

INTRO

Dette dokument opsummerer og behandler resultaterne fra de udførte tests foretaget af Force Technology i perioden 01.02.2022 – 08.02.2022.

Tests er foretaget ved Force Technology, Venlighedsvej 4, 2970 Hørsholm, Danmark.

For fuld testrapport se bilag.

Nordicco's Northern Air Aggressive Environment HVLS ventilator er testet for følgende:

1. Accelereret korrosions test
2. IP5X - Modstandsdygtig mod faste legemer (støv)
3. IPX5 - Modstandsdygtig mod vand

SAMLET KONKLUSION

På baggrund af testen foretaget af Force Technology klassificeres Northern Air Aggressive Environment systemet samlet som IP54. Her tages der hensyn til Motorens IP54 klassifikation i den samlede klassifikation af ventilatoren.

Derudover angiver den accelererede korrosionsanalyse af C4 coatingen stor modstandsdygtighed overfor begyndende korrosion, hvorfor systemet vurderes egnet til applikationer i korrosive miljøer. For delkonklusioner for de enkelte tests se afsnit 1-3.

1. ACCELERERET KORROSIONSANALYSE

Ventilatoren inkl. motor og drive samt flere assorterede metalbeslag, forlængerrør (drop tube) mv. er testet i salttågekammer efter følgende testmetode:

IEC 60068-2-52:2017, Environmental testing Part 2: Tests – Test Kb: Salt mist, cyclic.

Testmetode: Metode 3

Testen er udført for at teste 3 forskellige coatings af sort (ubehandlet) stål for at vurdere korrosionsbestandigheden af de enkelte coating typer.

Coating type	Coating beskrivelse	Emners visuelle kendetegn
C2 Coating	Enkeltlags pulverlakering	Alle sorte emner
C3 Coating	Sandblæsning og enkeltlags pulverlakering	Hvide emner med sort strip
C4 Coating	Sandblæsning, grunder pulverlakering og topcoat pulverlak	Hvide emner

Der er desuden for både C3 og C4 foretaget test i forhold til påførte skader på overfladen samt test af reparation af påførte skader.

Udover coating af sort stål er sikkerhedswire, sikkerhedswire lås samt vinger blevet testet.

1.1 Konklusion på baggrund af udført test:

I forhold til korrosionsbeskyttelse af sort stål angiver den udførte test at C4 coatingen yder stor beskyttelse overfor begyndende korrosion. Testen angiver desuden at påførte skader kan udbedres hvorefter der stadig opnås stor korrosionsbestandighed af emnerne. Konklusionen er baseret på resultaterne fra eksempelvis emnet angivet på billede 12 (side 15) der er udført som C4 samt beslaget på billede 17 (side 18) der ligeledes er udført i C4 coating inkl. påførte og reparerede slagskader. Testen angiver let farveforskel mellem reparationscoating og original coating, men ingen tegn på korrosion.

For ikke-pulverlakerede emner så som vinger, sikkerhedswire og sikkerhedswire lås viser testen stor modstanddygtighed overfor korrosion.

På baggrund af de udførte tests udføres Northern Air Aggressive Environment i Coating C4, hvorved den vurderes tilstrækkelig beskyttet til applikationer i højt korrosivt miljø.

2. IP5X - MODSTANDSDYGTIG MOD FASTE LEGEMER (STØV)

Testen er udført efter:

IEC 60529:2013 Degrees of protection provided by enclosures (IP Code).

Test klasse: IP5X (Støvsikker)

2.1 Konklusion

På baggrund af resultaterne i testen, hvor ingen akkumulering af støv blev observeret, kan drivet klassificeres som IP5X.

3. IPX5 - MODSTANDSDYGTIGHED MOD VAND

Testen er udført efter:

IEC 60529:2013 Degrees of protection provided by enclosures (IP Code).

Test klasse: IPX5 (Spuletæt fra alle retninger)

3.1 Konklusion:

På baggrund af resultaterne i testen, hvor ingen gennemtrængning af vand blev observeret, kan drivet klassificeres som IPX5.

TEST REPORT

Environmental test of indoor fan and fan assembly parts

Nordicco A/S

Report no.: 121-32625-1

Page 1 of 31

1 appendix



Task manager

Responsible

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OVERVIEW

Title	Environmental test of indoor fan and fan assembly parts
Test objects	3 pcs. indoor fans, Part no. NordicX00NA-AE Assorted pieces for fan assembly (See Section 2.2 for details) Detailed information is to be found in Section 2 The test objects were received 1 February 2022
Task no.	121-32625
Report no.	121-32625-1
Test period	1 February 2022 - 8 February 2022
Client	Nordicco A/S Karetmagervej 23 A 7000 Fredericia DENMARK Tel.: +45 73 70 90 83
Contact person	Jesper Hermansen E-mail: jesper@nordicco.eu Tel.: +45 61 48 64 60
Manufacturer	Nordicco A/S
Specifications	IEC 60068-2-52:2017, Test Kb: Salt mist, cyclic IEC 60529:2013 "Degrees of protection provided by enclosures (IP Code)"
Results	For results of the test, see Section 4
Revisions	Initial version
Test site	Venlighedsvej 4, 2970 Hørsholm, Denmark
Test personnel	Kristian Kolbye Jensen Jens Schoustrup-Thomsen

Disclaimer

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The test results only relate to the items tested.

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TABLE OF CONTENTS

1	Summary of test	5
1.1	Test requirements	5
2	Test objects	6
2.1	Test object	6
2.2	Test object	7
2.3	Test object	8
2.4	Test object	9
3	General test conditions	10
3.1	Test set-up	10
3.2	Visual inspection	10
3.3	Standard environment	10
4	Test and results	11
4.1	Salt mist	11
4.2	Dust protection, IP5X	22
4.3	Enclosure protection, IPX5	27
	Appendix 1 List of instruments	31

1 Summary of test

1.1 Test requirements

Test	Test method
Salt mist	IEC 60068-2-52:2017
Dust protection, IP5X	IEC 60529:2013
Enclosure protection, IPX5	IEC 60529:2013

The following tests were carried out as agreed with the client.

The test results relate only to the objects tested.

