



FYLKESMANNEN I OSLO OG VIKEN
Postboks 325
1502 MOSS

Dato: 27.03.2019
Saksnr.: DR Brann 2019-
Deres ref.: 002818-1

Søknad om tillatelse i medhold av forurensningsloven § 11

Innledning

Drammensregionens brannvesen IKS søker herved om tillatelse til brannforsøk med kontrollert brenning. Det søkes om en engangstillatelse. Det skal gjøres forsøk med brannslukking. Det søkes tillatelse til å brenne ca. 200 kg Li-Ion-batterier. Vi forventer at det blir noe utslipp til luft (røyk og gasser) og noe avfall til resirkulering.. Avrenning av slukke vann, brannskum og slukkepulver vil ledes til drenering og filtrering gjennom deponiet på Lindum AS.

Det er viktig å innhente kunnskap om branner og brannutvikling i Li-ion-batterier for brannvesenet. Samfunnet har utstrakt bruk av denne teknologien i alt fra mobiltelefoner, lommelykter, el-sykler og el-biler til store batterilagringsanlegg i industrien. Slike batterier transporteres på vei og er i alle hjem i hele landet.

Forsøkene skal filmes og dokumenteres med tanke på produksjon av opplæringsmateriell for allmenheten, for elektrobransjen, for transportører og brannvesen.

Søker er

Drammensregionens brannvesen IKS (DRBV)
Langesgate 11
3044 DRAMMEN org.nr. 984 054 408

Søknaden leveres i samarbeid med

Lindum AS org.nr 979 618 840

Andre deltakere i forsøkene er

Vestfold interkommunale brannvesen IKS,
NELFO AS
Eaton Norge og Eaton Sveis
Lindum AS

Eiendom

Området der forsøkene vil foregå er på brannøvingsområde hos Lindum, Lerpeveien 155 i Drammen kommune.

Kartside:

<https://kart.d-ikt.no/drammen/Content/Main.asp?layout=drammen&time=1553596502&vw=asv>

Reguleringer

Det vises til gjeldende tillatelse til etablering av brannøvelsesområde fra Fylkesmannen i Buskerud – Miljøvernavdelingen. Deres referanse 2004/3256. Vedlagt dokument. Bakgrunnen for egen søknad til dette forsøket er at gjeldende tillatelse kun beskriver propan, trevirke og alkohol som tillatte brennbare stoffer. Tillatelsen beskriver ikke batterier som brennbart materiale.

Valgte løsninger

Vedlagt følger en beskrivelse (på engelsk) av hvordan forsøkene vil gjennomføres. Batteriene vil bli påtent enten via elektrisk kortslutning eller ved varmepåvirkning fra brennbar gass (propan). Påtenningen vil ikke føre til utslipp.

Råstoffer og hjelpestoffer

Det søkes tillatelse til å brenne 3 stk. Li-Ion-batterier, samlet vekt ca. 200 kg. Li-Ion-batterier inneholder metaller og væsker. Litium-ion-batterier regnes ikke som miljøfarlig avfall i seg selv. Ved brann vil det utvikles gasser fra disse stoffene. Brannprosessen der noe brenner løpsk (engelsk: Thermal runaway) vil brenne heftig med stor varmeutvikling. Det frigjøres ulike typer gasser, se vedlegg.

Viser til tilsendt epost fra leverandør:

For type and gas and other pollution, you can refer to the MSDS, hazardous decomposition products:

Hydrogen Fluoride, Carbon Monoxide, Carbon Dioxide, Lithium Hydroxide, Manganese Dioxide, Nickel Oxide, Cobalt Oxide, Aluminum Oxide, possible fluoro-compounds, Carbon soot.

There is approx. 1.17 kg of Lithium per battery

Regards,

Jérôme Mayeux

Safety and Reliability engineer, Energy Storage

tel: +41 21 841 9276

jeromemayeux@eaton.com

Nøyaktig innhold eller mengde stoffer som slipper ut er krevende å dokumentere, både på forhånd og etterpå. Mest sannsynlig vil ikke hele batteriet brenne opp, vi har som mål å trene slukketeknikk.

