



Inspection No.: 221593

Industrie Service

REPORT OF THIRD PARTY INSPECTION

Order No.: 748295765

Commodity description: Stainless steel Tube and Fittings

Quantity: --

Manufacturer: FITOK INCORPORATED

Contact Person: Mr. Cheng Pengfei

Inspection Place: 1-4F, Block C, Zone E, Yingtai Industrial Park,
Dalang Street, Bao' an District, Shenzhen,
Guangdong, 518109, China

Inspection Date: 2014-12-15~16

Inspector: Mr. Xu Zhujun

Product ID Number: Samples as report

TÜV SÜD Industrie
Service GmbH
Shanghai Office
No. 88 Heng Tong Road,
Shanghai 200070, P.R.China
Telefon +86 21 6141 0123
Telefax +86 21 6141 8600
Internet: www.tuv-sud.cn
E-mail: zhujun.xu@tuv-sud.cn

Westendstraße 199
D-80686 München
Telefon (0 89) 57 91-11 21
Telefax (0 89) 57 91-22 62

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4 Seiten

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TÜV SÜD Industrie
Service GmbH





Inspection No.: 221593

Nature of Inspection:

1. Over pressure
2. External leakage test
3. Durability test
4. Corrosion resistance test
5. Vibration resistance test

This is to report that we, TÜV SÜD Industrie Service GmbH Shanghai Office at the request of FITOK INCORPORATED conducted the following inspections according to drawing list (see annex 3) provided by manufacutuer with order no.: 748295765.

1. Over Pressure

The over pressure test is performed on the lab of FITOK, the detail is showed in chapter 5.1 of annex 1, the result is conform to the request of Annex 5A over pressure test of ECER110.

2. External leakage test

The external leakage test is performed on the lab of FITOK, the detail is showed in chapter 5.2 of annex 1, the result is conform to the request of Annex 5B of ECER110.

3. Durability test

The Durability test is performed on the lab of FITOK, the detail is showed in chapter 5.3 of annex 1, the result is conform to the request of Annex 5L of ECER110.

4. Corrosion resistance test

The corrosion resistance test is performed on the lab of FITOK, the detail is showed in chapter 5.4 of annex 1, the result is conform to the request of Annex 5E of ECER110.

5. Vibration resistance test

The vibration resistance test is performed on the lab of FITOK, the detail is showed in chapter 5.5 of annex 1, the result is conform to the request of Annex 5N of ECER110

Inspector Signature: Xu Zhujun

Inspector:

Date of Issue: 2014-12-30

annex1-ECER110 Test Report
annex2-Test equipment data sheet
annex3-Drawing list for test samples

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ECE R110 Test Report

Performance Testing

of

Stainless Steel FITOK Tube Fittings



Test Report No. : FITOK-ECE R110TR-001
Test Location : FITOK Incorporated
Test Date : 2014.05.15 ~ 2014.12.15
Applicable Standard : ECE-Regulation No.110

TESTED BY : Cheng pengfei

CHECKED BY : Xia Rong

APPROVED BY :

Colin Zhao

Quality Manager

Ye yang wen.
Technical Manager

WITNESSED BY :


TÜV SÜD Automotive GmbH
Technical Expert

[illegible]

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1.0 Description

- 1.1 This procedure defines the approach for testing the performance characteristics of tube fittings manufactured by FITOK Incorporated. These fittings mechanically attach tubing, creating a deformation in the tubing, which results in a seal and restrained joint between the tubing and the fitting.
- 1.2 ECE-Regulation No.110 (hereinafter referred to as ECE R110):
Uniform provisions concerning the approval of
 - I. Specific components of motor vehicles using compressed natural gas (CNG) in their propulsion system;
 - II. Vehicles with regard to the installation of specific components of an approved type for the use of compressed natural gas (CNG) in their propulsion system.
- 1.3 The purpose of this procedure is to confirm FITOK TUBE FITTINGS' conformance to specified requirements of ECE R110.

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2.0 Test Prerequisites

2.1 ECE R110 defines: CNG components for use in vehicles shall be classified with regard to the working pressure and function:

- Class 0 High pressure parts including tubes and fittings containing CNG at a pressure higher than 3 MPa and up to 26 MPa.
- Class 1 Medium pressure parts including tubes and fittings containing CNG at a pressure higher than 450 kPa and up to 3,000 kPa (3 MPa).
- Class 2 Low pressure parts including tubes and fittings containing CNG at pressure higher than 20 kPa and up to 450 kPa.
- Class 3 Medium pressure parts as safety valves or protected by safety valve including tubes and fittings containing CNG at a pressure higher than 450 kPa and up to 3,000 kPa (3 MPa).
- Class 4 Parts in contact with gas subject to the pressure lower than 20 kPa.

