THERMO Tips

Form TT124 -0608

Anti-icing / Deicing

Abstract

This ThermoTip is intended to be a design tool for establishing heat loads required for anti-icing and deicing applications. The focus is primarily handrails and structures that are comprised of flat surfaces, such as helidecks, escape passages, decks, access ways, etc. Due to variations in physical structures, installation guidelines are covered briefly as it pertains to mounting on the surface.

Applications such as stairs, scuppers or doorways are not addressed, as determining heat loads for these types of surfaces require specific details for each application.

Introduction

In cold climate waters, the formation of ice on ships and offshore platforms can create serious problems impacting the safety of personnel and the economies of operation. Icing can be caused by sea spray and/or atmospheric water (snow, rain and fog).

The equipment and areas requiring measures against ice formation have been divided into two categories by Det Norske Veritas (DNV), as follow:

Category I: equipment or areas necessary for navigation, steering, propulsion, anchoring and lifesaving.

Category II: equipment or areas comprising decks and superstructures, helicopter decks, railings and cargo deck area.

Anti-icing is defined as the prevention of ice formation, and according to DNV is required for Category I equipment or areas. For these applications, anti-icing arrangements are required with sufficient capacity to keep the equipment or areas free from ice at all times in the service areas under moderate conditions.

Deicing is defined as the melting of ice already formed, and according to DNV is required for Category II equipment or areas. For these applications, deicing arrangements are required with sufficient capacity for removal of accumulated ice within a reasonable period of time (normally 4 to 6 hours) under moderate conditions.

Heat Load

DNV recommends power capacity for anti-icing and deicing be not less than:

- 300 W/m2 for open deck areas, helicopter decks, gangways, stairways, etc.
- 200 W/m2 for superstructures
- 50 W/m for railings with inside heating

These are minimum power capacity requirements. Lower ambient temperatures and higher wind speeds will increase the heat loss and more power may be needed.

Flat Surface Heat Loads

The calculated heat loads required for anti-icing of flat surfaces based on various combinations of ambient temperature and wind speed are shown below. These heat loads are for flat horizontal steel surfaces with a maintain temperature of 2°C. Flat surfaces include decks, access ways, escape ways, helidecks, etc.

Chart 1

Heat Loss from Flat Surface in w/m^2:

	Ambient (deg C)			
Wind (m/s)	-5	-10	-15	-20
no wind	300.0	300.0	300.0	300.0
5	300.0	300.0	334.0	432.2
10	300.0	378.1	535.7	693.2
15	300.0	506.3	717.3	928.2
20	365.2	626.1	886.9	1147.8

recommending minimum heat load of 300 w/m^2 in accordance with DNV

Handrail Heat Loads

The calculated heat loads required for anti-icing of handrails based on various combinations of ambient temperature and wind speed are shown below. These heat loads are for handrails constructed of hollow steel tubes with a maintain temperature of 2°C. This chart may be used for handrails from 30mm OD through 50mm OD.

Chart 2

Heat Loss from Handrail in w/m:

	Ambient (deg C)			
Wind (m/s)	-5	-10	-15	-20
no wind	50.0	50.0	58.7	75.8
5	50.5	85.3	127.0	155.2
10	84.0	142.4	200.5	258.5
15	106.6	180.1	253.9	327.8
20	123.4	208.7	294.0	379.3

recommending minimum heat load of 50 w/m in accordance with DNV

Custom Heat Load Calculations

Heating capacities for areas other than flat surfaces or handrails should be considered individually for customized heat loads and designs.

Design Data

All recommended designs provided are based on utilizing Thermon's RSX-15-2-FOJ Self-Regulating Cables.

Thermon's RSX 15-2 Self-Regulating Cable is well suited for anti-icing or deicing applications due to the high watts/meter output the cable exhibits at freezing temperatures. The relatively steep power output curve of this cable results in more power being available when the ambient temperature is below freezing; conversely, when the ambient temperature is above freezing, the power output is significantly reduced.

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Flat Surface Design Recommendations

Based on the flat surface heat loads shown in Chart 1 above, the following charts provide recommended heating cable spacing for installations with and without a parallel pass of aluminum tape over the cable.

Chart 3

Centerline Spacing of RSX 15-2-FOJ Cables in mm:
Cable powered at 240V
Installed without Aluminum Tape

Wind (m/s)	Ambient (deg C) -5	-10	-15	-20
no wind	153	153	153	153
5	153	153	138	106
10	153	121	86	66
15	153	91	64	49
20	126	73	52	40

recommending spacing to provide minimum 300 w/m^2 in accordance with DNV

Chart 4

Centerline Spacing of RSX 15-2-FOJ Cables in mm:
Cable powered at 240V
Installed with Aluminum Tape

Wind (m/s)	Ambient (deg C) -5	-10	-15	-20
no wind	197	197	197	197
5	197	197	177	137
10	197	156	110	85
15	197	117	82	64
20	162	94	67	51

recommending spacing to provide minimum 300 w/m^2 in accordance with DNV

Handrail Design Recommendations

Based on the handrail heat loads shown above, the following charts provide the recommended number of heating cables to be installed inside the handrail. Note, for extreme climate conditions where anti-icing is not feasible due to the required number of passes of cable, deicing has been provided (max 4 passes).