Energi

Det vil bli brukt ubetydelige mengder energi for å tenne på batteriene. Det vil utvikles noe varme når brannen pågår. Forsøkene foregår utendørs, varmen vil ikke påvirke det ytre miljø.

Miljøtilstand på anlegget

Lindum AS har jevnlig egenoppfølging og oppfølging fra Fylkesmannen. Den omsøkte tillatelsen vil ikke påvirke miljøtilstanden på anlegget i nevneverdig grad. Forsøkene vil foregå på asfaltert plate med avrenning til anleggets sigevann.

Påvirkning andre interesser

Brannøvelsesfeltet har vært drevet i 15 år uten konflikter eller uønsket påvirkning av nabolaget. Anlegget har vært brukt til å øve branner for brannvesenet iht. tillatelsen fra 2004. Det omsøkte forsøket vil heller ikke denne gangen påvirke andre interessenter.

Planene for forsøkene er forelagt Lindum AS. De har interesse av at forsøkene gjennomføres for å lære mer. Batterier leveres til Lindum, både åpent til gjenvinningsstasjon, og skjult i annet avfall. Branntilløp har skjedd, og industrivernet ved bedriften vil delta som observatører til forsøkene.

Avfallet

Alt avfall etter brenningen vil bli samlet inn og levert til resirkulering hos Batteriretur HQ, 1630 FREDRIKSTAD

Forebygging og begrensning

Vi vil i størst mulig grad «vaske ned» gassene i forsøkene, det betyr å spyle gassene med vann med brannslange, og dermed samle gassene slik at de renner til anleggets sivevann i stedet. Lindum AS planlegger å samle opp noe av avrenningsvannet med filtermateriale, for å kunne ta vannprøver i forbindelse med forsøkene.

Alle faste stoffer vil bli samlet inn og levert til godkjent mottak.

Konsekvensutredning

I brannsammenheng må forsøkene regnes som små. En bolig som brenner vil avgi mye større mengder røyk, gasser, forurenset slukkevann og farlig avfall. Vi har derfor ikke ambisjoner om ytterligere konsekvensutredning for forsøkene.

Det vil bli laget egen HMS-plan og gjennomført Sikker Jobb Analyse (SJA) slik at skade på personell ikke skal oppstå. Drammensregionens brannvesen IKS vil stå ansvarlig for dette.

Avslutning

Det finnes sjelden bedre alternative løsninger enn brann for å lære om branner og brannutvikling. Vi søker derfor om engangstillatelse for nevnte forsøk. Vi tillater oss å be om snarlig behandling. Forsøkene ønskes gjennomført i uke 17/2019.

Med hilsen

Henrik Trømborg
Branninspektør

Dokumentet er sendt elektronisk uten underskrift

Vedlegg: 2019.02.13_MSDS_Eaton Battery Pack V2
Fire Test Norway - Eaton xStorage Battery Pack V2
Utslippstillatelse fra Fylkesmannens Miljøvernnavdeling til Lindum AS
xStorage home info 2019

Vedlegg 1: Utslippstillatelse fra Fylkesmannens miljøvernnavdeling. 2004.

Vedlegg 2: Fire Test Norway - Beskrivelse av forsøkernes gjennomføring. 2019.

Vedlegg 3: 2019.02.13_MSDS Teknisk beskrivelse av batteritypen.

Vedlegg 4: xStorage home info. Teknisk beskrivelse av batteritypen

Nissan/Eaton 100V Battery Pack V2 Material Safety Data Sheet

Prepared for

Eaton industries manufacturing GmbH

Power Quality Electronics Division

Place de la gare, 2

1345 Le Lieu – Switzerland

Office: + 41 21 841 92 11

2/13/2019

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1 Introduction

This Material Safety Data Sheet (MSDS) is not a legally required document since the batteries for which this MSDS is created are to be considered as articles under the relevant European regulations for which no safety datasheet needs to be drawn up. In addition, the information contained in this MSDS is based on information provided from Nissan and is therefore drawn up to the best of Eaton's knowledge and based on such available information.

Eaton bears no liability if the information on which this MSDS is based turns out to be inaccurate or incomplete.