2.2 FITOK TUBE FITTINGS can be classified to Class 0 High pressure tube fittings according to its rated pressure and function.

2.3 According to ECE R110, Class 0 CNG components without synthetic / non-metallic parts should subject to the following tests:

Annex	Test Procedures
5A	Over pressure test
5B	External leakage test
5L	Durability test
5E	Corrosion resistance test
5N	Vibration resistance test

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3.0 Samples

3.1 FITOK Tube Fitting made out of stainless steel ASTM A479/182 Type 316 consists of body, front ferrule, back ferrule and nut. The two ferrules are compressed into the surface of the tube after made-up for Tube Fittings assembly.

3.2 3mm, 6mm, 8mm, 10mm, 12mm, 16mm and 1/8in, 1/4in, 5/16 in, 3/8 in, 1/2 in, 5/8in OD sizes of FITOK Tube Fittings are tested. They are made during mass production by a strict material management, a high precision design and the best processing technology.

3.3 Refer to table 1 for pictures of some samples.

3.4 All samples mentioned above are manufactured in accordance with drawings listed as in attachment III.

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Table 1: Pictures of some samples

No.	OD sizes	Type No.	Pictures	No.	OD sizes	Type No.	Pictures
1	3mm OD	SS-U-ML3		9	1/8in OD	SS-U-FL2	
2	6mm OD	SS-LU-ML6		10	1/4in OD	SS-LU-FL4	
3	8mm OD	SS-TTT-ML8		11	5/16in OD	SS-TTT-FL5	
4	10mm OD	SS-C-ML10		12	3/8in OD	SS-C-FL6	
5	12mm OD	SS-CF-ML12-NS4		13	1/2in OD	SS-CF-FL8-NS4	
6	16mm OD	SS-U-ML16-ML12		14	5/8in OD	SS-U-FL10-ML12	
7		SS-U-ML16-ML8		15		SS-U-FL10-ML8	
8		SS-TTT-ML16-ML16-ML12		16		SS-TTT-FL10-FL10-ML12	

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4.0 Test Plan

The serial number of FITOK tube fittings is established in easy way to identify.

Detailed information sees table 2 and table 3:

Table 2: Serial Number of FITOK Tube Fittings

Serial Number Tests FITOK TUBE FITTINGS		Annex 5A Over pressure test	Annex 5B External leakage test	Annex 5L Durability test	Annex 5E Corrosion resistance test	Annex 5N Vibration resistance test
3mm OD	SS-U-ML3	3-01	3-02	3-03	3-04	3-05
	SS-LU-ML3	3-01	3-02	3-03	3-04	3-05
	SS-TTT-ML3	3-01	3-02	3-03	3-04	3-05
	SS-C-ML3	3-01	3-02	3-03	3-04	3-05
6mm OD	SS-U-ML6	6-01	6-02	/	6-04	/
	SS-LU-ML6	6-01	6-02	/	6-04	/
	SS-TTT-ML6	6-01	6-02	/	6-04	/
	SS-C-ML6	6-01	6-02	/	6-04	/
8mm OD	SS-U-ML8	8-01	8-02	/	8-04	/
	SS-LU-ML8	8-01	8-02	/	8-04	/
	SS-TTT-ML8	8-01	8-02	/	8-04	/
	SS-C-ML8	8-01	8-02	/	8-04	/
10mm OD	SS-U-ML10	10-01	10-02	10-03	10-04	10-04
	SS-LU-ML10	10-01	10-02	10-03	10-04	10-04
	SS-TTT-ML10	10-01	10-02	10-03	10-04	10-04
	SS-C-ML10	10-01	10-02	10-03	10-04	10-04
12mm OD	SS-U-ML12	12-01	12-02	/	12-04	/
	SS-LU-ML12	12-01	12-02	/	12-04	/
	SS-TTT-ML12	12-01	12-02	/	12-04	/
	SS-C-ML12	12-01	12-02	/	12-04	/
	SS-CF-ML12-NS4	12-4-01	12-4-02	/	12-4-04	/
16mm OD	SS-U-ML16	16-01	16-02	16-03	16-04	16-05
	SS-LU-ML16	16-01	16-02	16-03	16-04	16-05
	SS-TTT-ML16	16-01	16-02	16-03	16-04	16-05
	SS-C-ML16	16-01	16-02	16-03	16-04	16-05
	SS-U-ML16-ML12	16-12-01	16-12-02	/	16-12-04	/
	SS-U-ML16-ML8	16-8-01	16-8-02	16-8-03	16-8-04	16-8-05
	SS-TTT-ML16-ML16-ML12	16-12-01	16-12-02	16-12-03	16-12-04	16-12-05

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Table 3: Serial Number of FITOK Tube Fittings

