NECTOR* T 3Pos Sealed Connector

1. SCOPE

1.1. Content

This specification covers the performances, tests, and quality requirements for NECTOR T 3 Pos Sealed Connector, a system for flexible power wiring applications:

- Electrical power distribution in building installations
- Lighting distribution
- Horticulture lighting

1.2. Qualification

When tests are performed on the subject product line, procedures specified in Table 3 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

2. APPLICABLE AND REFERENCED DOCUMENTS

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the latest edition of the document applies. In the event of conflict between requirements of this specification and the product inspection drawing, the Product Inspection Drawing shall take precedence. In the event of conflict between requirements of this Specification and referenced documents, this specification shall take precedence.

2.1. TE Connectivity Documents

- 114-133123: NECTOR T 3 Pos Application specification
- 114-20165: NECTOR T Contacts Application specification
- 107-133123-x: NECTOR T 3 Pos Packaging specifications

2.2. Industry Documents

- EIA-364: Electrical Connector/Socket Test Procedures Including Environmental Classifications
- IEC 61535-1: Installation Couplers Intended for Permanent Connection in Fixed Installations
- UL 2238: Cable Assemblies and Fittings for Industrial Control and Signal Distribution
- IEC 60060-2-32: Basic Environment Testing Procedures
- IEC 60695-2-11: Glowing/Hot-wire Based Test Methods
- IEC 60512-1-1: Connectors for Electronic Equipment – Tests and Measurements
- UL 8800: Outline of Investigation for Horticultural Lighting Equipment

2.3. Reference Documents

- 109-197: Test Specification (Tyco Electronics Test Specifications vs EIA and IEC Test Methods)

2.4. Part Number Overview

Part No.	Termination Type	Part Description
x-2379237-x	Screw	3P Inline Socket Connector
x-2379239-x	Screw	
x-2379238-x	Crimp	3P Inline Pin Connector
x-2379240-x	Crimp	
2359422-x	Screw	3P Panel mount Socket Conn.
x-2359422-x	Crimp	
2359518-x	Screw	3P Panel mount Pin Conn.
x-2359518-x	Crimp	
2359420-x	N/A	3P T-Splitter
2359421-x	N/A	3P Multi Splitter
2359527-x	N/A	Socket Crimp Contact
2359528-x		Pin Crimp Contact
2366866-1	N/A	Socket Safety Cap
2363703-1		Pin Safety Cap

3. REQUIREMENTS

3.1. Design and Construction

Product shall be of design, construction and physical dimensions specified on the applicable product drawings.

3.2. Materials

Materials used in the construction of this product shall be as specified on the applicable product drawing.

3.3. Ratings

- Current ratings according to Table 1.
- RTI_{elc} = 130 °C, RTI_{imp} = 125 °C, RTI_{mec} = 130 °C; CTI = 400 V
- Ambient temperature max 40 °C (maximum average temperature over 24 hours is 35 °C)
- Cable Types: H05VV-F and H07RN (Europe) and STOW (US)

IEC ratings		UL ratings			
500 V ac		600 V ac / dc		Voltage	
Current	Conductor size	Current	Conductor size	Operating Temperature	IP rating
16 A	1.5 mm²	7 A	18 AWG [b]	-40 ºC to 85 ºC	IP68 [a]
		10 A	16 AWG		
20 A	2.5 mm²	15 A	14 AWG		
25 A	4.0 mm²	20 A	12 AWG		

Table 1, ratings according to IEC and UL

Note: (a) IP68 test is for longer duration in compliance to IP67 test.
(b) 18AWG variant certified by UL. UL testing fulfills the internal qualification.