2 Product and Company Information

Product Name	Eaton Battery Pack V2
Nominal Voltage	90V DC
Maximum Capacity (Ah)	GEN1 2nd life: 46.7 Ah x 12 modules GEN2 : 66 Ah x 12 modules GEN4: 111.4 Ah x 6 modules
Maximum Capacity (Wh)	GEN1 2nd life: 4'200 Wh GEN2 : 5'940 Wh GEN4: 10'026 Wh
Model No.	<p>Residential Battery Packs</p> <p>XSTH1U12EV2 XST Home Batt V2 GEN1 2nd life - 4.2kWh XSTH2N12EV2 XST Home Batt V2 GEN2 New - 6.0kWh XSTH4N6EV2 XST Home Batt V2 GEN4 New - 10kWh XSTH1U12NV2 XST Home Batt V2 GEN1 2nd life - 4.2kWh NCM XSTH2N12NV2 XST Home Batt V2 GEN2 New - 6.0kWh NCM XSTH4N6NV2 XST Home Batt V2 GEN4 New - 10kWh NCM</p> <p>Commercial Battery Packs</p> <p>XSTC1U12EV2 XST C&I Batt V2 GEN1 2nd life 4.2kWh XSTC2N12EV2 XST C&I Batt V2 GEN2 New 6.0kWh XSTC4N6EV2 XST C&I Batt V2 GEN4 New 10kWh XSTCM1U12EV2 XST C&I Master Batt V2 GEN1 2nd life 4.2kWh XSTCM2N12EV2 XST C&I Master Batt V2 GEN2 New 6.0kWh XSTCM4N6EV2 XST C&I Master Batt V2 GEN4 New 10kWh XSTC1U12NV2 XST C&I Batt V2 GEN1 2nd life 4.2kWh NCM XSTC2N12NV2 XST C&I Batt V2 GEN2 New 6.0kWh NCM XSTC4N6NV2 XST C&I Batt V2 GEN4 New 10kWh NCM XSTCM1U12NV2 XST C&I Master Batt V2 GEN1 2nd life 4.2kWh NCM XSTCM2N12NV2 XST C&I Master Batt V2 GEN2 New 6.0kWh NCM XSTCM4N6NV2 XST C&I Master Batt V2 GEN4 New 10kWh NCM</p>
Manufacturer	Eaton industries manufacturing GmbH

Manufacturer Address	Eaton industries manufacturing GmbH Power Quality Electronics Division Place de la gare, 2 1345 Le Lieu - Switzerland
Emergency Telephone No.	+41 21 841 92 18

3 Composition Information

Hazardous Ingredients	Approximate % of Total Mass	CAS No.	LD ₅₀ (mg/Kg) (oral-rat)
Aluminium	5-15 w/w	7429-90-5	N/AV
Carbon	0.1-5 w/w	7440-44-0	440 (ivn-mouse)
Copper	5-15 w/w	7440-50-8	3.5 (ivn-mouse)
Electrolyte	5-20 w/w	-	2000
Lithium Hexafluorophosphate	0.1-15 w/w	21324-40-3	1700
Graphite	5-25 w/w	7782-42-5	N/AV
Lithium Manganese Oxide	25-35 w/w	12057-17-9	5000
Lithium Nickel Oxide	5-15 w/w	12031-65-1 5	50
Poly Vinylidene Fluoride	01-5 w/w	24937-79-9	N/AV
Steel, Nickel and inert polymer	Balance	N/APP	N/APP
Others	10-70 w/w	-	-

4 Hazard Identification

Emergency overview

May explode in a fire, which could release toxic hydrogen fluoride gas. Use extinguishing media suitable for materials burning in fire.

