NTS SERIES PRODUCT SPECIFICATION

NTS 系列产品规范

LTR	REVISION RECORD	PR	DATE
D3	Update NTS18Pos/26Pos	J. S	2026-03-18
D2	Update Content and NTS38Pos	J. S	2024-11-19
D1	Update rated voltage and NTS36Pos	J. S	2024-06-12
D	Update 12# terminal and NTS26Pos	J. S	2023-10-10
C	Update detail of 3.6.22 and rated voltage	L.G	2021-10-22

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TE Connectivity
Shanghai, China

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CONTENT

1. SCOPE 适用范围

1.1. Content 内容

This specification covers performance, tests and quality requirements for the TE Connectivity (TE) NTS Series Connector System.本规范适用于 NTS 系列产品(以下简称 NTS series) 的性能，测试和质量要求。

a. 本规范适用但不仅限于以下零件号：X =1, 2, 3, 4 refers to A,B,C,D keys.

CONNECTOR P/N	DESCRIPTION
2350890-X 1-2350890-X	NTS 20Pos. Plug housing assembly
2350891-X	NTS 20Pos. Rec housing assembly, Inline version
1-2350891-X 2-2350891-X	NTS 20Pos. Rec housing assembly, flange version
2405007-X	NTS 26Pos. Plug housing assembly
2405028-X	NTS 26Pos. Rec housing assembly, Inline version
1-2405028-X	NTS 26Pos. Rec housing assembly, flange version
2350943-X	Fix rings , For NTS 20/26/18Pos flange version
2366494-X	NTS 48Pos. Plug housing assembly
2366509-X	NTS 48Pos. Rec housing assembly, Inline version
2-2366509-X	NTS 48Pos. Rec housing assembly, Flange version
2366517-X	Fix rings , For NTS 48/36/38Pos flange version
2445859-X	NTS 36Pos. Plug housing assembly
2445860-X	NTS 36Pos. Rec housing assembly, Inline version
1-2445860-X	NTS 36Pos. Rec housing assembly, flange version
2455359-X	NTS 38Pos. Plug housing assembly
2455360-X	NTS 38Pos. Rec housing assembly, Inline version
1-2455360-X	NTS 38Pos. Rec housing assembly, flange version
2490856-X	NTS 18Pos. Plug housing assembly (*)
2490990-X	NTS 18Pos. Rec housing assembly, Inline version (*)
1-2490990-X	NTS 18Pos. Rec housing assembly, flange version (*)
CONNECTOR	DESCRIPTION

P/N	
2-2490990-X	NTS 18Pos. Rec housing assembly, screw version (*)
2490959-X	NTS 26Pos. Plug housing assembly (*)
2490960-X	NTS 26Pos. Rec housing assembly, Inline version (*)
1-2490960-X	NTS 26Pos. Rec housing assembly, flange version (*)

Note:
**: Connectors HSG made from V0 raw materials*

b. Back shells are sold separately.

CONNECTOR	TYPE	CORRUGATED TUBE SIZE	BACKSHELL P/N	USED ON
PLUG	180°	NW17&UFW17	2357302-1	NTS20P,NTS18P(*)
PLUG	180°	NW16	1-2357302-1	
RECEP.	180°	NW17&UFW17	2357302-2	
RECEP.	180°	NW16	1-2357302-2	
PLUG&RECEP.	90°	NW17&UFW17	2357921-1	
PLUG&RECEP.	90°	NW16	1-2357921-1	
PLUG&RECEP.	180°	NW26&UFW26	2378521-1	NTS48P,NTS36P,NTS38P
PLUG&RECEP.	90°	NW26&UFW26	2378527-1	
PLUG&RECEP.	180°	NW19&UFW19	2428519-1	NTS26P，NTS26P(*)
PLUG&RECEP.	90°	NW19&UFW19	2428518-1	

1.2. Qualification 鉴定

When tests are performed, the following specifications and standards shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.
本测试规范依照下面的规范及标准执行。所有的检验应依照合适的检验计划及产品图纸执行。

2. APPLICABLE DOCUMENTS 适用文件

2.1. Usable document 使用文件

In the event of conflict between the requirements of this specification and the drawing, the drawing shall take precedent.