Serial Number / Tests		Annex 5A Over pressure test	Annex 5B External leakage test	Annex 5L Durability test	Annex 5E Corrosion resistance test	Annex 5N Vibration resistance test
FITOK TUBE FITTINGS						
1/8in OD	SS-U-FL2	1/8-01	1/8-02	1/8-03	1/8-04	1/8-05
	SS-LU-FL2	1/8-01	1/8-02	1/8-03	1/8-04	1/8-05
	SS-TTT-FL2	1/8-01	1/8-02	1/8-03	1/8-04	1/8-05
	SS-C-FL2	1/8-01	1/8-02	1/8-03	1/8-04	1/8-05
1/4in OD	SS-U-FL4	1/4-01	1/4-02	/	1/4-04	/
	SS-LU-FL4	1/4-01	1/4-02	/	1/4-04	/
	SS-TTT-FL4	1/4-01	1/4-02	/	1/4-04	/
	SS-C-FL4	1/4-01	1/4-02	/	1/4-04	/
5/16in OD	SS-U-FL5	5/16-01	5/16-02	/	5/16-04	/
	SS-LU-FL5	5/16-01	5/16-02	/	5/16-04	/
	SS-TTT-FL5	5/16-01	5/16-02	/	5/16-04	/
	SS-C-FL5	5/16-01	5/16-02	/	5/16-04	/
3/8in OD	SS-U-FL6	3/8-01	3/8-02	3/8-03	3/8-04	3/8-05
	SS-LU-FL6	3/8-01	3/8-02	3/8-03	3/8-04	3/8-05
	SS-TTT-FL6	3/8-01	3/8-02	3/8-03	3/8-04	3/8-05
	SS-C-FL6	3/8-01	3/8-02	3/8-03	3/8-04	3/8-05
1/2in OD	SS-U-FL8	1/2-01	1/2-02	/	1/2-04	/
	SS-LU-FL8	1/2-01	1/2-02	/	1/2-04	/
	SS-TTT-FL8	1/2-01	1/2-02	/	1/2-04	/
	SS-C-FL8	1/2-01	12-02	/	1/2-04	/
	SS-CF-FL8-NS4	1/2-4-01	1/2-4-02	/	1/2-4-04	/
5/8in OD	SS-U-FL10	5/8-01	5/8-02	5/8-03	5/8-04	5/8-05
	SS-LU-FL10	5/8-01	5/8-02	5/8-03	5/8-04	5/8-05
	SS-TTT-FL10	5/8-01	5/8-02	5/8-03	5/8-04	5/8-05
	SS-C-FL10	5/8-01	5/8-02	5/8-03	5/8-04	5/8-05
	SS-U-FL10-ML12	5/8-12-01	5/8-12-02	/	5/8-12-04	/
	SS-U-FL10-ML8	5/8-8-01	5/8-8-02	5/8-8-03	5/8-8-04	5/8-8-05
	SS-TTT-FL10- FL10-ML12	5/8-12-01	5/8-12-02	5/8-12-03	5/8-12-04	5/8-12-05

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5.0 Test Procedures and Results

5.1 Over pressure test (Annex 5A)

5.1.1 Test Samples

3mm, 6mm, 8mm, 10mm, 12mm, 16mm and 1/8in, 1/4in, 5/16in, 3/8 in, 1/2in, 5/8in OD FITOK Tube Fittings.

5.1.2 Test Purpose

To show compliance with ECE R110 Annex 5A over pressure test.

5.1.3 Test Procedure

All tests were performed in accordance with ECE R110.

- 1) Perform at room temperature.
- 2) Connect the Samples to test equipment (Photograph No.1).
- 3) Using water pressurizes the samples to 390 bar, holds it for 3 minutes and then detects leakage.