3.4. Performance and test description

Product is designed to meet the electrical, mechanical, and environmental performance requirements specified in Table 3. Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

3.5. Test Requirements and Procedures Summary:

TEST DESCRIPTION	REQUIREMENT	PROCEDURE
Visual inspection	No visual damage	
Electrical		
Low Level Contact Resistance (LLCR)	Maximum 10 mΩ initial (subtract bulk resistance) After testing maximum 20 mΩ	EIA-364-23 Subject specimens to 100 mA maximum and 20 mV maximum open circuit voltage All connections to be measured Refer to Section 5.1 for setup
Insulation resistance	1000 MΩ minimum initial 100 MΩ minimum final	IEC 61535 §14.1 500 Vdc, 1 minutes. - Between all lines (mated) - Current carrying parts and housing (mated) - Open front of female covered with foil
Electric strength (Dielectric Voltage-Withstand)	No breakdown or flashover	IEC 61535 §14.2 Duration: 1 minutes. Test voltage as per §14.2.a; §14.2.b and §14.2.c
Protection against electrical shock	Shall comply to IP2X, IP2XC & IP2XD requirements. Safety caps must be used for testing IP2XD Test on 4mm^2 cable only	IEC 61535 §10.1 Test probed acc. to IEC 61032
Breaking capacity	After the test apply dielectric withstanding voltage at 1500 Vac. No flashover shall occur and contact parts shall not become loose Test on 4mm^2 cable only	IEC 61535 §17 Mating cycles: 250 total 100 without load →50 with load Max current rating in a circuit with φ= 0.6. Speed rate 0.8m/s 0.1m/s (ref. 15 strokes/min)
Current cycling aging test	Voltage drop <22.5 mV or 1.5 times the value after the 24th cycle Test on 4mm^2 cable only	IEC 61535 §21.5 384 cycled with current (30 min with current and 30 min without current) 4.0 mm^2: 31 A Current running through all conductors (earth is not a pole and not loaded)
Temperature rise	ΔT_{max} = 45 °C (IEC 61535) ΔR ≤ 10 mΩ (for test 1 and test 2) ΔT_{max} = 30 °C (UL 2238)	IEC 61535 §16 1.5 mm^2: 20 A 2.5 mm^2: 25 A 4.0 mm^2: 31 A UL 2238 §25 (4 hours at rated current) 16AWG: 10 A 12AWG: 20A In-line test setup: Test 1: energizes L, N with TCs on L, N (socket) and L (pin).

		Test 2: energizes L, PE with TCs on L, PE (socket) and PE (pin) Refer to Section 5.2 for T-Splitter and Multi Splitter set-up.
Mechanical		
Contact Mechanical strength	Contact displacement max 1 mm. For all conductor sizes. Torque 0.5 Nm for screw termination. Not applicable to T-splitter & Multi Splitter	IEC 61535 §12.3 Pre-ageing 70 °C for 1 hr. Pull force of 40 N, for 1 min
Conductor secureness test	No conductor displacement. Not applicable to T-splitter & Multi Splitter	UL 2238 §23 Tensile force of 90 N applied for 1 min. Test crimp termination of 16 & 12 AWG wires without housing.
Unintended mating test	Contacts shall not engage. Test on 4mm^2 cable only	IEC 61535 §9.1 120 N for 1 min applied to mate connectors in any unintended configuration.
Force for disengage (connector un-mating force)	10th disengagement cycle force shall not exceed 80 N. Test on 4mm^2 cable only Contact resistance max 20 mΩ	IEC 61535 §18 10 mating cycles at a max rate of 500 cycles/hour without locking latch and circular seal.
Latch Retention test	Latch must be functional. Mate & un-mate after the test. Test on 4mm^2 cable only	IEC 61535 §12.10 Pull force of 150 N applied 1 min.
Strain-Relief test	No cable movement. Not applicable to T-splitter & Multi Splitter	UL 2238 §24.1 Force of 133 N, for 1 min Test 16 & 12 AWG wires
Cable pull test	50 times pull cycles on unmated connector. 1 cycle/second speed. Cable displacement max 2 mm Not applicable to T-splitter & Multi Splitter	IEC 61535 §19.4 50 N for cable up to Ø8 mm 60 N for cable Ø8 mm to Ø11 mm 80 N for cable Ø11 mm to Ø16 mm
Cable Torque	Maximum angle displacement 45° Not applicable to T-splitter & Multi Splitter	IEC 61535 §19.4 Torque of 0.25 Nm applied to the cable for 1 min.
Sinusoidal vibration	No discontinuities of 1 microsecond or longer duration Shall meet “VISUAL INSPECTION” requirements For panel mount connectors, only the panel nut secureness to be checked after vibration & shock	EIA-364-28, Condition I Subject mated specimens to 10 Hz to 55 Hz traversed in 1 min. with 1.5 mm maximum total excursion. Two hours in each of 2 out of 3 mutually perpendicular planes
Mechanical Shock	No discontinuities of 1 µs or longer duration. For panel mount connectors, only the panel nut secureness to be checked after vibration & shock	EIA-364-27, Condition A Subject mated specimens to 50 G’s half-sine shock pulses of 11 ms duration. 3 shocks in each direction applied along 3 mutually perpendicular planes, 18 total shocks
Free Fall (drop) test	Test probe B according to figure 2 of IEC61032 (no cracks by naked eye)	IEC 60068-2-31 50 drops with cable length of 100 mm