在本规范的要求与图纸发生冲突时，以产品图纸为准。在本规范的要求与参考文件发生冲突时，以本规范为准。

2.2. TE specifications 泰科电子规范

- 109-1: General Requirements for Testing
- 0425-021-0000: HDP20 Series Performance and Application Characteristics
- 114-151006: Application Specification for DEUTSCH Size 12 S&F Pin & Socket
- 114-151000: Application Specification for DEUTSCH Size 16 S&F Pin & Socket
- 114-151001: Application Specification for DEUTSCH Size 16 S&F Pin & Socket
- 114-151003: Application Specification for DEUTSCH Size 20 S&F Pin & Socket
- 408-151008: Instruction Guide DEUTSCH Removal Tool DT-RT1

2.3. Other specifications 其他规范

- SAE J2030: Heavy-Duty Electrical Connector Performance Standard
- SAE J1455: Recommended Environmental Practices for Electronic Equipment Design in Heavy-Duty Vehicle Applications
- DIN 40050-9: Road Vehicles Degrees of protection (IP Code)
- EIA-364: Electrical Connector/Socket Test Procedures Including Environmental Classifications
- IEC-60529: Degrees of Protection Provided by Enclosures (IP Code)
- SAE J1128: Low Voltage Primary Cable
- USCAR-2 REVISION 6

3. REQUIREMENT 要求

3.1. Design and Construction 设计和结构

Products must meet the design, construction and physical dimensions specified in the applicable product drawings.

产品必须满足产品图纸上的设计，结构和尺寸要求。

3.2. Material 材料

Description of the material sees the related product drawings.

材料描述见相关产品图纸。

3.3. Test parameters and tolerances 测试参数与公差

Table 1: Test parameters and tolerances

Requirement 要求	Tolerance 公差
Ambient temperature 环境温度	23°C ± 5°C
Relative humidity 相对湿度	45% to 75%
Atmospheric pressure 大气压力	96kPa ± 10kPa

3.4. Ratings 等级

A. Operating Temperature / 工作温度: -40~125°C
B. Maximum Working Voltage /最大工作电压: Up to ≤ 60 V DC
Connector Mating & Un-mating under load is not permitted 不允许在负载下进行连接器互配插拔
C. Application / 产品应用: Under hood 发动机舱
D. Current (A): See Terminal Specification 见端子产品规范
E. Ingress Protection (IP) Level: IPX8 and IPX9K (with rear protection, such as back shell)

3.5. General Performance and Test description 通用性能和试验描述

The product is designed to meet the electrical, mechanical and environmental performance requirements specified in Para.4. All testes must be performed at the test condition of the
TE test specification 109-1 unless otherwise specified.