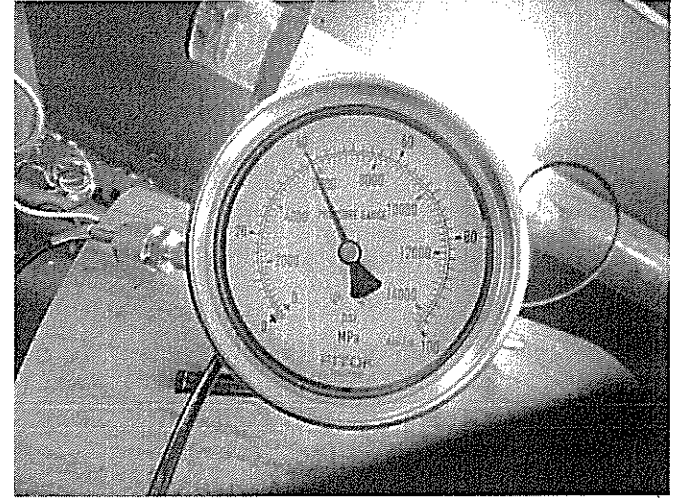
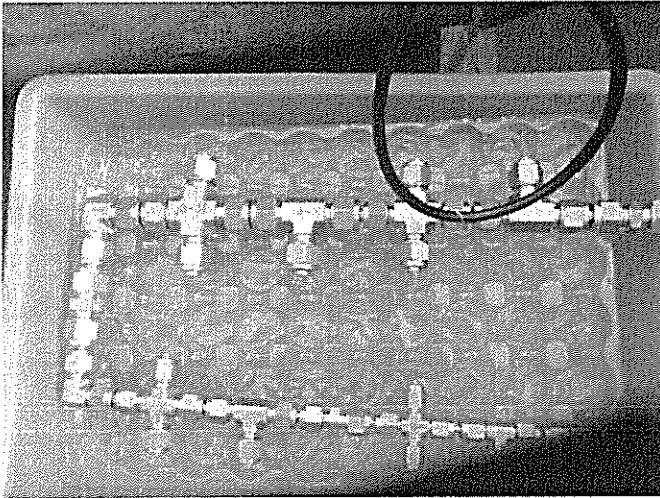
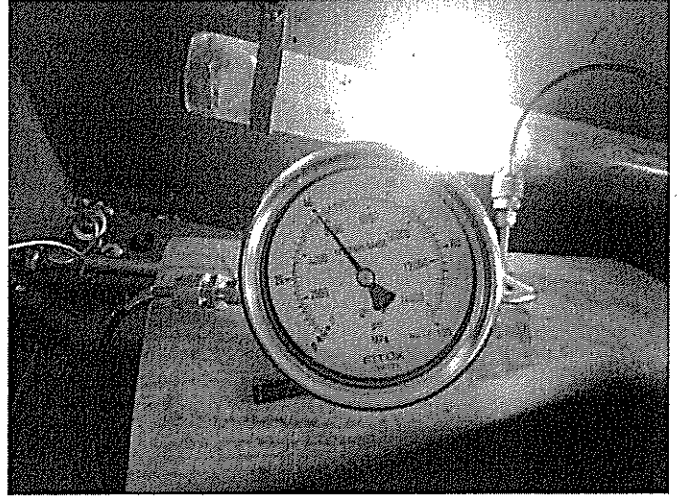
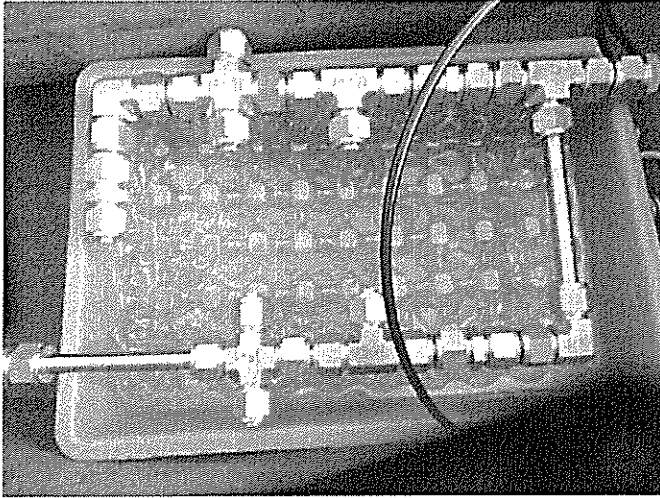
5.1.4 Test Result

FITOK Tube Fittings Size	Number of Test Samples	Test Pressure	Test Result
3mm	4	390 bar	Accepted
6mm	4	390 bar	Accepted
8mm	4	390 bar	Accepted
10mm	4	390 bar	Accepted
12mm	5	390 bar	Accepted
16mm	7	390 bar	Accepted
1/8in	4	390 bar	Accepted
1/4in	4	390 bar	Accepted
5/16in	4	390 bar	Accepted
3/8in	4	390 bar	Accepted
1/2in	5	390 bar	Accepted
5/8in	7	390 bar	Accepted

5.1.5 Test Conclusion

Test samples comply with the requirements of ECE R110 Annex 5A Over pressure test.

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Photograph No.1 Over pressure test

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5.2 External leakage test (Annex 5B)

5.2.1 Test Samples

3mm, 6mm, 8mm, 10mm, 12mm, 16mm and 1/8in, 1/4in, 5/16in, 3/8in, 1/2in, 5/8in OD FITOK Tube Fittings.

5.2.2 Test Purpose

To show compliance with ECE R110 Annex 5B External leakage test.

5.2.3 Test Procedure

All tests were performed in accordance with ECE R110.