Environmental		
Thermal shock	Shall meet visual requirements, Show no physical damage. Contact resistance max 20 mΩ	EIA-364-32, Test Condition I. Subject unmated specimens to 25 cycles between -40°C and +105°C with 30 min. dwells at temperature extremes and 1 min transition between temperatures
Humidity/temperature cycling	Shall meet visual requirements. Show no physical damage. Contact resistance max 20 mΩ	EIA-364-31, Method IV 10 cycles (10 days) between 25°C and 65°C at 90% to 100% RH
Ingress Protection (submerge)	IPX8	IEC 60529; Submerge 1m depth - 2 hours Safety caps must be plugged to T-splitter & Multi-splitter for test. For panel mounts, use mating connector for test.
Ingress Protection (spray)	IPX5	IEC 60529; For 3 minutes Safety caps must be plugged to T-splitter & Multi-splitter for test. For panel mounts, use mating connector for test.
Static heating test	No functional damage. No exposed live parts. Contact resistance max 20 mΩ	IEC 61535 §21.2 8 hours in 100 °C ± 2 °C.
Ball pressure test	No exposed live parts.	IEC 61535 §21.3 Metal ball of Ø5 mm pressed down on test subject (or plate of material of 2 mm thick) supported by metal plate of 3 mm thick with a force of 20 N. Test temperature: 125 °C ± 2 °C for those parts of installation couplers which retain current-carrying parts and parts of the earthing circuit in position; 70 °C ± 2 °C for other parts of installation couplers. After one hour remove the specimen and cool down within 10 s in cold water.
Resistance to rusting (corrosion)	After 24 hours, sample surface shall show no signs of rust. No functional damage. Contact resistance max 20 mΩ	IEC 61535 §25 All grease removed, parts are immersed for 10 min in a 10% solution of ammonium chloride, placed for 10 min in a box containing air saturated (20°C ±5°C), dried for 10 min in a heating cabinet at a temperature of 100°C ±5°C
Mixed flow gas test (Sulphuric acid gas)	No rusting, visual inspection	According to IEC 60068-2-60 Subjected for 10 days exposure
GWT (Glow Wire Test)	No visible flame. Self-extinguishes within 30 s after glow wire removal	IEC 61535 §24.1 Acc. to IEC 60695-2-11 at 850°C
Resistance to ageing	No functional damage. Contact resistance max 20 mΩ	IEC 61535 §21.4 Free hanging in a natural ventilated oven 100 °C ± 2 °C for 300 hours.