产品应能满足段落 4 中的电气，机械和环境等性能要求。所有试验均需按照 TE 规范 109-1 中的测试条件进行，除非另有说明。

3.6. Test Requirements and Procedures Summary 测试要求及方法

Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

Table 2

Test Description	Requirement	Procedure
3.6.1 Examination of Product	Meets requirements of product drawing. The connectors shall be correctly constructed, marked, and show good quality and workmanship.	SAE J2030 6.1 Visual inspection of product before and after unmating connectors for conditions such as torn seals, cracked plastic, evidence of fluid or dust ingress in sealed connector systems, arcing, charring, melting, or anything that affects the performance or serviceability of the product as deemed by a qualified engineer.
ELECTRICAL		
3.6.2 Contact Resistance	Low Level Contact Resistance Acceptance criteria Initial Maximum resistance: 16# terminal: 6 mΩ 20# terminal: 10 mΩ Final Maximum resistance 16# terminal: 10 mΩ 20# terminal: 16 mΩ For 12# contact，use voltage drop contact resistance: wire size 4~6mm^2, test current 25A, voltage drop Max 100mV	SAE J2030 6.2 Test with applied voltage not exceeding 20 mV open circuit and the test current shall be limited to 100 mA. The resistance of a cable equal in length to that of the two measuring points shall be subtracted from the measured values. The cable used shall be from the same batch of cable as used for the connector wiring. Measurements shall be taken after thermal equilibrium at current levels. For 12# contact , Test current per below with applied voltage of 12 VDC max open circuit.The resistance of an equal length wire (reference wire) shall be subtracted from the actual readings to determine the added resistance of the terminal. The reference wire shall be from the same reel as used for the connector wiring.
3.6.3 Insulation Resistance	The insulation resistance shall be greater than 20 MΩ.	SAE J2030 6.3 Using a 1000 VDC insulation resistance test measurement device or equivalent, check insulation resistance between each contact to each adjacent contact or housing edge.
3.6.4 Voltage proof (withstand voltage)	Value and nature of the test voltage: U_{eff} = 500V (AC) frequency: 50 or 60Hz No flash over or breakdown between adjacent contacts and outer contour of the housing permitted.	Acc. to ISO 16750-2 (4.11) Temperature: 23+/-5°C Humidity: 45-55% Duration: 60s
MECHANICAL		
3.6.5 Connector Retention	The connector shall remain coupled after the specified pulling force is applied. There shall be no evidence of cracking, distortion, or detrimental damage to the connector following the test.	USCAR 5.4.2 Samples should be tested with connector primary locking mechanism (without CPA) fully engaged. Retention force must be>110Newtons, the load shall be applied for 30s.

Table 2

Test Description	Requirement	Procedure
3.6.6 Drop Test	There shall be no evidence of cracking, distortion or detrimental damage to the connector following the test. Small chips and dents that do not adversely affect the connector shall be disregarded.	SAE J2030 6.17 The free end of the cord or cable, which shall be 1500 mm ± 25 mm long, shall be fixed to a wall at a height of 750 mm ± 25 mm above a concrete floor. The specimen shall be held so that the cord or cable is horizontal and allowed to fall to a concrete floor eight times. Wire the sample (unmated connector) according to its application(TPA on position).Rotate the specimens through approximately 45 degrees at its fixing each time.
3.6.7 Durability	No evidence of damage to the contacts, contact plating, connector housing, or seals which may be detrimental to reliable connector performance.	SAE J2030 6.11 The connector shall be mated and unmated for a total of 20 complete cycles at room temperature.
3.6.8 Maintenance Aging	Shall meet visual requirements and show no physical damage.	SAE J2030 6.6 with a deviation using 5 cycles Subject at least 10% of the cavities to 5 cycles of inserting and removing its respective contact. The five cycles shall also include any disassembly required to remove the contacts. The connectors shall be mated and unmated during each cycle. Insertion and removal shall be performed using manufacturer's recommended practice.
3.6.9 Mating / Unmating Forces	Required force to mate the plug and receptacle pair and engage latching mechanism shall not exceed 135 N. Required force to separate the plug and receptacle pair and fully disengage latching mechanism shall not exceed 135 N. （*For NTS18P Forces not exceed 180N）	SAE J2030 6.9 and 6.10 For connectors without mechanical assist, test the maximum required force to mate the plug and receptacle pair and engage the latching mechanism. The force is not to exceed 135 N. For connectors without mechanical assist, test the maximum force required to separate the plug and receptacle with the latch mechanism fully disengaged. The force is not to exceed 135 N.
3.6.10 Mismating	Polarization and different keys shall resist a minimum of 178N axial force without damage.	SAE J2030 6.21 Connectors with two or more contacts shall be keyed or of such a design that any intended polarization is not defeated by improper assembly during installation.
3.6.11 Shock	No discontinuity in excess of 1.0 microsecond at 100 mA during the last hour of each axis. Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as needed.	SAE J2030 6.16 10 cycles of 1/2 sine pulses, 50 g, 11 millisecond duration X, Y, and Z axis are to be tested. Monitor for discontinuity greater than 10 Ω in excess of 1.0 microsecond at 100 mA. Connector under test to be fixed to the shock plane with the wire harness fixed to non-shocked objects no closer than 100 mm and not farther than 300 mm from the rear of the connector.