4.1 Primary Routes of Entry

Skin contact	No
Skin absorption	No
Eye contact	No
Inhalation	No
Ingestion	No

4.2 Symptoms of Exposure

Skin contact	No effect noticed in routine handling of product
Skin absorption	No effect noticed in routine handling of product
Eye contact	The bulk solid has no effect on the eye
Inhalation	Not applicable
Ingestion	Ingestion is not likely given the physical size and state of the product
Reported as a carcinogen	N/A

4.3 First Aid Measure

Skin:	Not a health hazard
Eyes:	Not an eye hazard
Inhalation:	Not an inhalation hazard
Ingestion:	If parts swallowed, seek emergency medical aid. If patient is choking and can partially breathe, encourage patient to cough. Do not strike patient's back. This may lodge the part further in throat. If patient is not breathing, perform standing Heimlich manoeuvre until object is dislodged or patient becomes unconscious. An unconscious patient should be lowered gently to the floor on their back and abdominal thrust performed continuously until cell is ejected from throat or medical aid arrives.

4.4 Fire Fighting Measures

Use sand, water mist (no direct water jet or flooding), carbon dioxide, dry chemical powder or appropriate foam. Use agent appropriate for surrounding materials. Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes. Extremely corrosive Hydrogen fluoride gas is produced upon combustion of cell contents.

4.5 Accidental Release Measures

Evacuate area if fire is present or likely. Wear SCBA (Self-Contained Breathing Apparatus) for fire-related emergencies. Using gloves, pick up or sweep up fire-damaged cells, bag individually in plastic bags and place in closed metal containers. 205 Liters lined steel drums are appropriate. Cardboard boxes may be used for small quantities. Avoid raising dust while sweeping. Transport container outdoors. Hold burned cells and fire cleanup solids for disposal as potential hazardous waste. Unburned cells exposed to fire or mechanically damaged cells shall be considered as hazardous waste and transport in appropriate container. A fire with over 100kg of cells burnt will likely require reporting to environmental officials. Always consult and obey all international, federal and local environment laws.

4.6 Handling and Storage

Store in a cool dry place.

Store at room temperature for best results:

- Keep away from heat, sparks and flames.
- Keep between 0°C and 60°C.
- Do not exceed 10 consecutive days above 30°C
- Charge between -20°C and 40°C.
- Use only approved charging equipment.
- Do not disassemble cell.
- Do not puncture, crush or dispose of in fire.

4.7 Exposure Control/ Personal Protection

Gloves :

Fabric or plastic gloves for handling individual cells. Fabric gloves for warehouse container handling.

Respirator:

No respirator required for normal handling. SCBA required for fires.

Eyewear:

Not required beyond employer policy.

Required for handling individual cells

Clothing:

Standard industrial clothing in normal use. Impervious suit in fires.

Footwear:

Wear steel toed footwear if large containers of cells are being handled

4.8 Physical and Chemical Properties

Appearance: Aluminum, Laminated film	Odor: None	Odor threshold: N/APP	Vapour pressure (mmHg) N/APP	Vapour Density (air=1) N/APP
Evaporation rate: N/APP	Boiling Point: N/APP		Freezing Point: N/APP	PH (10%in water) N/APP
Specific gravity: 1.5-2.5	Coeff. Of water /oil distribution: N/APP		Water Solubility: Insoluble	Percent Volatiles: NONE
Flammability N/APP	Conditions: Organic Components will burn if cell incinerated. Combustion of cell contents will cause evolution of Hydrogen Fluoride.			
Flashpoint : N/APP	Upper Flammable Limit: N/APP	Lower Flammable Limit: N/APP	Auto-Ignition Temps: N/APP	

4.9 Stability and Reactivity

Impact sensitive : NO	Static discharge Sensitive: NO
Stability: STABLE	Hazardous polymerization will not occur: Spontaneous decomposition at normal temperatures will not occur.
Incompatibilities : Do not crush, puncture, incinerate, immerse in water or heat over 125°C	
Reactivities: None known	
Hazardous Decomposition Products: Hydrogen Fluoride, Carbon Monoxide, Carbon Dioxide, Lithium Hydroxide, Manganese Dioxide, Nickel Oxide, Cobalt Oxide, Aluminum Oxide, possible fluoro-compounds, Carbon soot.	