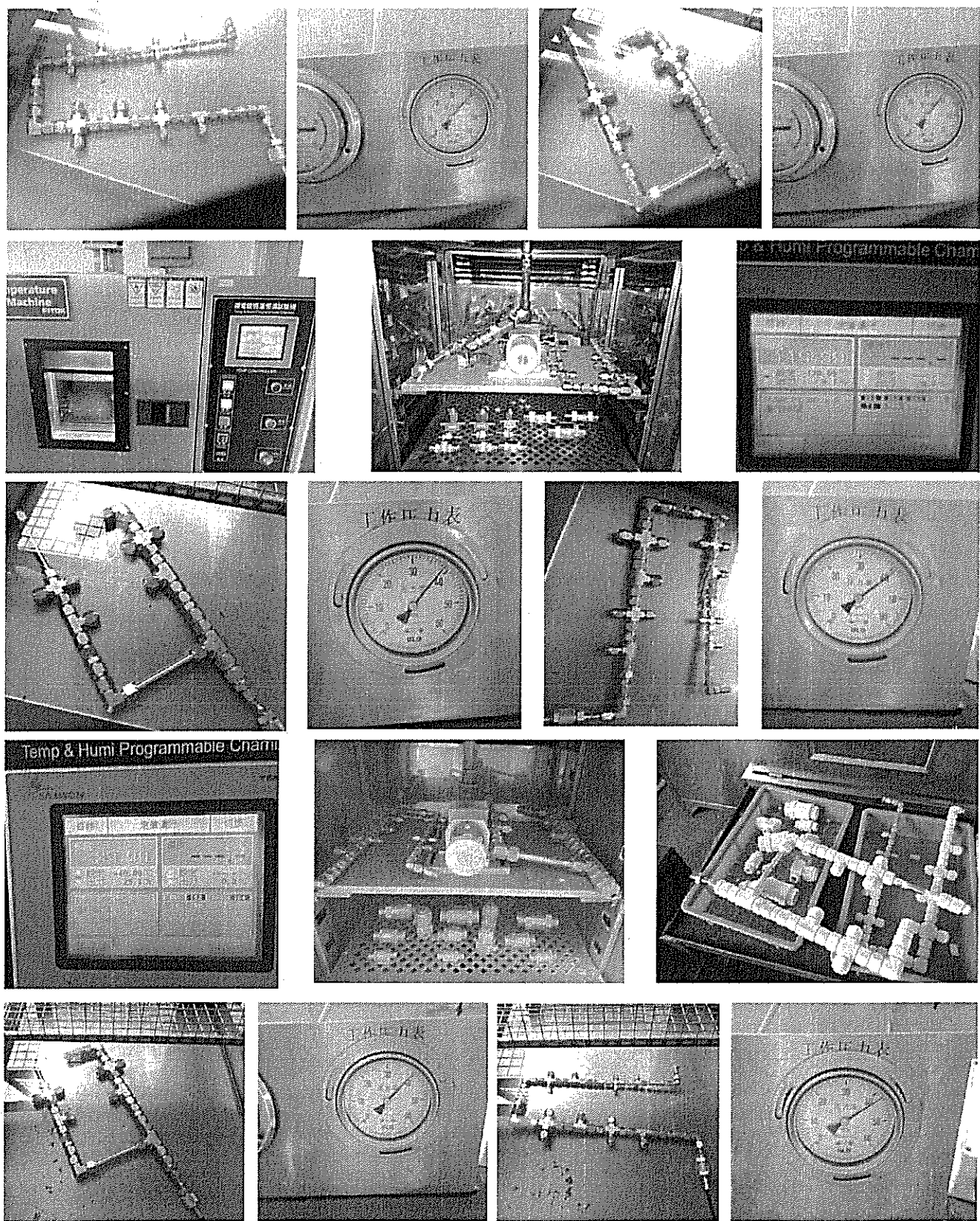
- 1) Connect the samples to test equipment (Photograph No.2).
- 2) Using nitrogen pressurizes the samples to 390 bar and then detects leakage.
- 3) Perform at Maximum Operating Temperature 120°C for 8 hours,
Perform at Minimum Operating Temperature -40°C for 8 hours,
Perform at Room Temperature for 3 minutes.

5.2.4 Test Result

FITOK Tube Fittings Size	Number of Test Samples	Test Pressure (bar)	Test Temperature and Time	Test Result
3mm	4	390	Room temperature: 3min 120°C: 8H -40°C: 8H	Accepted
6mm	4	390		Accepted
8mm	4	390		Accepted
10mm	4	390		Accepted
12mm	5	390		Accepted
16mm	7	390		Accepted
1/8in	4	390		Accepted
1/4in	4	390		Accepted
5/16in	4	390		Accepted
3/8in	4	390		Accepted
1/2in	5	390		Accepted
5/8in	7	390		Accepted

5.2.5 Test Conclusion

Test samples meet the requirements of ECE R110
Annex 5B External leakage test.