Table 2, Test Requirments

Qualification and Re-qualification of products:

TEST	Groups						
	A	B	C	D	E	F	G
Visual inspection	1,10	1,	1,5,23	1,	1,6,8	1,6	1
Contact resistance	2,6,8	2,4,6,8,11, 13	2,8,10,12, 14,18,22	2,6,8,10	2	2,5	
Insulation resistance	3		6,16,20	4	3		
Electric strength	4		7,17,21	5	4	4	
Protection against electrical shock	8						
Breaking capacity						3	
Current cycling aging	5						
Temperature rise				7, 11(d)			
Contact mechanical strength		9(a)					
Conductor secureness test (UL)					10(e)		
Unintended mating	9						
Force for disengage	7						
Latch retention		14(a)					
Strain-relief (UL)					9(b)		
Cable pull		5					
Cable torque		7					
Sinusoidal vibration			11(c)				
Mechanical shock			13(c)				
Free fall (drop) test		10					
Thermal shock		3					
Humidity/temperature cycling				3			
Ingress Protection (IPX8)			3		5		
Ingress Protection (IPX5)			4		7		
Static heating			9				
Ball pressure		12					
Resistance to rusting			19				
Mixed flow gas			15				
Glow wire							2
Resistance to ageing				9			

Table 3, Test Groups & Sequence

NOTE

(a) To be tested on 5 samples of any cable size.

(b) To be tested without terminating wires to the contacts.

(c) To be tested when samples reach room temperature after static heat test.

(d) Temperature rise test after resistance to ageing to be tested at rated current.

(e) Loose contacts terminated to wires to be used for testing.

3.6.1 Sample quantity and preparation for test groups:

Product	Wire Size	A	B	C	D	E	F	G
In-line (screw type) mated pair 2379237-x Socket 2379238-x Pin	1.5 mm²		5	5	5			
	2.5 mm²		5	5	5			
	4.0 mm²	5	5	5	5		5	1
	16 AWG				5	5		
	12 AWG				5	5		
In-line (crimp type) mated pair 2379239-x Socket 2379240-x Pin	1.5 mm²				5			
	2.5 mm²				5			
	4.0 mm²				5			
Socket Panel Mount 2359422-1	4.0 mm²			5				1
Pin Panel Mount 2359518-1	4.0 mm²			5				1
T- Splitter 2359420-1	N/A	5	5					1
Multi Splitter 2359421-1	N/A		5	5	5		5	1

Table 4, Sample quantity per Test group

4. SAMPLE COMPOSITION AND PREPARATION

Connectors are designed to meet the electrical, mechanical and environmental performance requirements according to specified test conditions.

The samples shall be prepared in accordance with product drawings, they shall be selected at random from current production.

4.1. Re-Qualification Testing

If changes significantly affection fit, form or function are made to the product or the manufacturing process, of which negative influence of the product quality cannot be excluded, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality and reliability engineering.

4.2. Quality Conformance Inspection

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.