5 Toxicological Information

This product does not elicit toxicological properties during routine handling and normal use :

Exposure Limits	Irritancy	Sensitization	Carcinogenicity
None listed	None	Not anticipated	Not anticipated
Teratogenicity	Mutagenicity	Reproductive Toxicity	Synergistic Products
Not anticipated	Not anticipated	Not anticipated	Not expected

If cells are opened through misuse or damage, discard immediately. Internal components of cell are irritant and sensitising agents.

6 Ecological Information

Some materials within the cell are bio-accumulative. Under normal conditions these materials are contained and pose no risk to persons or the surrounding environment.

In the case of worn-out cells disposed in land, the tabs or laminate film may be corroded and leak electrolyte.

Product must not be disposed of in landfill. Product must be recycled by qualified facility.

7 Disposal Considerations

California Regulated debris.

RCRA Waste Code: Non-regulated.

Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators

Dispose of in accordance with local regulations.

Do not disassemble or modify the cell or product. When the battery is disposed of, ensure it is non-conducting by insulating positive and negative terminals. Spent product must be recycled.

8 Transport Information

In case of transportation, confirm no leakage or overspill from container. Package in a cargo safely without damage. Ensure cargo stack cannot become unstable during carriage through rain or other means. Do not subject the cargo to excessive shock which may result in damage to the cell. Please refer to **3.6-Handling and Storage** for more information.

Codes and classification in accordance with :

- International Air Transport Association (IATA) Dangerous goods regulations 2018 (59th edition)
- IATA-GDR special provision A88, A99, A154, A164
- European Agreement concerning the International Carriage of Dangerous Goods by Road **2017**
- International Maritime Dangerous Goods (IMDG) 2017
- National regulations for transport on land GB12268-2005
- The UN Classification number: Class 9 3481
- Packing instruction: PI 903 for Road and PI 967 (Section I for lithium batteries) for Air shipment

9 Regulatory Information

1. IATA (International Air Transport Association): Dangerous goods regulations
2. ICAO (international Civil Aviation Organization): Technical Instructions for Safety Transport of Dangerous Goods by Air.
3. IMO(International Maritime Organization): International Maritime Dangerous Goods (IMDG) Code

None of the constituents of this product is considered to be hazardous by OSHA (as defined in OSHA hazard communication standard 29 CFR 1910). Use extinguishable media for burning materials.

Note. This regulatory information is not necessarily all inclusive. None of the constituent parts of this product are subjected to reporting requirements of CERCLA, the Clean Air Act and Clean Water Act (US). This product is not formulated with, nor do the manufacturing processes utilize Class 1 or 2 ozone depleting substances.

10 Other information

The information presented in the material safety data sheet is based on the present state of knowledge and current legislation.

This safety data sheet provides guidance on health, safety and environmental aspects of the product and should not be construed as any guarantee of technical performance or suitability for specific applications.

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. Exact composition information is immediately available on a confidential base to medical professionals treating exposure to cell components or combustion by-products.

HYDROFLUORIC ACID EXPOSURE DURING FIRE FIGHTING

This information is given for the use of professional fire fighters responding to a warehouse fire where fire from other materials may incinerate cells. This section is provided solely in case of exposure, during firefighting, to the combustion by-products. Hydrofluoric acid is not present in the product. Contact with cells causes none of the following symptoms.

Hydrofluoric acid is extremely corrosive. Contact with hydrogen fluoride fumes is to be avoided. Permissible exposure limit is 3 ppm. In case of contact with hydrogen fluoride fumes, immediately leave the area and seek first aid and emergency medical attention. Symptoms may have delayed onset. Fluoride ions penetrate skin readily causing destruction of deep tissue layers and even bone. Fluoride interferes with nerve impulse conduction causing severe pain or absence of sensations. Immediately flush eyes or skin with water for at least 20 minutes to neutralize the acidity and remove some fluoride. Remove and destroy all contaminated clothing and permeable personal possessions. Before re-use, impermeable possessions should be soaked in benzalkonium chloride after water washing. Following flushing of the affected areas, an iced aqueous solution of benzalkonium chloride or 2.5% calcium gluconate gel should be applied to react with fluoride ion. Compresses and wraps may be used for areas where immersion is not practical. Medicated dressing should be changed every 2 minutes. Exposure to hydrofluoric acid fumes sufficient to cause pain requires immediate hospitalization for monitoring for pulmonary oedema.

