

INSPECTION REPORT

Report No. MD-FT2601-D03

Date: 15-Aug-2026

PROJECT:	Inspection of casting fittings
PO No:	MD-FT2601

Client:						
Contract Reference: MD-FT2601						
Supplier:	FLUID TECH PIPING SYSTEMS (TIANJIN) CO.,LTD UNIT B308, SHUAILING TECHNOLOGY PARK, NO.83 QIWEI ROAD, HEDONG DISTRICT TIANJIN 300171, CHINA					
Department / All.						
Section:	Detail in the report					
Inspector: Mr. Zhang	Major NCR: N/A					
Summary of inspection	Observations: As indicated at the end of the report					
<u>Preamble</u>						
Inspector Mr. Zhang visited Fluid Tech piping systems company 's Weifang Foundry . On 15 Aug . 2026,witnessed the material mechanical property and chemical analysis test for ASTM A536 65-45-12 material randomly.						
<u>Reference Standard or specification</u>						
- GB/T 1348-2019 Spheroidal Graphite Iron Castings - GB/T 9441-2019 Metallographic Examination of Spheroidal Graphite Cast Iron - ASTM A536-84 (2019) e1: ASTM A536 Standard Specification for Ductile Iron Castings						
<u>Purpose</u>						
- Entrusted by Fluid Tech piping systems company 's Weifang Foundry, authorized inspectors of our institution conducted full on-site random witness supervision on three inspection items of ASTM A536 65-45-12 spheroidal graphite iron specimens, including: - Uniaxial tensile mechanical property test - Metallographic examination (graphite nodularity grading + pearlite matrix assessment) - Chemical analysis with chemical solutions						
<u>Production status information</u>						
<u>Measured Instruments Calibration Information</u>						
No	Measuring instruments	Model/type	Instrument No	Calibration Date	Period of validity	Remark
1	Tensile Testing Machine	WE-600D	2414151	15Jun2026	14Jun2027	
<u>Observation:</u>						
Witness Report for Tensile Mechanical Property Test of ASTM A536 65-45-12 Ductile Iron Specimen						
Calibration Validity Verification of Test Equipment The tensile testing machine used for this test has been calibrated by CCIC Metrology Co., Ltd. Shandong Branch. Key verification items are listed as below:						

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- 1) The laboratory's quality management system complies with ISO/IEC 17025:2017; all calibration results are traceable to the International System of Units (SI).
- 2) Calibration certificate number: 260803LX020, displacement speed verification item No.3054, calibration validity until 2026-09-25.
- 3) The calibration certificate is complete and within valid period; the testing equipment meets metrological requirements for tensile property measurement of ductile iron specimens.
- 4) Calibration objection clause: The client may submit written objections within five working days upon receipt of calibrated equipment, which confirms formal and standardized calibration management.

2. Witness Process Description

- 1) The inspector was present throughout the full tensile test procedure, including specimen installation, parameter setup, loading execution, fracture observation and original data recording.
- 2) On-site photos were taken synchronously during testing to record specimen status, equipment display and test operation, which are attached as objective witness evidence.
- 3) Test operation strictly followed the test method specified as per ASTM A536-84 (2019) e1, with standard specimen gauge length L0=5d for elongation A5 measurement.
- 4) No abnormal operation, equipment failure or data modification occurred during the whole witnessed test process; test operations were fully standardized and traceable.

3. Mandatory Mechanical Property Requirements of ASTM A536 65-45-12

Per ASTM A536-84 (2019) e1, the minimum mechanical properties of ASTM A536 65-45-12 standard test blocks are stipulated as follows:

Mechanical Index	Standard Minimum Requirement	Actual	Result
Tensile Strength Rm	≥ 448 MPa	542.97 MPa	Acceptable
0.2% Proof Yield Strength Rp0.2	≥ 310 MPa	435.64 MPa	Acceptable
Elongation after Fracture A5	≥ 12 %	13.45%	Acceptable

● **Chemical analysis with chemical solutions**

1. Calibration Result Compliance Check

- 1) Appearance & functional inspection: Passed
- 2) Randomly witness analysis sample taken from finished grade QT450 products
- 3) Witnessed the chemical analysis test with chemical solution method

2. Spectral Chemical Composition Result Compliance Assessment

According to ASTM A536 standard, Chemical Requirements, clause 9.1 It is the intent of this specification to subordinate chemical composition to mechanical properties; however, any chemical requirements may be specified by agreement between the manufacturer and the purchaser.

Inspector according to Chinese standard GB/T 1348-2019, material grade QT450-10 ferritic spheroidal graphite iron; GB/T 1348-2019 specifies the standard chemical composition range (mass fraction, %) as follows: material grade QT450-10 and ASTM A536 65-45-12 it's similar material grade, just for reference.

