



# Descriptive Report and Test Results

**MASTER CONTRACT:** 224693

**REPORT:** 2523148

**PROJECT:** 2523148

**Edition 1:** January 29, 2013; Project 2523148 – Toronto  
Issued by E. Migliozi

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## **PRODUCTS**

Class 4228 01 – Motors and Generators – For Hazardous Locations

Class 4228 81 – Motors and Generators – For Hazardous Locations – Certified to US Standards

Class I, Div. 2, Groups A, B, C and D, Temperature coded: T4A, T3C, T2C or T2B (Where applicable)

Three-phase squirrel cage induction motors, TXA, TXC, TFA and TFC Series, NEMA frames 143T to 447T, TEFC, rated 200 HP max, 575 V max, 60 Hz, continuous duty, Class F insulation, 40°C ambient temperature.

Notes: a) S.F. 1.25 for frame sizes 143T to 256T  
b) S.F. 1.15 for frame sizes 284T to 447T  
c) Refer to Table 1 for temperature code

## **APPLICABLE REQUIREMENTS**

- CAN/CSA C22.2 No. 0-10
- CAN/CSA C22.2 No. 100-04
- CAN/CSA C22.2 No. 213-M1987
- NFPA 70
- ANSI/UL 1004
- ANSI/UL SU 1836
- General Requirements - Canadian Electrical Code Part II.
- Motors and Generators
- Non-Incendive Electrical Equipment for Use in Class I, Div 2 Hazardous Locations
- US National Electric Code
- Motors and Generators
- Outline of Investigation for Electric Motors and Generators for Use in Class I, Division 2 and Class II, Division 2 Hazardous Locations.

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## **MARKINGS**

Product markings shall be in accordance with the related standards. In addition, it shall be the responsibility of the manufacturer to provide additional markings on the product to comply with the requirements of the local regulatory authorities. For example, in Canada, any caution and warning markings must be provided in French and English.

In addition to the Marking required for the Ordinary Location Motors covered under File 224693, the following Markings shall be added:

- Manufacturer's name;
- Motor type designation;
- Hazardous Locations Designation (Class I, Division 2, Group A, B, C and D and additionally optional Class I, Zone 2, Groups IIC, IIB, IIA);
- Temperature Code (Refer to Table 1);
- Complete electrical ratings (e.g., volts, frequency, horsepower, revolutions per minute, etc.);
- Class of insulation;
- Service Factor ;
- Number of poles;
- Serial number or date code;
- Enclosure type;
- Number of phases;
- Ambient temperature;
- CSA Monogram with the C US indicator.

The above Marking shall be permanently marked on a metal Nameplate (s) ( 0.5 mm min. thickness) or on a Certified Adhesive Label (s) and secured to the Motor Frame with double sided, very high bond transfer adhesive or rivets.

## **ALTERATIONS**

Marking as stated above

## **FACTORY TESTS**

The equipment at the conclusion of manufacture, before shipment, shall withstand for one min, without breakdown, the application of 1000V ac plus twice the max rated voltage between live parts and exposed non-current-carrying metal parts. The factory test may be made at existing room temperature. As an alternative, a potential 20 percent higher may be applied for one sec.

Warning: The factory test(s) specified may present a hazard of injury to personnel and/or property and should only be performed by persons knowledgeable of such hazards and under conditions designed to minimize the possibility of injury.

**SPECIAL INSTRUCTIONS FOR FIELD SERVICES**

1. Component descriptions marked with either the “(INT)” or “(INT\*)” identifiers may be substituted with other components providing the requirements specified under the notes in the “Description” are complied with.
  
2. This report contains reference to certain construction and engineering documents that have been deemed critical to ensuring continued compliance with applicable construction and performance requirements. A list of these documents, with drawing numbers and the appropriate revision levels is summarized in this report. Documents detailed herein are subject to inspection by CSA International personnel and shall be made available in the manufacturing location upon request. Failure to produce these documents in a timely manner constitutes noncompliance and is subject to the actions outlined in the CSA Product Service Agreement.

**COMPONENT SPECIAL PICKUP**

Component descriptions marked with the identifier “(CT)” are subject to annual pickup and Conformity Testing.

**DESCRIPTION**

Notes:

1. Component Substitution
  - a) Critical components (those identified by mfr name, cat no), which are NOT identified with either “INT” or “INT\*” are not eligible for substitution without evaluation and report updating.
  - b) The term “INT” means a “Certified” and/or “Listed” (or a “Recognized” and/or “Accepted”) component may be replaced by one “Certified” and/or “Listed” by an organization (accredited by OSHA/SCC), for the same application; providing the applicable country identifiers are included and requirements in item “d” below are complied with.
  - c) The term “INT\*” means a “Recognized” and/or “Accepted” component may be replaced by one “Recognized” and/or “Accepted” by an organization (accredited by OSHA/SCC), for the same application, providing the applicable country identifiers are included, the component is **also** CSA Certified, the requirements in item “d” below are complied with and any “conditions of suitability” for the component (as recorded in this descriptive report) are complied with.
  - d) Components which have been substituted, must be of an equivalent rating, configuration (size, orientation, mounting) and the applicable minimum creepage and clearance distances are to be maintained from live parts to bonded metal parts and secondary parts.
  - e) Substitution of a “Certified” and/or “Listed” component with a component that is “Recognized” or “Accepted” is not permitted without evaluation and report updating.