Photograph No.2 External leakage test

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5.3 Durability test (Annex 5L)

5.3.1 Test Samples

3mm, 10mm, 16mm and 1/8in, 3/8 in, 5/8in OD FITOK Tube Fittings.

5.3.2 Test Purpose

To show compliance with ECE R110 Annex 5L Durability test.

5.3.3 Test Procedure

All tests were performed in accordance with ECE R110.

1) Connect the samples to test equipment (Photograph No.3).

2) Using nitrogen pressurizes the samples to 260 bar.

3) A cycle is 20 seconds.

4) Perform 19200 cycles at room temperature.

Perform 400 cycles at minimum operating temperature -40°C.

Perform 400 cycles at maximum operating temperature 120°C.

5) After that, subject the samples to the leakage tests and detect leakage.

5.3.4 Test Result

FITOK Tube Fittings Size	Number of Test Samples	Test Pressure (bar)	Test Temperature and Cycles	Durability Test Result	External Leakage Test Result (390bar)
3mm	4	260	Room temperature: 19200 cycles -40°C: 400 cycles 120°C: 400 cycles	Accepted	Accepted
10mm	4	260		Accepted	Accepted
16mm	6	260		Accepted	Accepted
1/8in	4	260		Accepted	Accepted
3/8in	4	260		Accepted	Accepted
5/8in	6	260		Accepted	Accepted

5.3.5 Test Conclusion

Test samples meet the requirements of ECE R110 Annex 5L Durability test.

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Photograph No.3 Durability test

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5.4 Corrosion resistance test (Annex 5E)

5.4.1 Test Samples

3mm, 6mm, 8mm, 10mm, 12mm, 16mm and 1/8in, 1/4in, 5/16in, 3/8in, 1/2in, 5/8in OD FITOK Tube Fittings.

5.4.2 Test Purpose

To show compliance with ECE R110 Annex 5E Corrosion resistance test.

5.4.3 Test Procedure

All tests were performed in accordance with ECE R110.

- 1) Put the samples into test equipment (Photograph No.4).
- 2) Test temperature should be between 33°C and 36°C.
- 3) Subject the samples to the leakage tests after they have been submitted to 144 hours salt spray test according to ISO 15500-2.
- 4) Detect leakage.