2 Test objects

2.1 Test object

Name of test object	Indoor fan
Model / type	Northern Air Aggressive Environment
Part no.	NordicX00NA-AE
Serial no.	100314
Manufacturer	Nordicco A/S
Supply voltage	220 – 240 V _{AC}
Comments	Test object for salt mist test

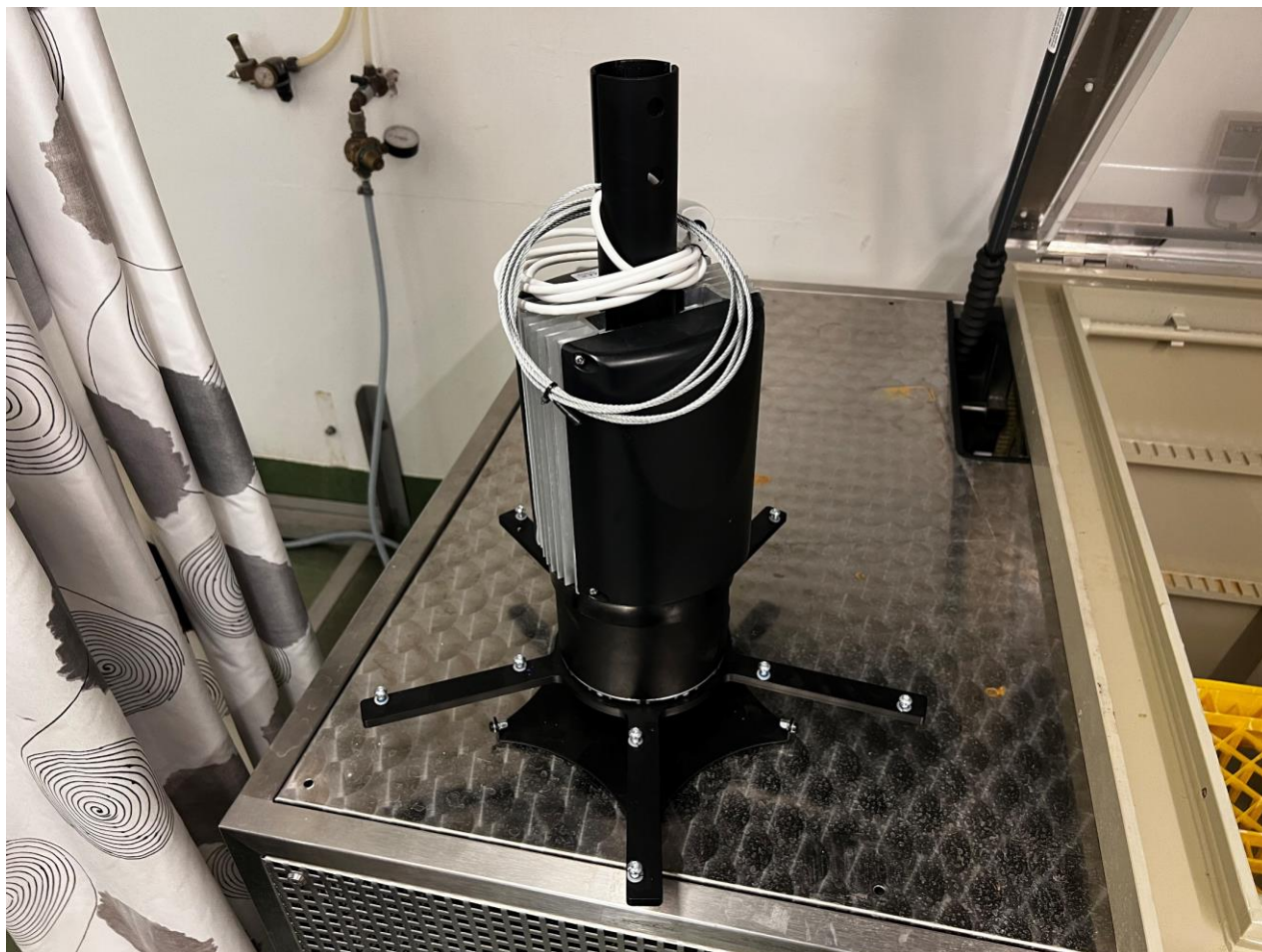


Photo 1 Test object.

2.2 Test object

Name	Part number
Extension tube	20003
Saddle extension plate	20028
Airblade – Air	20201
Guy wire mount plate	20024
Power Distributor	20009
Starfish	20005
Safety wire	300-104
Gripple	10013
Cable retainer	20007
Cable retainer bottom	20008
HEX standoff	20006
Wood/concrete mount	20032

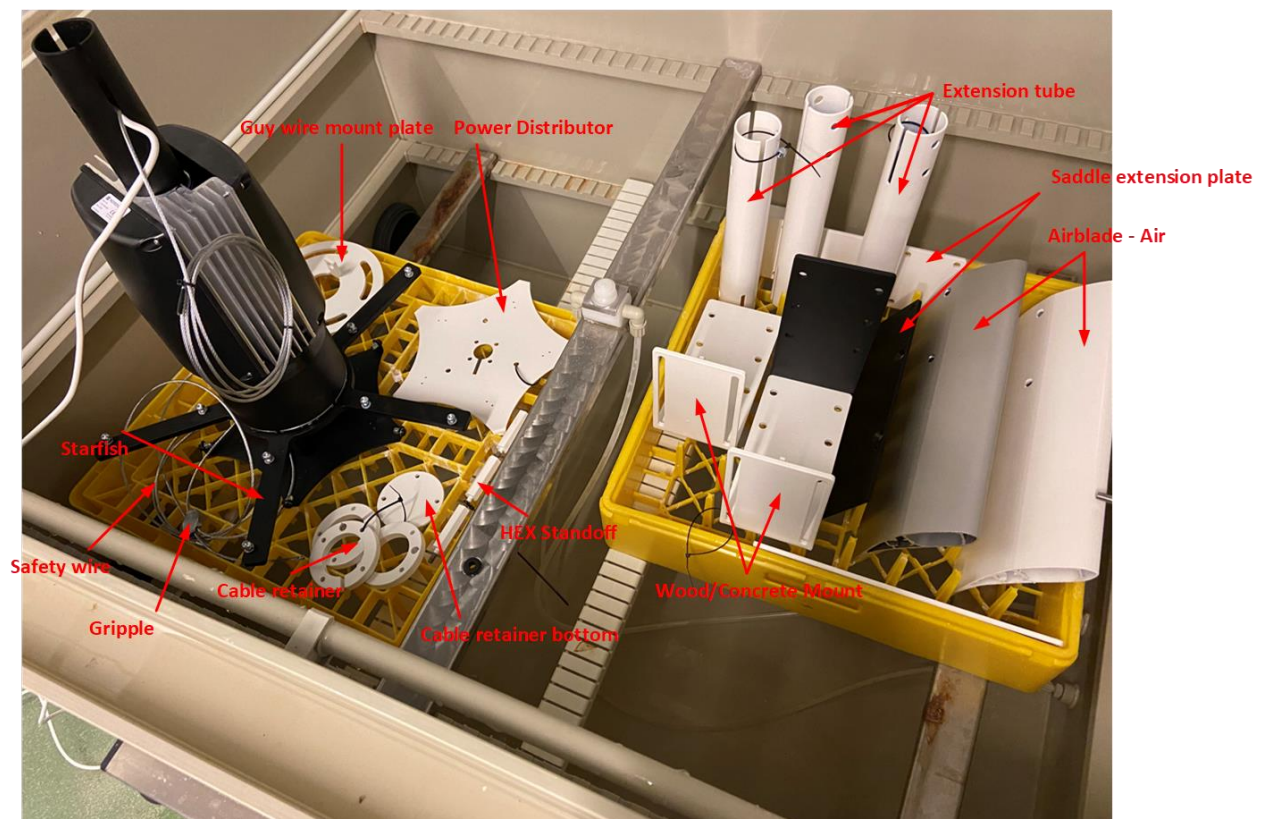


Photo 2 Test objects. Assorted pieces for fan assembly for salt mist test.