**General:** The subject motors are similar in construction to those covered in report 2437712 and 2296492 for use in Ordinary Location. The purpose of this report is to cover the subject motors for use in Class I, Div. 2, Groups A, B, C and D Hazardous Locations.

Report 2296492 covers squirrel cage induction motors, TFA and TFC Series, TEFC, frame sizes 143T to 447T, rated 200 HP max, 460 V max, 2, 4 or 6 pole, 60 Hz, Class F insulation, continuous duty, SF 1.15.

Report 2437712 covers squirrel cage induction motors, TXA and TXC Series, TEFC, frame sizes 143T to 447T, rated 200 HP max, 575 V max, 2, 4 or 6 pole, 60 Hz, Class F insulation, continuous duty, SF 1.15.

**Nomenclature:** The significance of the alpha-numeric model numbering system is as follows:

xx    x    xxx    xx    U    x    B

I    II    III    IV    V

- I: Enclosure type, TX – TEFC enclosure;  
Enclosure type, TF – TEFC enclosure;
- II: Enclosure material, may be C or A;  
C – Cast iron;  
A – Cast aluminum;
- III: Frame size;
- IV: Output power, HP;
- V: No. of pole.

**Construction:**

- 1-) Stator Enclosure: Material: Cast iron, aluminum or steel.  
Ventilation Openings: None.  
Dimensions: Min 5.0 mm thick; dimensions refer to reports 2296492 and 2437712
- 2-) Stator: Material: Laminated silicon steel.  
Dimensions: dimensions refer to reports 2296492 and 2437712
- 3-) Insulation System: The insulation system (Class 155(F), designated TOP-155.) is UL Recognized and is described in UL Report E331739, Vol.1, Sec.1, Table I, issued 2009-07-16.  
  
Construction as described below:
  - a) Winding – UL Recognized (OBMW2), listed in the insulation system, enameled copper wire, varnish impregnated. The winding is measured OD with DC winding resistance as described in Item 5 above;
  - b) Slot Liner – DMD, designated DMD (F6641), by Dong Fang Insulating Material Co., Ltd overall 0.25 mm thick minimum, with PET layer 0.18 mm minimum. Each extended minimum 2.4 mm beyond Lamination.  
Alternate – Same as above except DMD (F6641), by Chang Zhou Isovolta. Listed in the insulation system.
  - c) Slot Wedge – Treated fiber, designated 3830, by Jiayin Zhutang Electrical Material Factory, measured 2.0 mm thick minimum. Each extended minimum 2.4 mm beyond Lamination.
  - d) Phase Insulation – DMD, designated DMD (F6641), by Dong Fang Insulating Material Co., Ltd, overall 0.2 mm thick minimum.  
Alternate – Same as above except DMD (F6641), by Chang Zhou Isovolta. Listed in the insulation system.
  - d) Varnish – UL Recognized (OBOR2), designated R-1140-m, by JiaXing Rota-Ropa Insulating Material Co., Ltd.
- 4-) Lead Wire: CSA Certified/UL Recognized. Type: AWM I A/XLPE or equivalent listed in Insulation System above, minimum No 18 AWG, 150 °C, 600 V. No white or naturally gray colored conductor is used.  
Method of Connection to Coil Ends: Splices in motor are twisted and soldered, insulated by sleeving and wrapped by the tape from the Insulation System with minimum two layers and bound to windings with tie cord from the Insulation System. Leads are routed through smooth-edged hole in Frame.  
Length: A minimum free length of 152 mm is provided in the Terminal Box.
- 5-) Rotor: Dimensions: See dimensions below.  
Materials: Laminated silicon steel with cast aluminum shorted ring bar, end rings and impellers on each end.  
Method of Securing to Shaft: Key and press fitted.
- 6-) Terminal Box: Material: Cast iron, aluminum or steel, 1.2 mm thick min.  
Type: Diagonal split, fully gasketed.  
Mounting: Secured to the motor enclosure with bolts.  
Gasket: Chloroprene rubber, 100 °C temperature rating.
- 7-) Conduit Openings: Machines will have provision for permanent connection to wiring system.  
Threaded NPT conduit openings are provided and in accordance with CSA C22.2 No. 0.5.
- 8-) Grounding and Bonding: Cr. Plated steel M5x10 machine screw with serrated external teeth lock-washer.  
Grounding symbol is molded or provided on a metallic plate riveted beside to grounding screws.  
Securement: threaded into motor enclosure by tapped hole.