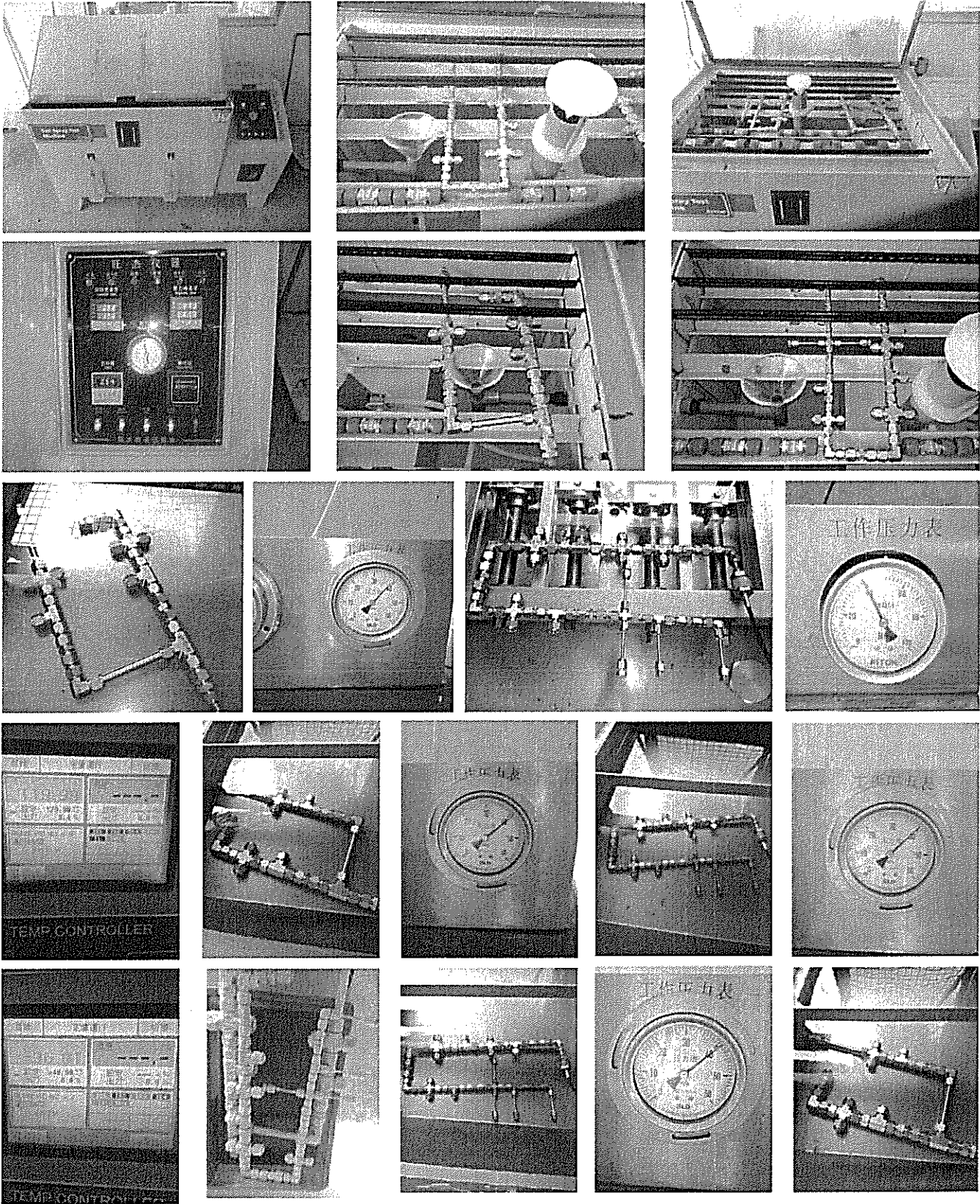
5.4.4 Test Result

FITOK Tube Fittings Size	Number of Test Samples	Corrosion Resistance Test Result	External Leakage Test Result (390bar)
3mm	4	Accepted	Accepted
6mm	4	Accepted	Accepted
8mm	4	Accepted	Accepted
10mm	4	Accepted	Accepted
12mm	5	Accepted	Accepted
16mm	7	Accepted	Accepted
1/8in	4	Accepted	Accepted
1/4in	4	Accepted	Accepted
5/16in	4	Accepted	Accepted
3/8in	4	Accepted	Accepted
1/2in	5	Accepted	Accepted
5/8in	7	Accepted	Accepted

5.4.5 Test Conclusion

Test samples meet the requirements of ECE R110 Annex 5E Corrosion resistance test.

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Photograph No.4 Corrosion resistance test

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5.5 Vibration resistance test (Annex 5N)

5.5.1 Test Samples

3mm, 10mm, 16mm and 1/8in, 3/8 in, 5/8in OD FITOK Tube Fittings.

5.5.2 Test Purpose

To show compliance with ECE R110 Annex 5N Vibration resistance test.

5.5.3 Test Procedure

All tests were performed in accordance with ECE R110.

- 1) Perform at room temperature.
- 2) Connect the samples to test equipment (Photograph No.5).
- 3) Samples shall be vibrated for 2 hours at 17 Hz with amplitude of 1.5 mm (0.06 in.) in each of three orientation axes.
- 4) After completion of total 6 hours of vibration, subject the samples to External Leakage Test.

5.5.4 Test Result

FITOK Tube Fittings Size	Number of Test Samples	Vibration Resistance Test Result	External Leakage Test Result (390bar)
3mm	4	Accepted	Accepted
10mm	4	Accepted	Accepted
16mm	6	Accepted	Accepted
1/8in	4	Accepted	Accepted
3/8in	4	Accepted	Accepted
5/8in	6	Accepted	Accepted

5.5.5 Test Conclusion

Test samples meet the requirements of ECE R110 Annex 5N Vibration resistance test.

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Photograph No.5

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6.0 Summary for Test Conclusion

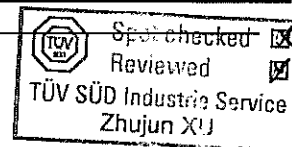
Test Result: Following tests meet the requirements of ECE R110.

Conclusion: FITOK Tube Fittings meet the requirements of ECE R110.

Section	Test Procedure	ECE R110	Test Result
5.1	Over pressure test	Annex 5A	Accepted
5.2	External leakage test	Annex 5B	Accepted
5.3	Durability test	Annex 5L	Accepted
5.4	Corrosion resistance test	Annex 5E	Accepted
5.5	Vibration resistance test	Annex 5N	Accepted

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Attachment I Test Equipment Data Sheet



1. Over pressure test

Description	Model No.	Pressure Range
Hydraulic Test Board	PT101-M-250	Max 250 MPa

2. External leakage test

Description	Model No.	Temp/Pressure Range
Low-Temperature Thermal Cycling Test Equipment	WHCT-150-10-880	-60~150℃
Pneumatic Test Board	PT201-M-100	Max 100 MPa