Comments Three types of coating are tested. C2, C3 and C4 powder coating and an air blade with/without coating.

2.3 Test object

Name of test object	Indoor fan
Model / type	Northern Air Aggressive Environment
Part no.	NordicX00NA-AE
Serial no.	100311
Manufacturer	Nordicco A/S
Supply voltage	220 – 240 V _{AC}
Comments	Test object for IP5X



Photo 3 Test object. Enclosure boundaries marked by red square.

2.4 Test object

Name of test object	Indoor fan
Model / type	Northern Air Aggressive Environment
Part no.	NordicX00NA-AE
Serial no.	100312
Manufacturer	Nordicco A/S
Supply voltage	220 – 240 V _{AC}
Comments	Test object for IPX5



Photo 4 Test object. Enclosure boundaries marked by red square.

3 General test conditions

3.1 Test set-up

The test set-ups can be seen in Section 4.

3.2 Visual inspection

A visual inspection was carried out by FORCE Technology after each test. The inspection included opening the test object and looking for ingress of dust, water, salt and corrosion.

3.3 Standard environment

Normal environmental condition:

Temperature	:	15 °C - 35 °C
Humidity	:	25 %rh - 75 %rh
Air pressure	:	86 kPa - 106 kPa (860 mbar - 1060 mbar)
Power supply voltage	:	$U_{nom} \pm 3 \%$

4 Test and results

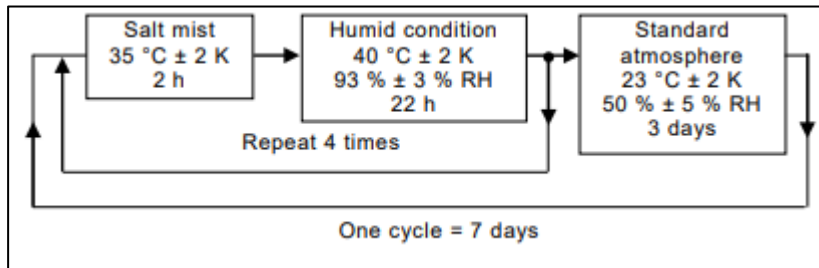
4.1 Salt mist

Test specification and Test method

IEC 60068-2-52:2017, Environmental testing Part 2: Tests – Test Kb: Salt mist, cyclic.

Severity

Test method 3.



Concentration of NaCl	:	5 % NaCl
pH of salt solution	:	6.5 - 7.2
Salt mist condition	:	35 °C (4 x 2 hours)
Humid condition	:	40 °C / 93 %rh (4 x 22 hours)
Standard atmosphere	:	23 °C / 50 %rh (3 days - 72 hours)
Number of cycles	:	1
Total duration	:	7 days

Procedure

The test objects are installed in the salt mist chamber and sprayed with the salt mist solution for a period of 2 hours.

At the end of the spraying period, the test objects are exposed to humidity and stored at a temperature of 40 °C ± 2 °C and a relative humidity of 93 %rh ± 3 %rh for a period of 22 hours. This is repeated four times.

The test objects are then stored under standard atmosphere at a temperature of 23 °C ± 2 °C and a relative humidity of 50 %rh ± 5 %rh for a period of three days.

The above constitutes one cycle.

The test object is deenergised during the exposure.

After the finalisation of the exposure a visual inspection is performed.

Results

The visual inspection conducted after the exposure showed the following results:

- C2 powder coating: Corrosion at client produced test scratches and along sharp edges
- C3 powder coating: Corrosion at client produced test scratches and along sharp edges
- C4 powder coating: Corrosion at client produced test scratches and inside extension tubes without coating. Otherwise, no corrosion observed
- Air blade with/without coating: No changes in appearance

No salt residues were observed on the inside of the test object.

See photos on the following pages for details.



Photo 5 Test set-up salt mist chamber.



Photo 6 Visual inspection (fan). Slight oxidation on aluminium heat sink.



Photo 7 Visual inspection (fan). Corrosion on/inside fan extension tube.



Photo 8 Visual inspection (fan). Corrosion on screw for the lid.

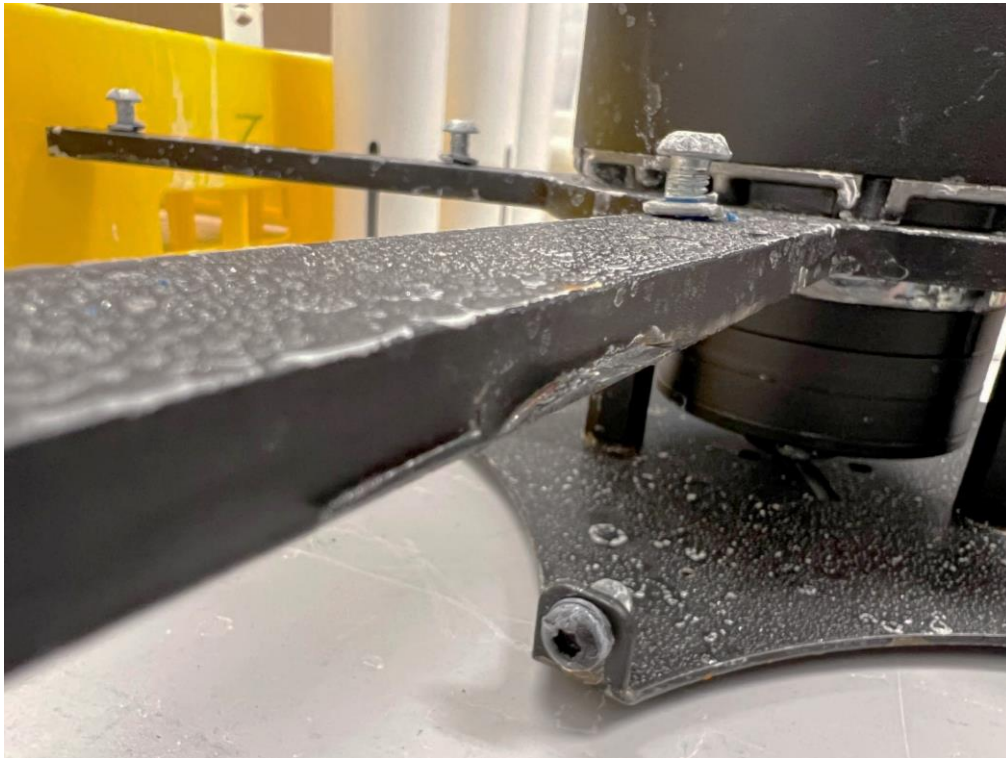


Photo 9 Visual inspection (fan). Corrosion and peeling of coating.