9-) Fan: Made of cast aluminum..

Note: Non-Metallic fans are not used on the subject motors.

**Temperature Code:** Table 1

Frame size	Max HP			Sinusoidal	
	2 pole	4 pole	6 pole	SF 1.15	S.F 1.25
143T/145T	2 HP	2 HP	1 HP	--	T4A
182T/184T	5 HP	5 HP	2 HP	--	T3C
213T/215T	10 HP	10 HP	5 HP	--	T3C
254T/256T	20 HP	20 HP	10 HP	--	T2C
284T/286T	30 HP	30 HP	20 HP	T2B	--
324TS/326TS	50 HP	50 HP	30 HP	T2B	--
364TS/365TS	75 HP	75 HP	50 HP	T2C	--
405T	100 HP	100 HP	75 HP	T2B	--
444T/445T	150 HP	150 HP	125 HP	T2B	--
447T	200 HP	200 HP	150 HP	T2B	--

**DESCRIPTIVE DOCUMENTS LIST:** Attached as Appendix 1- Drawings

Documents detailed herein are subject to inspection by CSA International personnel and shall be made available in the manufacturing location upon request.

Title	Drawing No.	Date
NEMA TEFC 145T	TXCR145T2U4B	--
NEMA TEFC 184T	TXCR184T5U4B	--
NEMA TEFC 215T	TXCR215T10U4B	--
NEMA TEFC 256T	TXCR256T20U4B	--
NEMA TEFC 326T	TXCR326T50U4B	--
NEMA TEFC 365T	TXCR365T75U4B	--
NEMA TEFC 445T	TXCR445T150U4B	--
NEMA TEFC 447T	TXCR447T200U4B	--

## TEST RESULTS

**Project 2523148:** Representative sample motors were tested and witnessed by a CSA representative at Shanghai Testing & Inspection Institute for Electrical Equipment located at 505 Wuning Rd, Shanghai, China. The complete test report is attached under Appendix 2 (Kept in Eng File only)

Summary of the test result:

1-) Nameplate information: Model TXC145T2U4B, rated 2HP, 230/460V, 60 Hz, 1730 rpm, Insulation class F, TEFC, SF 1.25, 10.50 Nm.

### Rating & Temperature Test:

- cold resistance: 6.980  $\Omega$  at 30.3 °C ambient temperature
- hot resistance: 8.455  $\Omega$  at 32.3 °C ambient temperature
- rise by resistance: 53.96 K
- rise by thermocouple: 52.1K
- rotor temperature: 107.5 °C (determined by temperature sensing tape)
- Lead wire: 36.1 °C
- frame: 70.7 °C
- bearing: 72 °C
- ambient t temperature: 33 °C

Results: The maximum surface temperature measured was 114.5 °C and is below the maximum temperature allowed of 120°C (T4A).

The maximum temperature measured on the windings is below the maximum temperature allowed for the insulation class.

2-) Nameplate information: Model TXC184T5U4B, frame 184, rated 5HP, 230/460V, 60 Hz, 1745 rpm, 12.8/6.4A, Insulation class F, TEFC, SF 1.25, 25.76 Nm.

### Rating & Temperature Test

- cold resistance: 2.543  $\Omega$  at 28 °C ambient temperature
- hot resistance: 3.323  $\Omega$  at 30 °C ambient temperature
- rise by resistance: 78.5K
- rise by thermocouples: 81.1 K
- rotor temperature: 137.5 °C (determined by temperature sensing tape)
- Lead wire: 38 °C
- frame: 79.3 °C
- bearing: 70.9 °C
- ambient t temperature: 30 °C

Results: The maximum surface temperature measured was 147.5 °C and is below the maximum temperature allowed of 160°C (T3C).

The maximum temperature measured on the windings is below the maximum temperature allowed for the insulation class.

3- Nameplate information: Model TXC215T10U4B, frame 215, rated 10HP, 230/460V, 60 Hz, 1750 rpm, 24.8/12.4A, Insulation class F, TEFC, SF 1.25, 51.3 Nm.

Rating & Temperature Test

- cold resistance: 0.9114  $\Omega$  at 30 °C ambient temperature
- hot resistance: 1.1584  $\Omega$  at 33 °C ambient temperature
- rise by resistance: 68.7 K
- rise by thermocouples: 69.5 K
- rotor temperature: 130.5°C (determined by temperature sensing tape)
- Lead wire: 41.9 °C
- frame: 70.7 °C
- bearing: 72 °C
- ambient t temperature: 33 °C

Results: The maximum surface temperature measured was 137.5 °C and is below the maximum temperature allowed of 160°C (T3C).