Chart 5

Number of Passes of RSX 15-2-FOJ Cables inside Handrail:
Cable powered at 240V

Wind (m/s)	Ambient (deg C) -5	-10	-15	-20
no wind	2	2	2	3
5	2	3	4	4
10	3	4	4	4
15	3	4	4	4
20	4	4	4	4

denotes deicing provided (typical)

Installation

The following installation recommendations should be considered as guidelines based on typical structural configurations found on ships and off-shore platforms. Due to the large numbers of physical variations in locations and space available for electrical connections and/or junction boxes, installations and terminations of heating cables are customized for each application. Please refer to the Appendix for photographs of existing installations showing some of these variations.

Flat Deck Surfaces : Heating cables for anti-icing or deicing of flat surfaces are usually installed on the bottom surface of the steel plate, utilizing brackets with either a spot-welded bolt system (Illustration A) or adhesive. For some applications, a parallel pass of aluminum tape over the cable is recommended due to the heat loss (Illustration B). Thermal insulation is often installed over the heating cable to minimize heat loss off the back of the plate.

Flat Helicopter Deck Surfaces : Heating cables for anti-icing or deicing of helicopter decks are usually installed along the outside of the channel utlizing aluminum tape or brackets attached with adhesive (Illustration C). For helicopter decks constructed of aluminum channels with extruded grooves or brackets for mounting of the heating cable, Thermon should be consulted for effective power output calculations.

Handrails : Heating cables for anti-icing or deicing of handrails are to be installed in parallel passes inside the handrail (Illustration D).

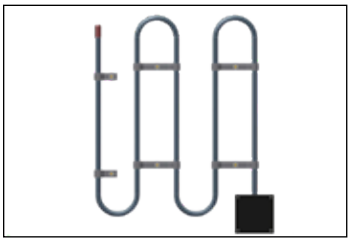

Illustration A

Illustration B

Illustration C

Illustration D

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Appendix : Photographs of Existing Installations

Photo 1a: Heating Cable installation on flat surface utilizing brackets with spot-welded bolts.

Photo 1b: Heating Cable installation on flat surface utilizing brackets with spot-welded bolts.

Photo 2: Heating Cable installation on flat surface utilizing brackets with adhesive.

Photo 3: Heating Cable installed inside a handrail.

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Appendix : Photographs of Existing Installations

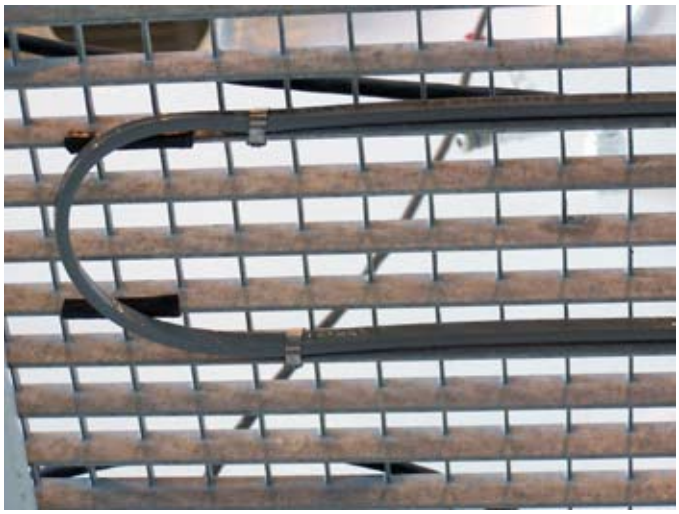

Photo 4: Heating Cable installed below open deck grating.

Photo 5: Heating Cable installed below stair grating, with junction box shown..

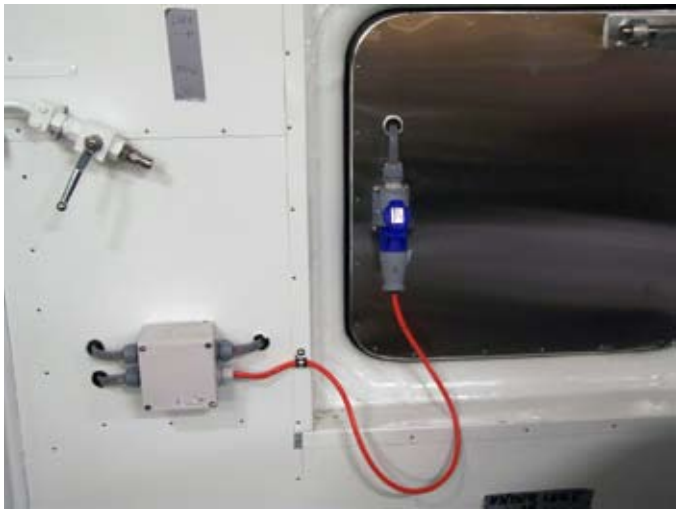

Photo 6: Door with Heating Cable installed, junction box shown.

Photo 7: Door frame with Heating Cable installed, power lead and end termination kit shown.