Photo 10 Visual inspection (fan). No signs of corrosion or salt residue inside the test object.



Photo 11 Visual inspection. (Extension tube, P/N: 20003) corrosion on scratch made by the client. Other extension tubes had no changes.

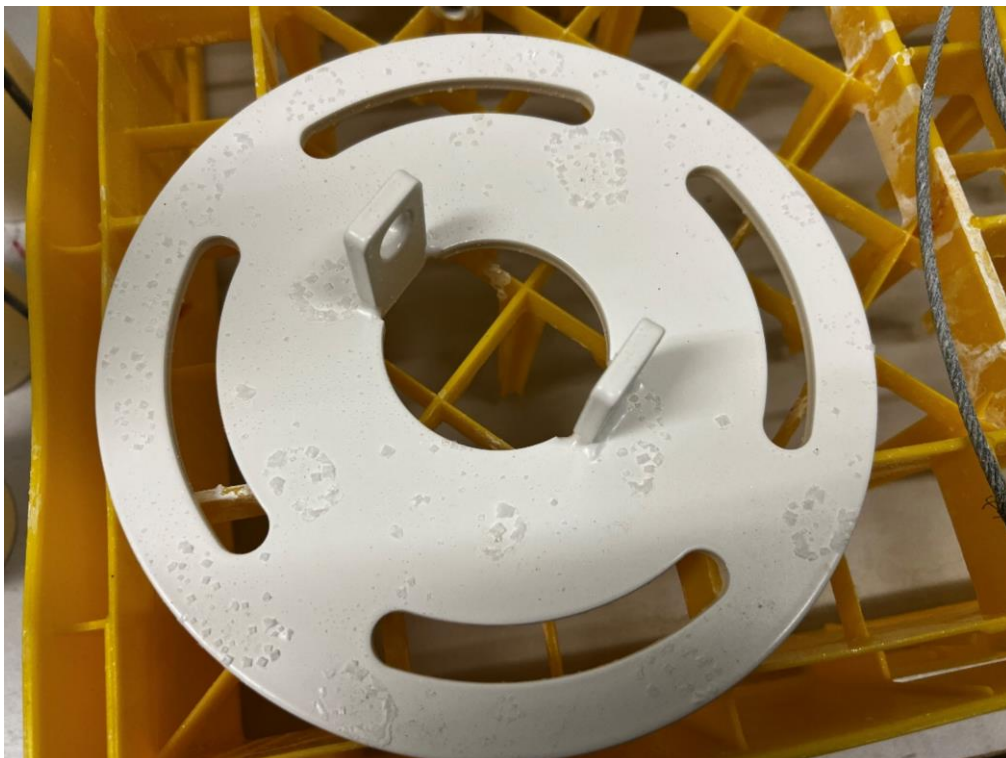


Photo 12 Visual inspection. (Guy wire mount plate, P/N: 20024) no signs of corrosion.



Photo 13 Visual inspection. (Safety wire & Gripple, P/N: 300-104 & 10013). Oxidation and slight corrosion observed.



Photo 14 Visual inspection. (Power distributor, P/N: 20009) slight corrosion along edges.



Photo 15 Visual inspection. (Cable retainers P/N: 20007 & 20008) slight corrosion along edges and scratches made by the client.

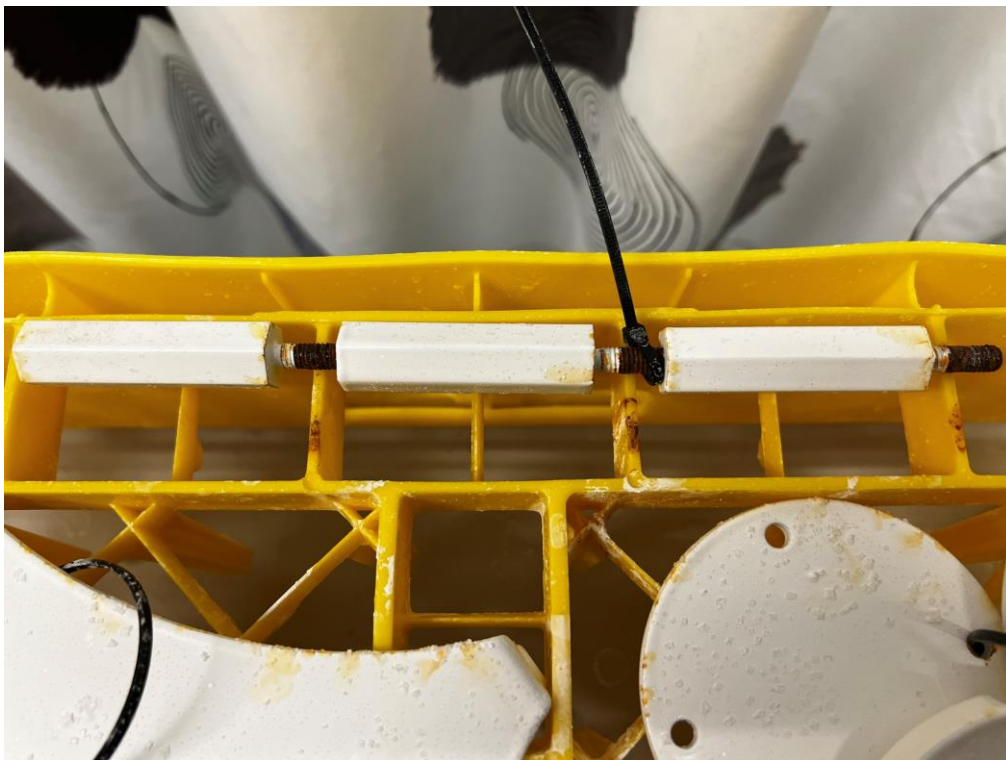


Photo 16 Visual inspection. (Hex standoff P/N: 20006) corrosion along edges and on screw thread.



Photo 17 Visual inspection. (Wood/concrete mount P/N: 20032) slight coloration on repaired cracks, otherwise no change.