The maximum temperature measured on the windings is below the maximum temperature allowed for the insulation class.

4- Nameplate information: Model TXC256T20U4B, frame 256, rated 20HP, 230/460V, 60 Hz, 1760 rpm, 47.0/23.5 A, Insulation class F, TEFC, SF 1.25, 102 Nm.

Rating & Temperature Test

- cold resistance: 0.3891  $\Omega$  at 28.6 °C ambient temperature
- hot resistance: 0.5167  $\Omega$  at 32.4 °C ambient temperature
- rise by resistance: 82.48K
- rise by thermocouples: 84.3K
- rotor temperature : 218.9 °C (determined by temperature sensing tape)
- Lead wire: 47.3 °C
- frame: 64.3 °C
- bearing: 55.8°C
- ambient t temperature: 32.4 °C

Results: The maximum surface temperature measured was 226.5 °C and is below the maximum temperature allowed of 230°C (T2C).

The maximum temperature measured on the windings is below the maximum temperature allowed for the insulation class.

5- Nameplate information : Model TXC326T50U4B, frame 326, rated 50HP, 230/460V, 60 Hz, 1770 rpm, 118.4/59.2A, Insulation class F, TEFC, SF 1.15, 231.8 Nm.

Rating & Temperature Test

- cold resistance: 0.1370  $\Omega$  at 30 °C ambient temperature
- hot resistance: 0.1832  $\Omega$  at 33 °C ambient temperature
- rise by resistance: 86.2K
- rise by thermocouples: 88.9 K
- rotor temperature: 227.5 °C (determined by temperature sensing tape)
- Lead wire: 48.9 °C
- frame: 49.2 °C
- bearing: 68.7 °C
- ambient t temperature: 33 °C



Results: The maximum surface temperature measured was 234.5 °C and is below the maximum temperature allowed of 260°C (T2B).

The maximum temperature measured on the windings is below the maximum temperature allowed for the insulation class.

6- Nameplate information: Model TXC365T75U4B, frame 365, rated 75HP, 230/460V, 60 Hz, 1775 rpm, 172.4/86.2A, Insulation class F, TEFC, SF 1.15, 345.7 Nm.

#### Rating & Temperature Test

- cold resistance: 0.06544 Ω at 28 °C ambient temperature
- hot resistance: 0.08415 Ω at 30 °C ambient temperature
- rise by resistance: 73.05K
- rise by thermocouples: 86.1 K
- rotor temperature: 216.5 °C (determined by temperature sensing tape)
- Lead wire: 53.6 °C
- frame: 66.8 °C
- bearing: 69.3 °C
- ambient t temperature: 30 °C

Results: The maximum surface temperature measured was 226.5 °C and is below the maximum temperature allowed of 230°C (T2C).

The maximum temperature measured on the windings is below the maximum temperature allowed for the insulation class.

7- Nameplate information: Model TXC445T150U4B, frame 445T, rated 150HP, 460V, 60 Hz, 1780 rpm, 169A, Insulation class F, TEFC, SF 1.15, 345.7 Nm.

#### Rating & Temperature Test

- cold resistance: 0.02709 Ω at 30.7 °C ambient temperature
- hot resistance: 0.03670 Ω at 34.9 °C ambient temperature
- rise by resistance: 89.88K
- rise by thermocouples: 93.1 K
- rotor temperature : 237.4°C (determined by temperature sensing tape)
- Lead wire: 55.6 °C
- frame: 72.0 °C
- bearing: 86.3 °C
- ambient t temperature: 34.9 °C

Results: The maximum surface temperature measured was 242.5 °C and is below the maximum temperature allowed of 260°C (T2B).

The maximum temperature measured on the windings is below the maximum temperature allowed for the insulation class.

8- Nameplate information: Model TXC447T200U4B, rated 200HP, 460V, 60 Hz, 1780 rpm, 223A, Insulation class F, TEFC, SF 1.15, 916.8 Nm.

#### Rating & Temperature Test

- cold resistance: 0.01783  $\Omega$  at 28.0 °C ambient temperature
- hot resistance: 0.02472  $\Omega$  at 32.7 °C ambient temperature
- rise by resistance: 96.23K
- rise by thermocouples: 91.2 K
- rotor temperature: 244.2 °C (determined by temperature sensing tape)
- Lead wire: 51.4 °C
- frame: 61.8 °C
- bearing: 78.9 °C
- ambient t temperature: 32.7 °C

Results: The maximum surface temperature measured was 251.5 °C and is below the maximum temperature allowed of 260°C (T2B).

The maximum temperature measured on the windings is below the maximum temperature allowed for the insulation class.

No more tests deemed necessary

END OF REPORT