5. TEST SETUP

5.1. Low level contact resistance, measurement points:

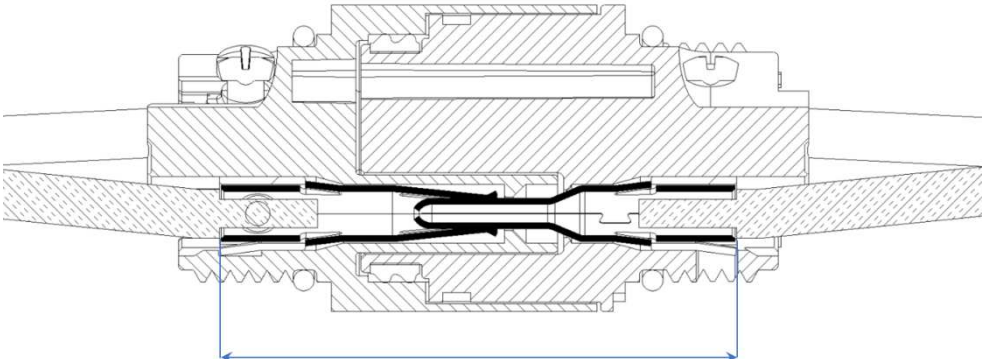


Figure 1, In-Line connector

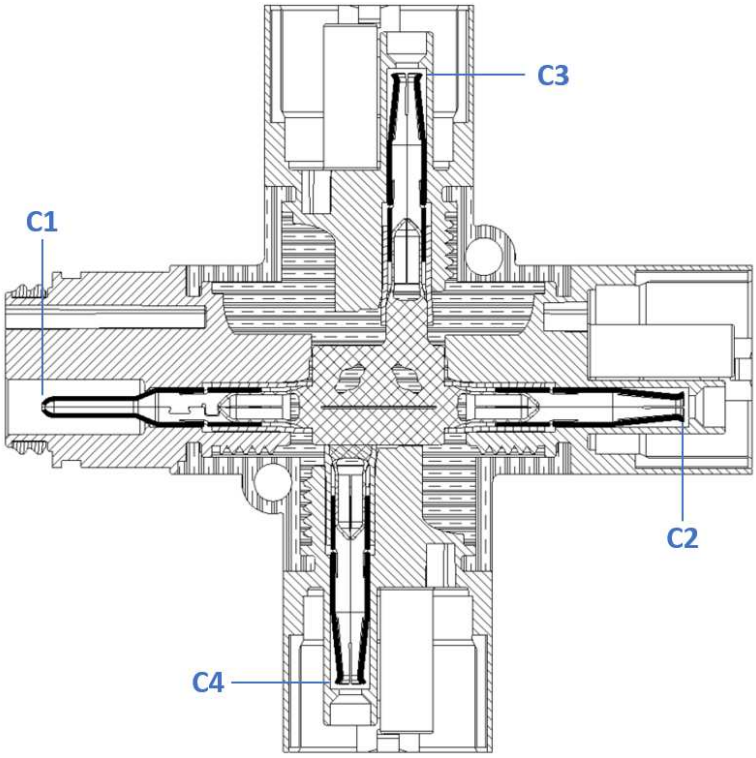


Figure 2, T- Splitter and Multi Splitter

Test points for resistance measurement: to be checked on Line, Neutral & Ground

C1 ←→ C2

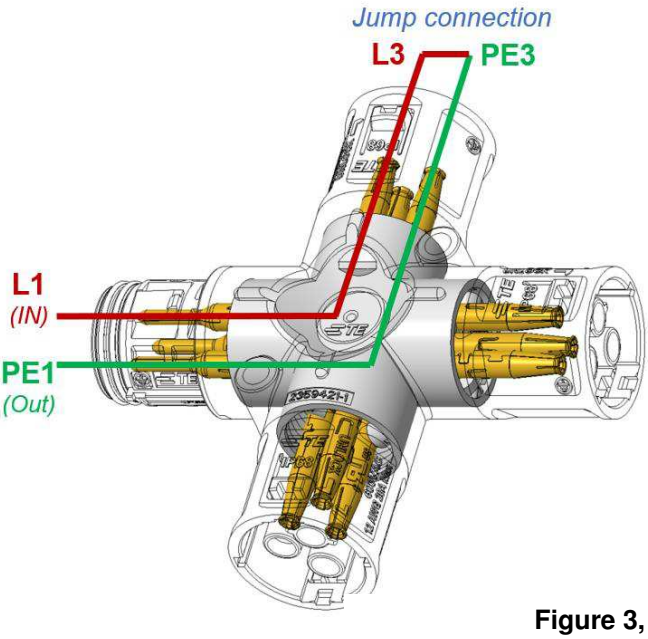
C1 ←→ C3

C1 ←→ C4

5.2. Temperature rise test:

5.2.1 Circuit diagram for T-splitter and Multi Splitter

Branch Circuit 1: *Line 1 → Line 3 → Ground 3 → Ground 1*



Branch Circuit 2: *Line 1 → Line 3 → Neutral 3 → Neutral 1*