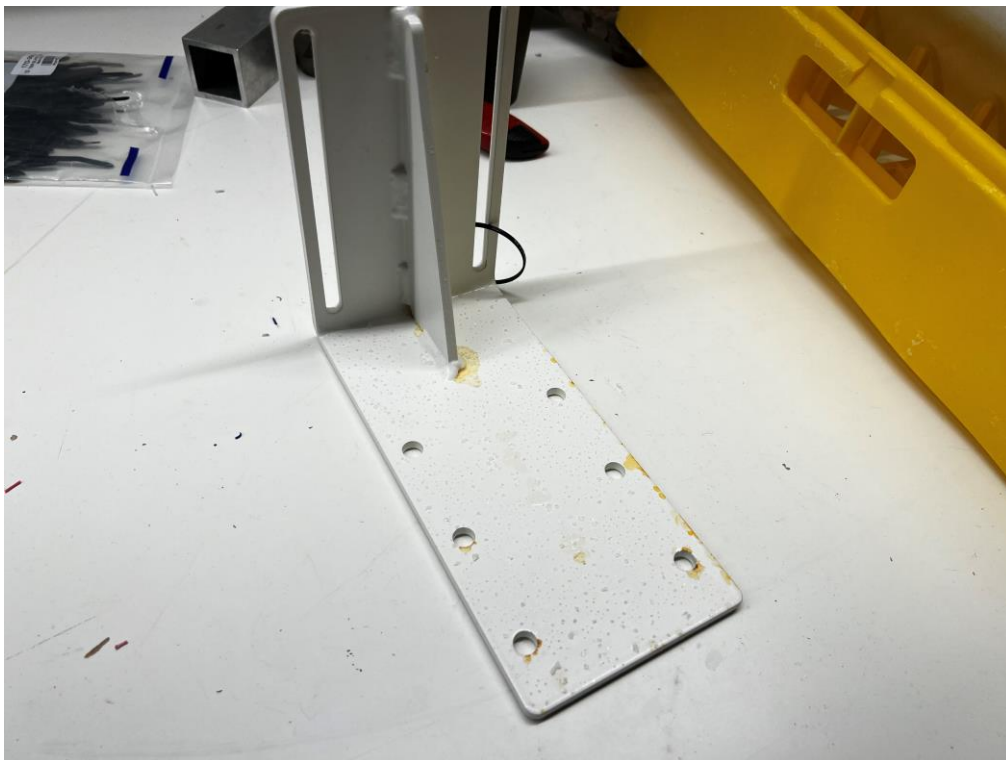


Photo 18 Visual inspection. (Wood/concrete mount P/N: 20032) slight coloration on repaired cracks, and corrosion on edges and crevice from missing welding.

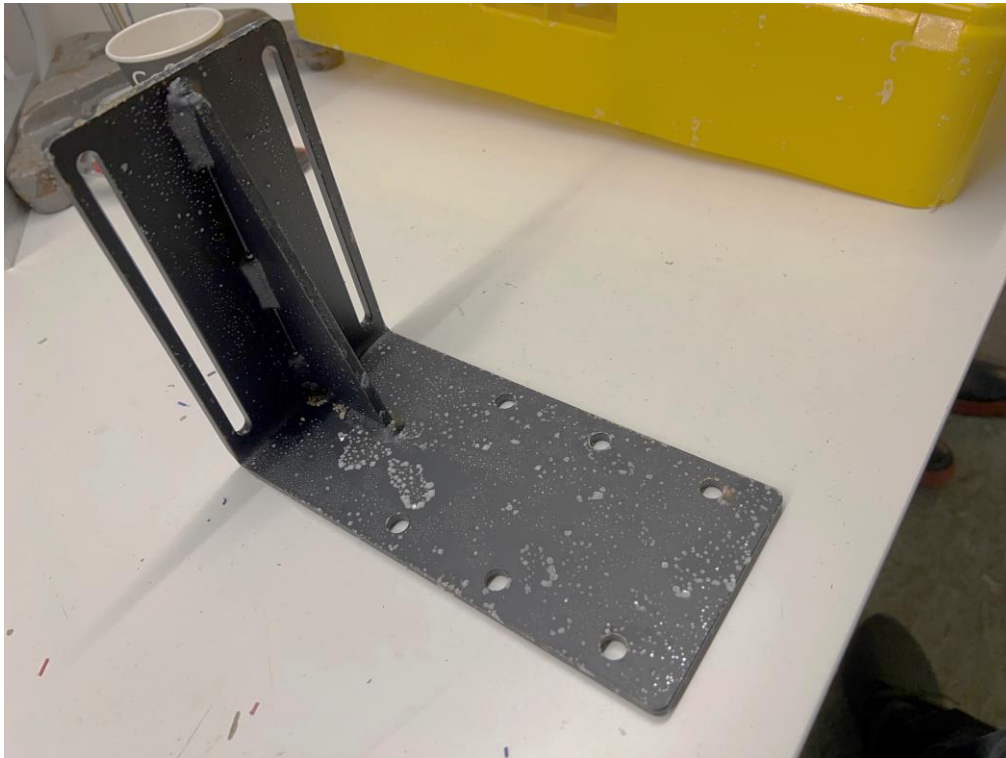


Photo 19 Visual inspection. (Wood/concrete mount P/N: 20032) corrosion on scratches made by the client and along edges and crevices from missing welding.



Photo 20 Visual inspection. (Saddle extension plate P/N: 20028) corrosion on scratches made by the client and along edges.