Table 2

<table>
<tr><th>Test Description</th><th>Requirement</th><th>Procedure</th></tr>
<tr><td>3.6.12 Terminal – Connector insertion force</td><td>Insertion:
1. Inserting force: 30N max.
2.The forward stop push-through force F≥50N</td><td>USCAR-2 5.4.1
Terminal –Connector insertion</td></tr>
<tr><td>3.6.13 Terminal Retention in Connector</td><td>The terminal shall maintain its original position in the connector throughout the test. The terminals shall withstand the minimum force specified.
<table>
<tr><th rowspan="2">Contact Size</th><th colspan="3">Minimum Pull Out Force(N)</th></tr>
<tr><th>utilize 2nd lock</th><th colspan="2">no 2nd lock</th></tr>
<tr><td>12</td><td>133</td><td>95</td><td>-</td></tr>
<tr><td>16</td><td>111</td><td>80</td><td>60(*)</td></tr>
<tr><td>20</td><td>89</td><td>45</td><td>-</td></tr>
</table>
*: For connectors hsg made from V0 raw materials,see section 1.1.</td><td>SAE J2030 6.18 with a deviation using
The contacts shall be subjected to a direct pull. The minimum value shall be applied for 15s. The pull is to be exerted on the conductor by means of a tension-testing machine or equivalent to prevent sudden or jerking force during test.
NOTE: Secondary-locking devices should be utilized if available.</td></tr>
<tr><td>3.6.14
Terminal pull force</td><td>Pull force after temperature /Humidity cycling
<table>
<tr><th>Contact Size</th><th>Minimum Pull Out Force
N</th></tr>
<tr><td>12</td><td>95</td></tr>
<tr><td>16</td><td>80</td></tr>
<tr><td>20</td><td>65</td></tr>
</table></td><td>Adjust the force tester to pull the terminal straight back from the connector. Straight back force is critical to avoid side loads and binding which can affect force measurements. Increase the pullout force at a uniform rate not to exceed 50mm/min, until pullout occurs.</td></tr>
<tr><td>3.6.15
Vibration</td><td>There shall be no discontinuity in excess of 1.0 microsecond at 20 mV and 100 mA during the last hour of each axis. Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as needed.</td><td>J2030 6.15
Connectors under test shall be fixed to the vibrating plane with the wire harness fixed to non-vibrating objects no closer than 10 cm [4 in.] and not farther than 30 cm [12 in.] from the rear of the connector. Apply current as specified in Table for the first 3 h in each axis Monitor each circuit for discontinuity greater than 10 Ω in excess of 1 microsecond at 100 mA during last hour of vibration in each axis.
<table>
<tr><th>Parameter</th><th>Requirement</th></tr>
<tr><td>Sine Sweep</td><td>10 to 2000 Hz</td></tr>
<tr><td>Initial Displacement</td><td>0.07 in [1.78 mm] DA</td></tr>
<tr><td>Maximum Acceleration</td><td>20 G’s</td></tr>
<tr><td>Test Duration</td><td>24 hours</td></tr>
<tr><td>Time Per Axis X, Y, Z</td><td>8 hours</td></tr>
<tr><td>Test Current
(first 3 hours each axis)</td><td>See Following Table</td></tr>
<tr><td>Monitor for Discontinuity
(last hour each axis)</td><td>-</td></tr>
</table></td></tr>
</table>