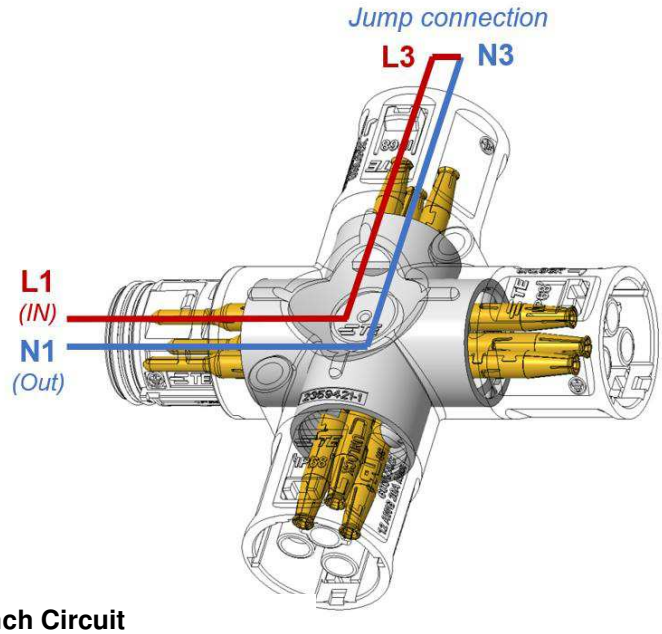
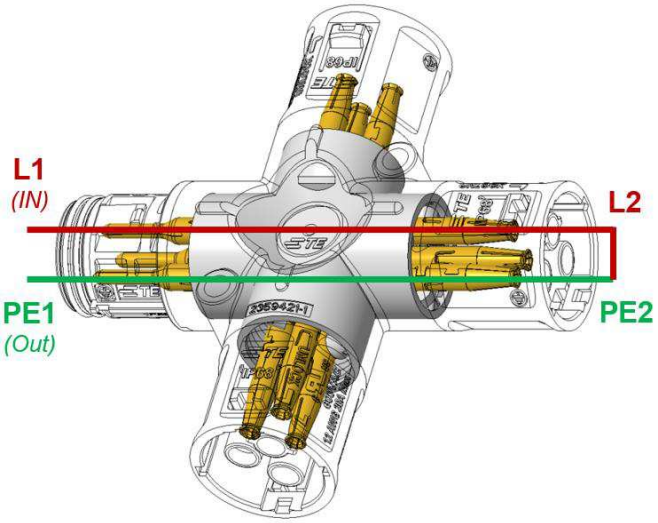


Figure 3, Branch Circuit

Straight Circuit 1: *Line 1 → Line 2 → Ground 2 → Ground 1*



Straight Circuit 2: *Line 1 → Line 2 → Neutral 2 → Neutral 1*

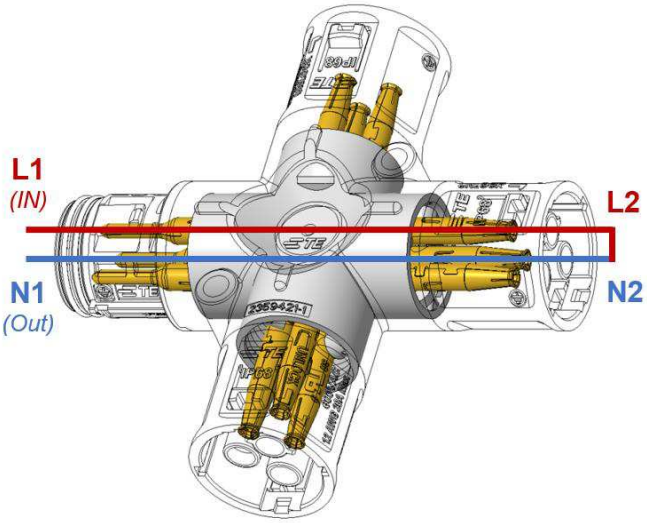


Figure 4, Straight Circuit

5.2.2 Thermocouple points for T-splitter and Multi Splitter:

Suitable size holes must be drilled at locations as per drawing (Figure 5). Thermocouple must be placed inside these holes ensuring the tip is in contact with contacts. Thermocouple must be secured with thermal conductive glue.