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Element	Reference Requirement Range	Test Result Judgement Basis(%)	Result
Carbon (C)	3.50 ~ 3.90%	3.7%	
Silicon (Si)	2.25 ~ 3.00%	2.6%	
Manganese (Mn)	0.15 ~ 0.35%	0.15%	
Sulfur (S)	≤ 0.025%	0.012%	
Phosphorus (P)	≤ 0.025%	0.02%	

● Metallographic Examination Assessment

Two core metallographic items were witnessed and assessed under 100× magnification as required by ASTM A536 Grade 65-45-12: graphite nodularity grading and pearlite matrix proportion evaluation.

1 Graphite Nodularity Grading

ASTM A536 65-45-12 ferritic ductile iron requires nodularity ≥ Grade 3 (nodularity rate ≥82%) as minimum acceptance standard.

- On-site metallographic micrograph observation: Most graphite presents spherical and agglomerated spherical shape, with negligible vermicular graphite.
- Recorded nodularity grade: Grade 3, nodularity rate ≥82%
- Judgement: Meets the minimum nodularity requirement of ASTM A536 Grade 65-45-12, Grade 3 Nodularity Metallograph (100×), graphite morphology is qualified.

Pearlite Matrix Content Assessment

ASTM A536 65-45-12 is typical ferritic spheroidal graphite iron; standard specifies pearlite proportion shall not exceed 10% for standard ASTM A536 65-45-12 material.

- Corroded metallographic specimen observation: Matrix is dominated by ferrite, only scattered tiny pearlite flakes distributed locally.
- Recorded pearlite proportion: ≤8%
- Judgement: Pearlite content complies with standard requirements, matrix structure meets ASTM A536 65-45-12 material characteristics.

General Comprehensive Conclusion

After full on-site random witness, cross-verification of calibration certificates, original test data, metallographic micrographs and inspection records:

- The CX-9800 optical emission spectrometer used for composition analysis holds valid calibration certificate with complete metrological traceability;
- Metallographic nodularity grading and pearlite matrix assessment results fully meet standard requirements;
- Tensile test result was in accordance with ASTM A536 65-45-12 requirements;
- The chemical analysis test result was in accordance with ASTM A536 65-45-12 requirements.

Detail photos for this inspection

REM

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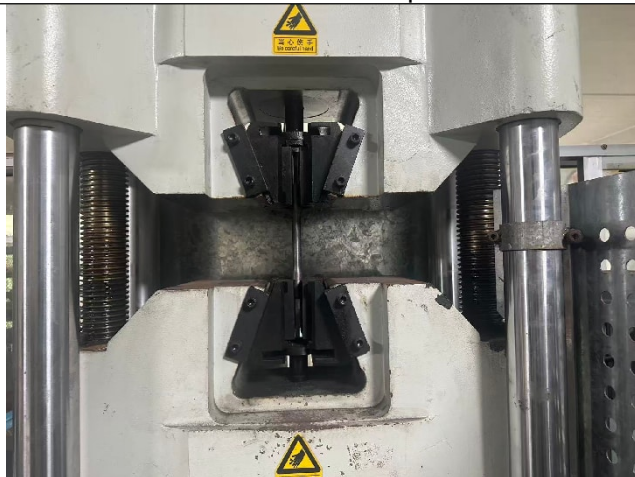
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Tensile test sample



Checking tensile test sample dimension



Witnessing tensile test



Witnessing tensile test



Witnessing tensile test



Witnessing tensile test

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Checking the elongation after tensile test



Tensile test sample



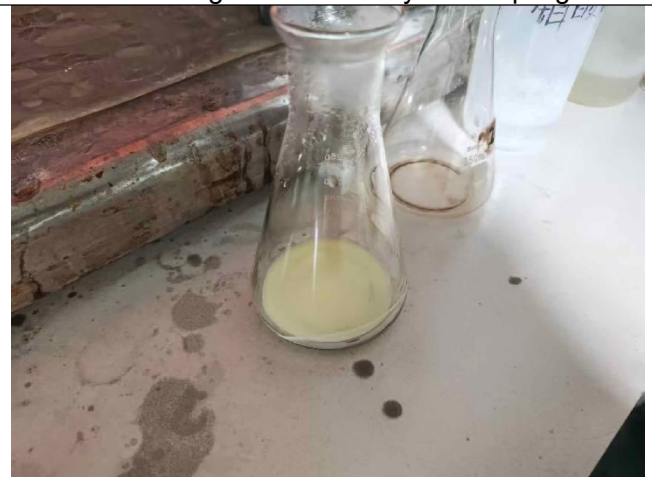
Randomly select the chemical analysis material