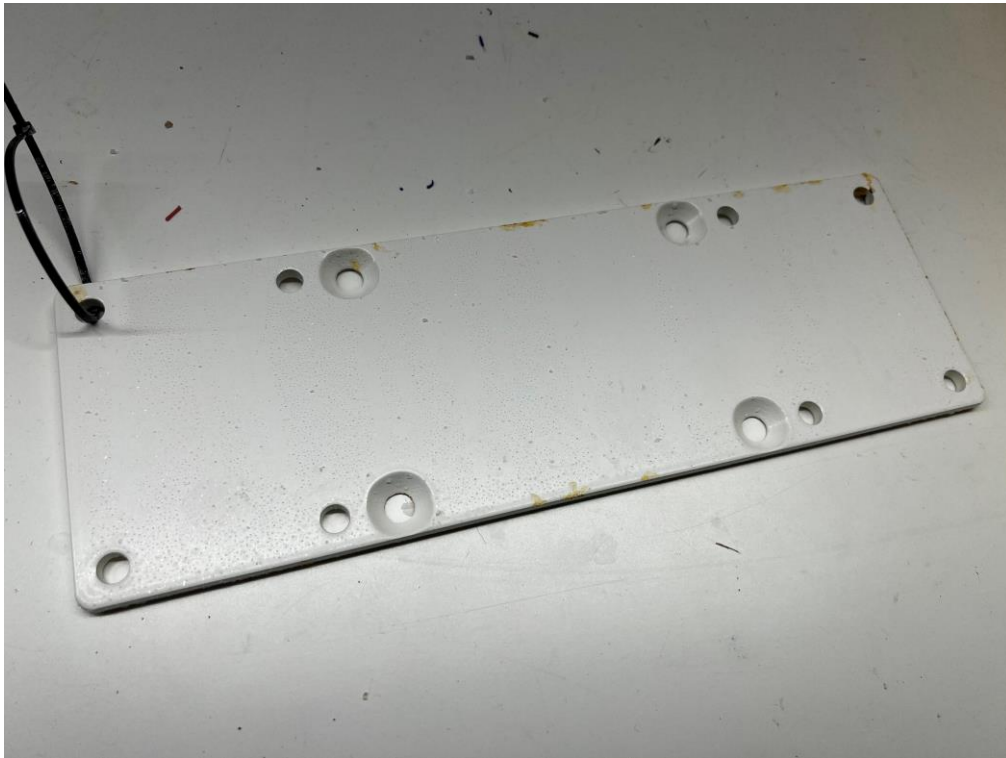


Photo 21 Visual inspection. (Saddle extension plate P/N: 20028) corrosion on scratches made by the client and along edges.

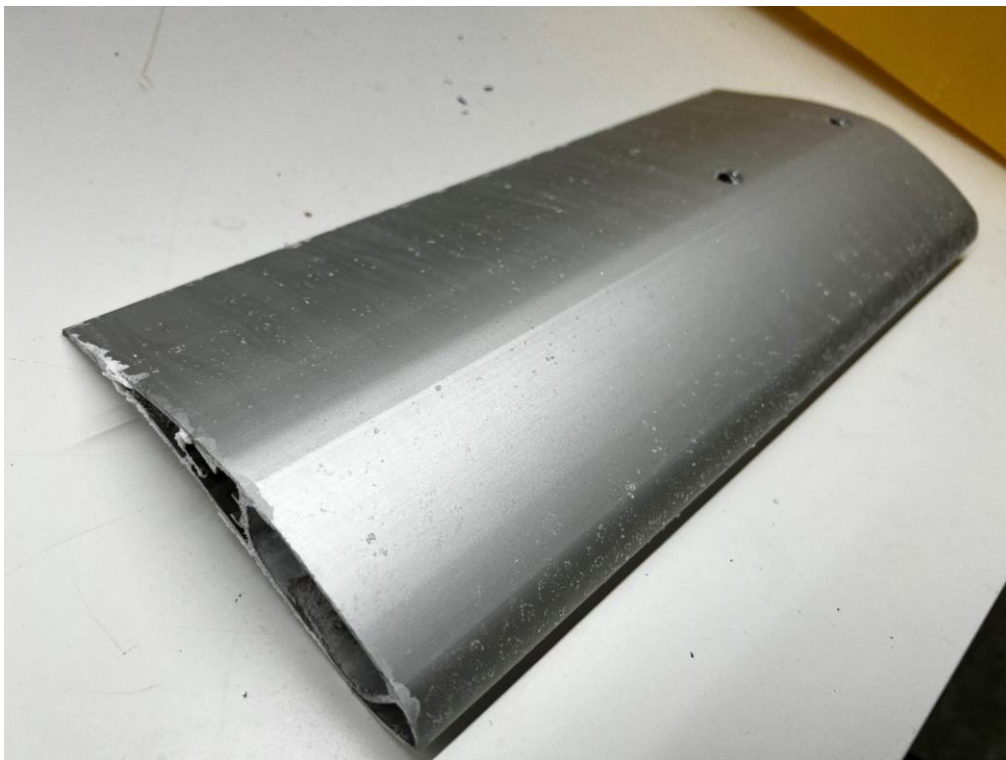


Photo 22 Visual inspection. (Air blade P/N: 20201) no changes observed.

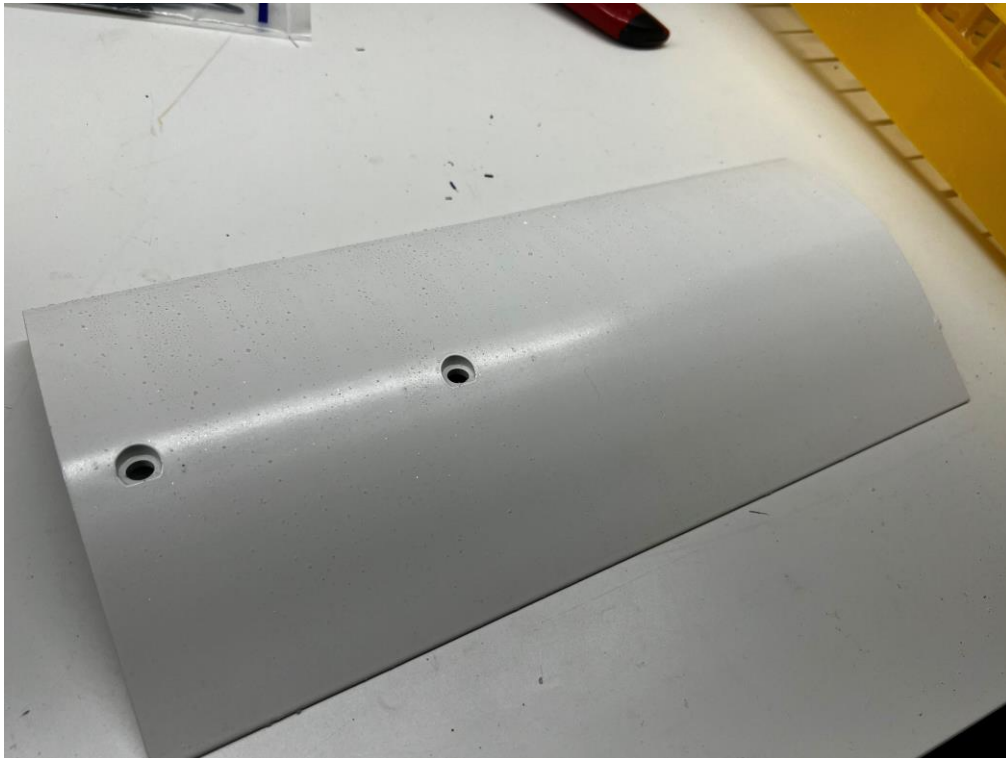


Photo 23 Visual inspection. (Air blade P/N: 20201) no changes observed.

4.2 Dust protection, IP5X

Test specification and Test method

IEC 60529:2013 Degrees of protection provided by enclosures (IP Code).

Severity

IP5X (dust-protected):

Category : 2 (no air pressure reduction)

Enclosures where no pressure difference relative to the surrounding air is present.

Dust medium : Talcum

Air pressure : Normal air pressure

Duration : 8 hours

Procedure

The test object is de-energised during the exposure.