3. Durability test

Description	Model No.	Temp/Pressure Range
Ball Valve Life Testing Machine	FK-SB-196	Max 100 MPa
Low-Temperature Thermal Cycling Test Equipment	WHCT-150-10-880	-60~150℃
Pneumatic Test Board	PT201-M-100	Max 100 MPa

4. Corrosion resistance test

Description	Model No.	Temp/Pressure Range
Salt Spray Test Machine	WJ-90	/
Low-Temperature Thermal Cycling Test Equipment	WHCT-150-10-880	-60~150℃
Pneumatic Test Board	PT201-M-100	Max 100 MPa

5. Vibration resistance test


Description	Model No.	Temp/Pressure Range
Vibration Test Equipment	SW-400TFA	/
Low-Temperature Thermal Cycling Test Equipment	WHCT-150-10-880	-60~150℃
Pneumatic Test Board	PT201-M-100	Max 100 MPa

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Attachment II Calibration Data Sheet

Calibration Certification No.	Date of Calibration	Calibration Valid Until	Applied Test	Calibration Laboratory
LX14014463156	2014.07.22	2015.01.21	Over pressure test	SHENZHEN METROLOGY& MEASUREMENT INSTITUTE OF AVIC
LX14016200156	2014.08.13	2015.08.12	External leakage test	
RX13006705172	2013.11.05	2014.11.04		
RX14007729142	2014.11.10	2015.11.09		
RX13006705172	2013.11.05	2014.11.04	Durability test	
RX14007729142	2014.11.10	2015.11.09		
143600004	2014.01.02	2015.01.01	Vibration resistance test	Shenzhen Academy of Metrology& Quality Station

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 TÜV SÜD Industrie Service Zhujun XU	Spot checked <input checked="" type="checkbox"/>
	Reviewed <input checked="" type="checkbox"/>

Attachment III Drawing list for test samples

Test Sample		Drawing No.	Test Sample		Drawing No.
3mm OD	SS-U-ML3	U-ML3	1/8in OD	SS-U-FL2	U-FL2
	SS-LU-ML3	LU-ML3		SS-LU-FL2	LU-FL2
	SS-TTT-ML3	TTT-ML3		SS-TTT-FL2	TTT-FL2
	SS-C-ML3	C-ML3		SS-C-FL2	C-FL2
6mm OD	SS-U-ML6	U-ML6	1/4in OD	SS-U-FL4	U-FL4
	SS-LU-ML6	LU-ML6		SS-LU-FL4	LU-FL4
	SS-TTT-ML6	TTT-ML6		SS-TTT-FL4	TTT-FL4
	SS-C-ML6	C-ML6		SS-C-FL4	C-FL4
8mm OD	SS-U-ML8	U-ML8	5/16in OD	SS-U-FL5	U-FL5
	SS-LU-ML8	LU-ML8		SS-LU-FL5	LU-FL5
	SS-TTT-ML8	TTT-ML8		SS-TTT-FL5	TTT-FL5
	SS-C-ML8	C-ML8		SS-C-FL5	C-FL5
10mm OD	SS-U-ML10	U-ML10	3/8in OD	SS-U-FL6	U-FL6
	SS-LU-ML10	LU-ML10		SS-LU-FL6	LU-FL6
	SS-TTT-ML10	TTT-ML10		SS-TTT-FL6	TTT-FL6
	SS-C-ML10	C-ML10		SS-C-FL6	C-FL6
12mm OD	SS-U-ML12	U-ML12	1/2in OD	SS-U-FL8	U-FL8
	SS-LU-ML12	LU-ML12		SS-LU-FL8	LU-FL8
	SS-TTT-ML12	TTT-ML12		SS-TTT-FL8	TTT-FL8
	SS-C-ML12	C-ML12		SS-C-FL8	C-FL8
	SS-CF-ML12-NS4	CF-ML12-NS4		SS-CF-FL8-NS4	CF-FL8-NS4
16mm OD	SS-U-ML16	U-ML16	5/8in OD	SS-U-FL10	U-FL10
	SS-LU-ML16	LU-ML16		SS-LU-FL10	LU-FL10
	SS-TTT-ML16	TTT-ML16		SS-TTT-FL10	TTT-FL10
	SS-C-ML16	C-ML16		SS-C-FL10	C-FL10
	SS-U-ML16-ML12	U-ML16-ML12		SS-U-FL10-ML12	U-FL10-ML12
	SS-U-ML16-ML8	U-ML16-ML8		SS-U-FL10-ML8	U-FL10-ML8
	SS-TTT-ML16-ML16-ML12	TTT-ML16-ML16-ML12		SS-TTT-FL10-FL10-ML12	TTT-FL10-FL10-ML12