Table 2

<table>
<tr><th>Test Description</th><th>Requirement</th><th>Procedure</th></tr>
<tr><td></td><td></td><td>Test Currents
<table>
<tr><th rowspan="2">Contact Size</th><th>Wire Gauge</th><th>Test Current</th></tr>
<tr><th>AWG [mm²]</th><th>(Amps)</th></tr>
<tr><td>12</td><td>10 [5.0-6.0]
12 [4.0]</td><td>17.0</td></tr>
<tr><td rowspan="3">16</td><td>16 [1.5-1.0]</td><td>10.0</td></tr>
<tr><td>18[0.75]</td><td>8.0</td></tr>
<tr><td>20[0.5]</td><td>5.0</td></tr>
<tr><td rowspan="2">20</td><td>16 [1.5-1.0]</td><td rowspan="2">5.0</td></tr>
<tr><td>20 [0.50]</td></tr>
</table></td></tr>
<tr><td colspan="3">ENVIRONMENTAL</td></tr>
<tr><td>3.6.16
Fluid Immersion</td><td>There shall be no evidence of cracking, distortion, or detrimental damage to the connector following the test.</td><td>J2030 6.14
Subject each sample group to one fluid only. The wired mated connectors shall be submerged in the fluids below at the temperatures listed. Each connector shall be submerged for five minutes, then removed from the fluid to air dry for 24 hours. This cycle is to be completed a total of five cycles.
<table>
<tr><th>Fluid</th><th>Temperature ±3°C</th></tr>
<tr><td>Roundup Original</td><td>+23</td></tr>
<tr><td>Aqueous Urea</td><td>+23</td></tr>
<tr><td>Motor oil 30wt</td><td>+85</td></tr>
<tr><td>Brake fluid</td><td>+85</td></tr>
<tr><td>50/50 antifreeze mixture</td><td>+85</td></tr>
<tr><td>Gear oil 90wt</td><td>+85</td></tr>
</table></td></tr>
<tr><td>3.6.17
Pressure Spray</td><td>There shall be no evidence of water ingress into the connector housing.</td><td>USCAR-2 5.6.7 IPX9K
The test specifies a spray nozzle that is fed with 80°C water at 80 to 100 bar and a flow rate of 14 to 16 L/min. The nozzle is held 10 to 15 cm from the tested device at angles of 0°, 30°, 60° and 90° for 30 s each. The test device sits on a turntable that rotates.</td></tr>
<tr><td>3.6.18
Pressure/
Vacuum Leak</td><td>No evidence of water or florescent dye shall be present in the interior of either mated connector</td><td>USCAR-2 5.6.6 Pressure/Vacuum Leak
air pressure or vacuum 15 seconds
Initial:48 kPa
Final: 28Kpa</td></tr>
<tr><td>3.6.19
Temperature Life</td><td>There shall be no evidence of cracking, distortion, or detrimental damage.</td><td>SAE J2030 6.7
The cabled-mated connectors shall be subject to 1000 h at 125 ± 3 °C without current flowing.</td></tr>
<tr><td>3.6.20
Temperature humidity Cycling</td><td>No defect, crack, could not affect their fit and function</td><td>USCAR-2 5.6.2
Temperature humidity Cycling 40Cycle</td></tr>
</table>