The test object is placed inside the dust test chamber in an upright position as would be expected during normal use. Hereafter, it is exposed to swirling dust conditions as described in the reference specification.

After the exposure, the test object is brushed down on all external surfaces. It is then carefully opened and visually inspected for ingress of dust. Special attention is paid to dust accumulated on parts critical to the functionality of the test object.

Acceptance condition for first characteristic number 5

The protection is satisfactory if, on inspection, dust has not accumulated in a quantity or location that, as with any kind of dust, could interfere with the correct operation of the equipment or impair safety.

Results

The test was performed as specified. A visual inspection showed that there was no accumulated dust inside the enclosure. Furthermore, an $\varnothing$ 1.0 mm test wire could not enter through any holes or openings, and adequate clearance was kept between the test wire and hazardous parts.



Photo 24 Before exposure, IP5X.



Photo 25 After exposure, IP5X.



Photo 26 Visual inspection, IP5X.



Photo 27 Visual inspection. Lid – no ingress of dust observed.



Photo 28 Visual inspection. No ingress of dust observed inside the enclosure of the test object.

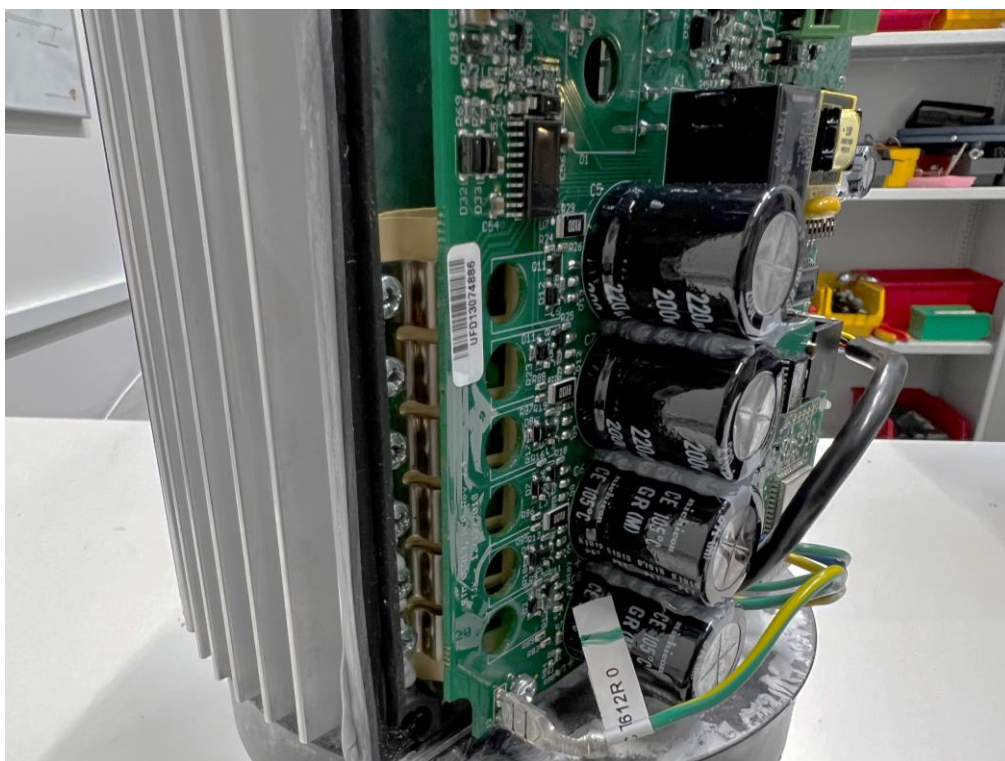


Photo 29 Visual inspection. No ingress of dust observed inside the enclosure of the test object.

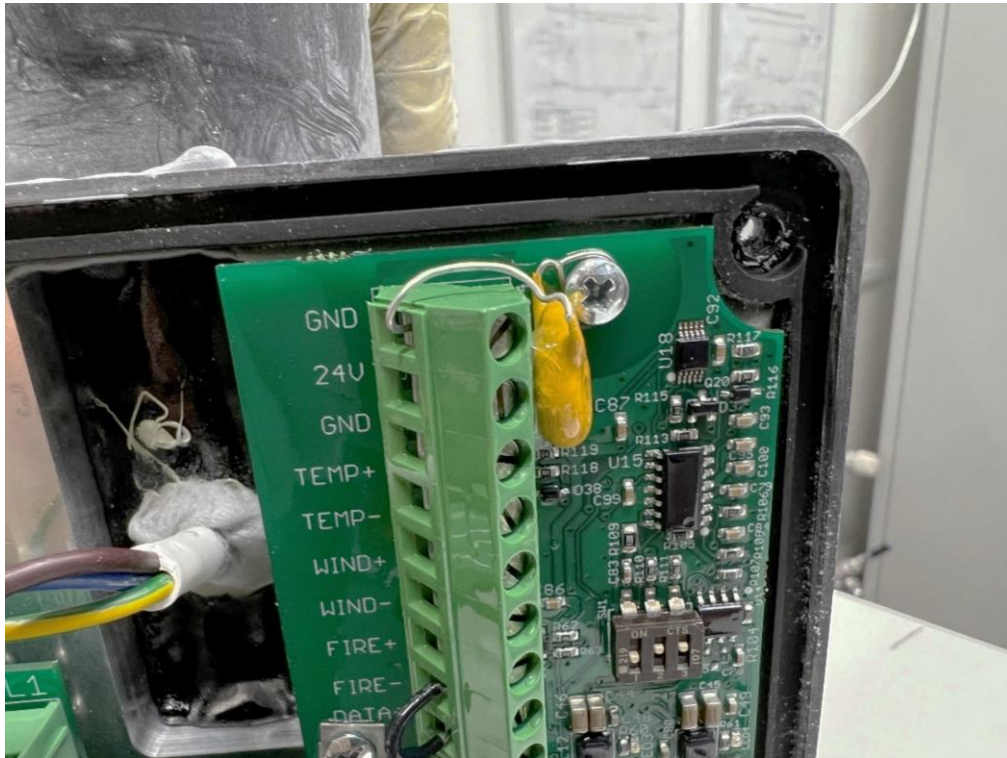


Photo 30 Visual inspection. No ingress of dust observed inside the enclosure of the test object.