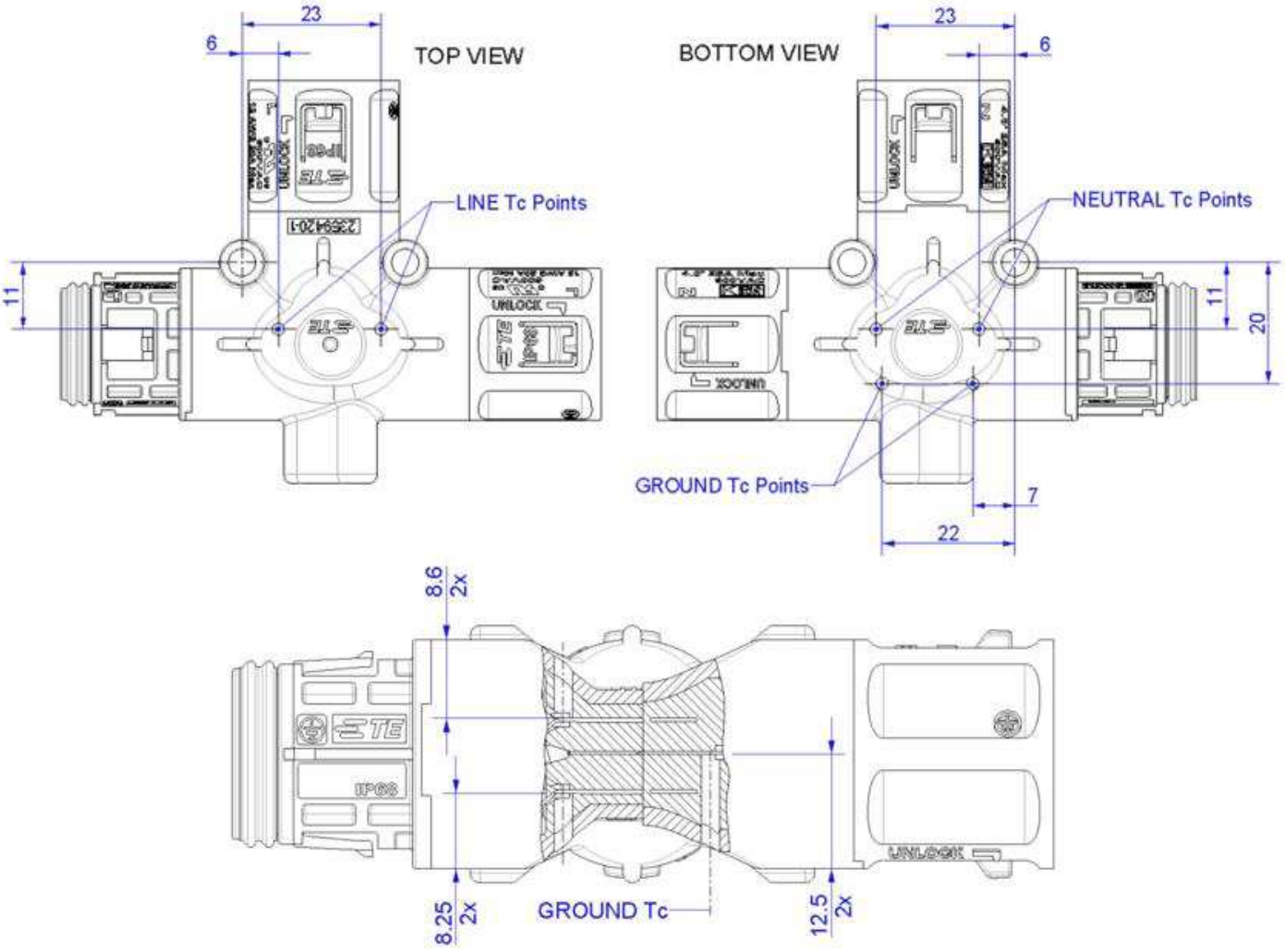


Figure 5, Drawing for drilling holes