Table 2

Test Description	Requirement	Procedure
3.6.21 Thermal Shock 1	Shall show no evidence of cracking, chipping, or other damage detrimental to the normal operation of the connector.	SAE J2030 6.13 with deviation The cabled-mated connector shall be subjected to 10 cycles of thermal shock. One cycle shall consist of a soak time at –40 °C ambient, then a transition within 2 min to an ambient of 125 °C, with a soak time there and then a transition back to -40 °C ambient within 2 min. The soak times shall be established as the time necessary to bring the internal connector temperature on test to within 5 °C of each of the ambient temperatures.
3.6.22 Thermal Shock 2	No defect, crack, could not affect their fit and function	USCAR-2 5.6.1 Thermal Shock Class 3(-40℃ to + 125℃), 99Cycle
3.6.23 Water Immersion	Test samples must meet insulation resistance test requirements.	SAE J2030, 6.19 with deviation IPX8 The wired mated connectors shall be placed in an oven at 125 °C ± 3 °C for 1 h then remove and allow recover to room temperature, then place the samples in water with a 5% salt in weight content and 0.1 g/L wetting agent, to a depth of 1 m for 4 hours. Water temperature is to be 23 °C ± 3 °C. Test samples for insulation resistance per SAE J2030 6.3 and visually inspect for moisture inside the connector. The ends of the cable are to be sealed during this test.
3.6.24 IPX8 enhance	No evidence of water or florescent dye shall be present in the interior of either mated connector	Immerse samples in 2m depth,48Hours
3.6.25 Submersion	No evidence of water or florescent dye shall be present in the interior of either mated connector	USCAR-2 5.6.5 Submersion 125℃ chamber 2H, 0℃ salt water 30 Minute
3.6.26 Visual Examination	No evidence of damage to the contacts, contact plating, connector housing, or seals which may be detrimental to reliable connector performance.	SAE J2030 6.27 Conduct a visual examination for identification of product such as torn seals, cracked plastic, evidence of fluid or dust ingress in sealed connector systems, arcing, charring, melting, or anything that could affect the performance and serviceability of the product.
3.6.27 IP6KX Dust-tight	No ingress of dust.	ISO 20653 -2013 Place the samples in the dust chamber and set the parameter as below: - 6 s movement of air/dust mixture. - Pause of 15 mins. Total: 20 of these cycles

3.7. Product Qualification and Requalification Test Sequence 试验顺序

Test samples were subjected to the following tests in the order given.

Test or Examination	Test Group (a)											
	1	2	3	4	5	6	7	8	9	10	11	12
	Test Sequence (b)											
Examination of Product	1	1	1	1	1	1	1	1	1	1	1	1
Terminal –Connector insertion force											2	
Fluid Immersion					2							
Maintenance Aging			2									
Pressure/Vacuum Leak						2,5			4,10	4,10		
Water Immersion				2,5								
Insulation Resistance				3,6		3			5,8,11	5,8,11		
Contact Resistance		2,4,6 ,8							3,9	3,9		
Voltage proof (withstand voltage)				7								
Thermal Shock 1		3	3									
Thermal Shock 2										6		
Temperature humidity Cycling									6			
Temperature Life	2			4		4						
Vibration		5										
Mating / Unmating Forces			4,6									
Shock		7										
Submersion									12	12		
Pressure Spray						6			13	13		
Durability			5						2	2		
IPX8 enhance								2				
Terminal Retention in Connector			7								3	
Connector Retention	3											
Drop Test							2					
Mismating			8									
Terminal pull force									14			
IP6KX Dust-tight												2
Visual Examination	4	9	9	8	3	7	3	4	7	7	4	3

4. QUALITY 质量

4.1. Qualification test 鉴定

Samples must be in accordance with drawings and be taken in a random way in the production in progress.

样件必须与产品图纸一致，并且是生产过程中随机选取的。

4.2. Requalification test 重新鉴定

If changes significantly affecting form, fit, or function are made to the product or to the manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by product engineering.

如果产品或者制造过程中有显著影响外观，装配和功能的设变，质保需要协调按照原先工程部定义的测试顺序，重新验证全部或者部分测试项目。

4.3. Acceptance 验收

Acceptance is based on verification that the product meets the requirements of section 3.6. Failures attributed to equipment, test setup, or operator deficiencies shall not disqualify the product. When product failure occurs, corrective action shall be taken and samples resubmitted for qualification. Testing to confirm corrective action is required before resubmitted.

归咎于测试设备，样件安装或者操作员的失误的失效不应判定产品不合格。当产品失效发生时，需要有纠正措施以及重新提交样件进行验证。在重新验证前，需确认已有纠正措施。

4.4. Quality conformance inspection 质量合格检验

The applicable TE Connectivity quality inspection plan will specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification

TE Connectivity 的质量检验计划将指定适用的质量标准。尺寸和功能要求，应按照适用的产品图纸和本规范。