Witnessing chemical analysis sampling



Witnessing chemical analysis test



Witnessing chemical analysis test

REM

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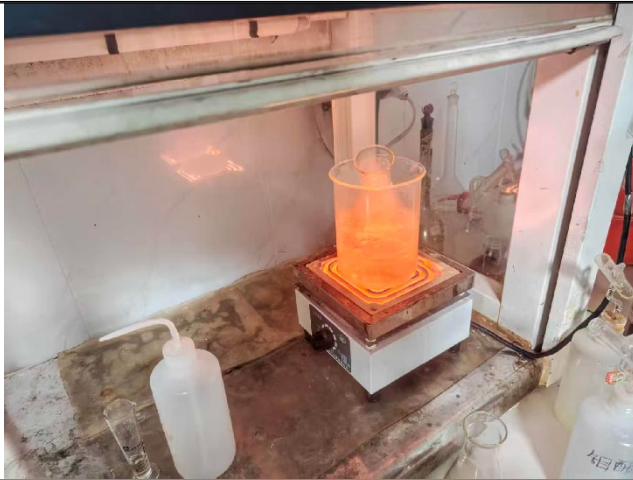
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Witnessing chemical analysis test



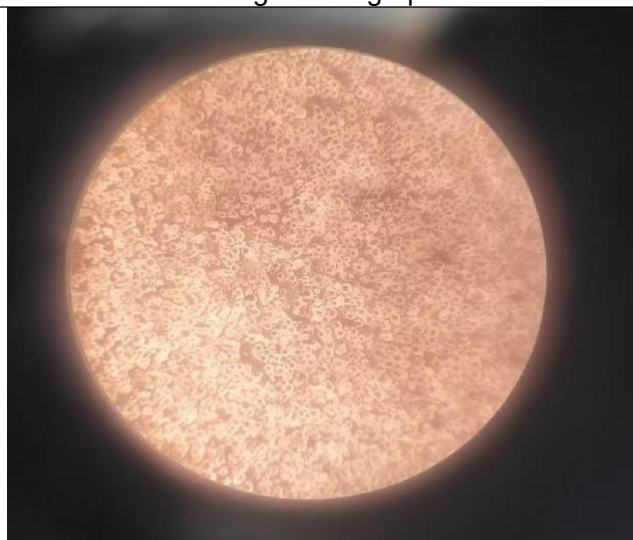
Witnessing chemical analysis test



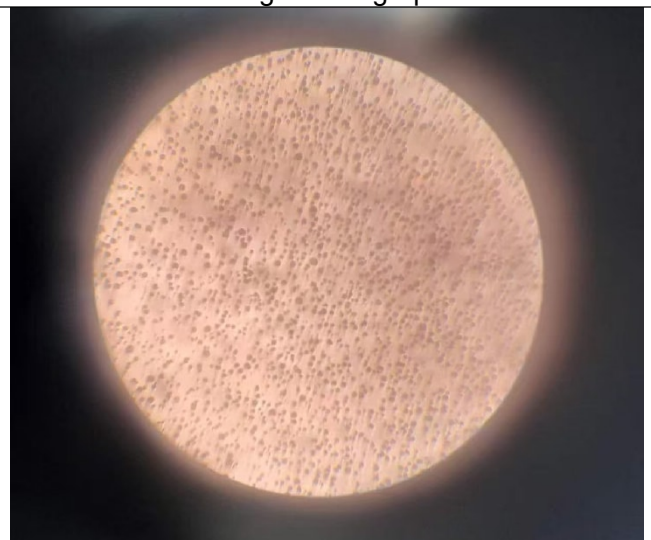
Witnessing metallographic test



Witnessing metallographic test



Metallographic test evaluation



Metallographic test evaluation

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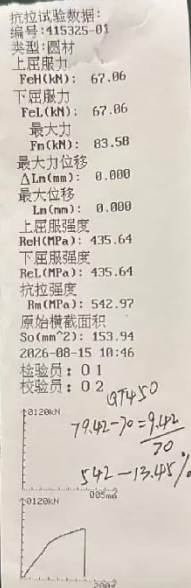
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Tensile test result

		化验结果					
日期	来源	C	S	Si	Mn	P	样
8.14	165卡北			2.60			生铁口试
	114卡南			2.68			生铁口试
	块北	3.79	0.004				生铁口试
	块南	3.67	0.013				生铁口试
8.15	416	3.7	0.012	2.6	0.15	0.02	生铁口试
							生铁口
							生铁口
							生铁口
							生铁口

Chemical analysis test result

[illegible]

Metallographic test record