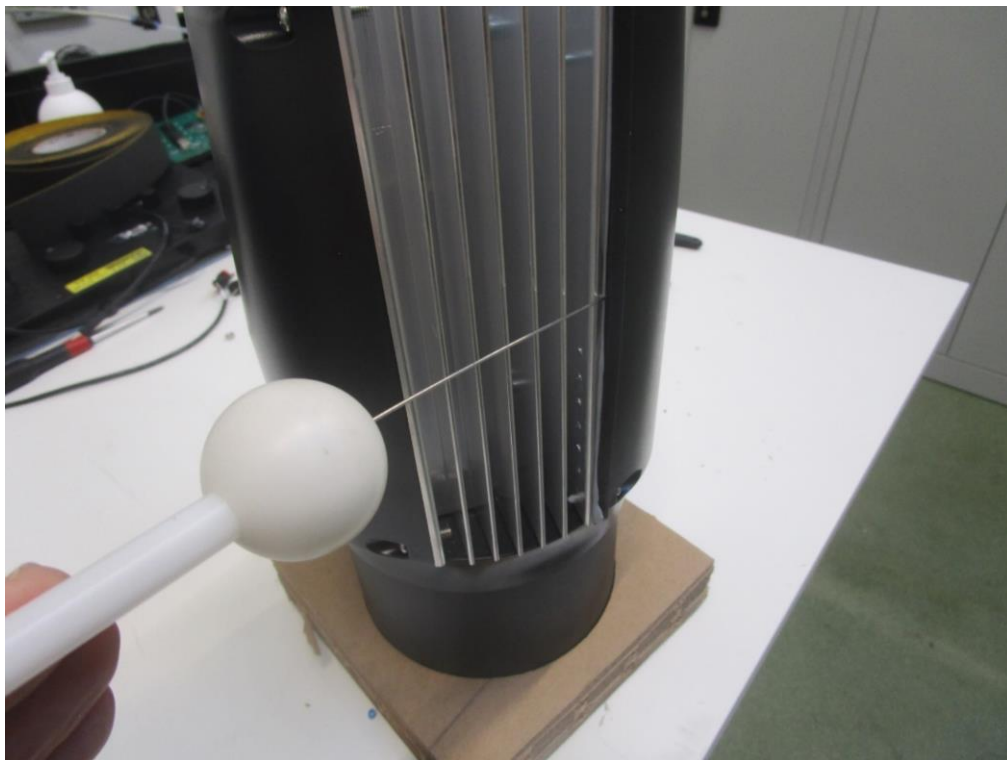


Photo 31 Enclosure protection, IP5X. 1 mm probe could not enter the enclosure and adequate clearance was kept.

4.3 Enclosure protection, IPX5

Test specification and Test method

IEC 60529:2013 Degrees of protection provided by enclosures (IP Code).

Severity

IPX5: (Protection against water jets from all directions)

Internal diameter of the nozzle	:	6.3 mm
Flow	:	12.5 l/min
Test duration	:	1 min per m ² , 3 min. minimum
Distance from nozzle to object	:	2.5 to 3 m

Procedure

The test object is de-energised during the exposure.

The test object is subjected to the specified flow of water for the specified duration from all practical directions.

After the test, the test object is wiped off on all external surfaces, and an internal visual inspection is performed.

Acceptance condition for second characteristic number 5

In general, if any water has entered it shall not be sufficient to interfere with the correct operation of the equipment or impair safety.

Results

The test was performed as specified. The visual inspection showed no ingress of water inside the test object.

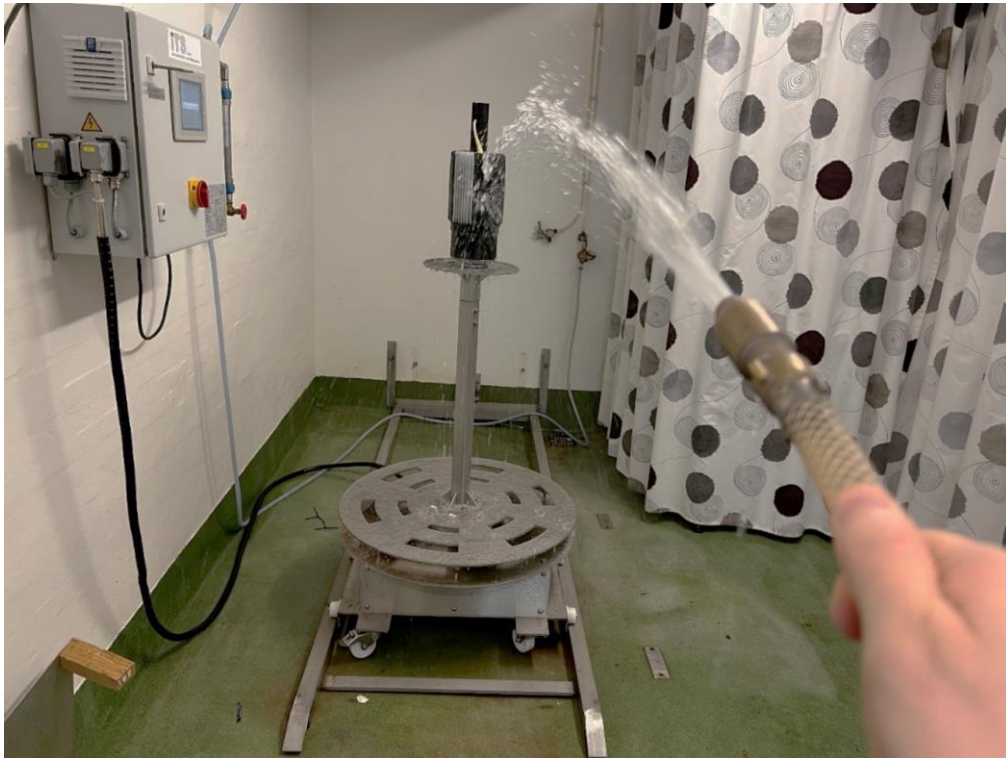


Photo 32 During exposure, IPX5.



Photo 33 After exposure, IPX5.



Photo 34 Visual inspection, IPX5. No ingress of water observed inside lid.



Photo 35 Visual inspection. IPX5. No ingress of water observed inside the enclosure of the test object.



Photo 36 Visual inspection. IPX5. No ingress of water observed inside the enclosure of the test object.



Photo 37 Visual inspection. IPX5. No ingress of water observed inside the enclosure of the test object.

APPENDIX

Appendix 1 List of instruments

NO.	DESCRIPTION	MANUFACTURER	TYPE NO.
EVFGT-33-2	Salt mist chamber	Köhler Automobiltechnik	HKT1000
EVFGT-29	Climatic room	DELTA	V/A
43240	Psychrometer	DELTA	EP3
EVFGT-34	Wet Room	DELTA	IP Water
43280	Flowmeter	Eberhardt/IOSIL	MS 501-T20-1A1A1A
EVFGT-49	IP Dust	Weiss Technik	ST 2000
43257	Humidity Logger	ELPRO-BUCHS	TH1
43301	Tape Measure	Stanley	5m / 300-696
43273	Stopwatch	Hanhart	DELTA E 200
43281	Thermometer	Elma	711
43239	IP Probe test kit	ED&D	A,B,C,D,E,F,G