UT, MT, PT)	PDF
5	Hydraulic Test Reports	PDF
6	QC Department Acceptance Certificate	PDF
7	Certificates of Conformity (TR TC 016/2011, ASME, PED)	PDF
8	Installation and Operation Manual	PDF
9	Warranty Card	PDF

SECTION 4. CUSTOMER INSPECTION AND ACCEPTANCE

Boilte provides customers with the opportunity to be present during testing and acceptance of equipment at the production site:

Stage	What is Verified	Customer Participation
Intermediate	Quality of component manufacturing, welds,	Upon request

Stage	What is Verified	Customer Participation
Inspection	geometry	
Final Testing	Hydraulic tests, automation verification	Mandatory (recommended)
Final Acceptance	Compliance with specifications, completeness, documentation	Mandatory

Acceptance is formalized by a bilateral Delivery and Acceptance Certificate.

Approved by:
Chief Technical Officer of Boilte