Checked by: Guy Millet  Title: Quality & EHS Manager	Approved by: Sébastien Chambon  Title: Engineering Manager
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Eaton xStorage Battery Pack V2

Fire Test – Norway

April 2019, week 17

1 Introduction

The Norway fire fighters are going to perform fire test of the Eaton batteries to investigate the consequence and create procedure for the fire fighter during operation.

Eaton is willing to support this effort and cooperate with the Norway fire fighters to perform the tests in safe and constructive way.

2 Safety Aspect

Lithium batteries shall be considered as dangerous good. When expose to flame, it may burn / explode and release toxic gases such as Hydrogen Fluoride. HazMat protection is required when operating in the fumes of batteries. Refer to MSDS attached.

2.1 Test location

To be updated

IEC 62619 – clause 6.1 requirement:

“The test facility should have a sufficient structural integrity and a fire suppression system to sustain the conditions of overpressure and fire that may occur as a result of testing. The facility should have a ventilation system to remove and capture gas which might be produced during the tests. Consideration should be given to high voltage hazards when applicable.”

Eaton interpretation: An external shelter would be sufficient, considering that the battery thermal runaway may not propagate to other buildings.

Common fire extinguishing system: Sand, water mist for cooling purpose (no direct flooding as it may release more Hydrogen Fluoride and eject metal particles, e.g. lithium) or powder / foam (disadvantage: difficult to clean up).

2.2 Safety material at disposal

To be updated

HAZMAT protection

Safety gloves and mask for dismantling tested product

Hydrogen Fluoride neutralization (refer to STS-07138 attached)

2.3 Management of waste: tested products

Managed by the fire dpt.

Product used for the test shall be considered as hazardous waste and sent for recycling

Fully burn batteries can be considered as relatively safe. Batteries exposed to fire or with mechanical damage should be transported in dedicated protection box.

Eaton recycling partner: SNAM (<https://www.snam.com>) / UMICORE (<https://www.umicore.com>)

3 Communication Aspect

Test reports shall be issued in English for the Eaton internal records.

Eaton is also requesting that no picture of the batteries on fire with an Eaton logo should be available for public diffusion, e.g. mask on the logo of the plastic cover.

4 Test location

To be updated

Nelfo to provide map of the test area and details of the shelter

4.1 Testing room

To be updated

External shelter with exhaust for ventilation and hole for cables (DC power and instrumentation)

4.2 Instrumentation

Tolerance requirement according IEC 62619 – clause 4 requirement:

- a) $\pm 0.5\%$ for voltage;
- b) $\pm 1\%$ for current;
- c) $\pm 2^{\circ}\text{C}$ for temperature
- d) $\pm 0.1\%$ for mass
- e) $\pm 1\%$ for dimension

Description of the instrumentation available at the test centre:

To be updated

- DC source (Nelfo) → see residential test
- Flame source (Fire dpt) → see C&I test
- 1 video camera (Nelfo)
- 1 thermal camera (fire dpt)
- Exhaust fume analysis? Not available
- Thermo-couple and temperature module recorder (Nelfo)

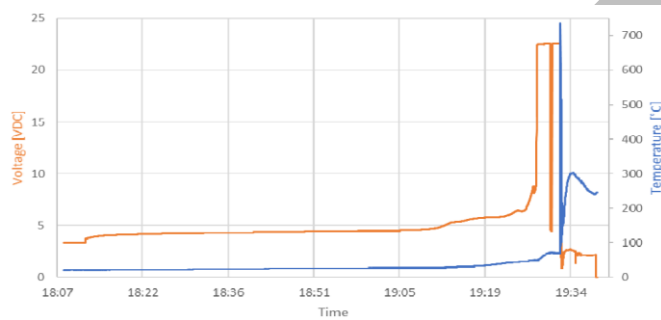
Eaton propose to pre-install 3 thermocouples able to monitor at least the range $[0^{\circ}\text{C} - 800^{\circ}\text{C}]$ inside the batteries (1 per battery). Nelfo to inform asap the monitoring capability (type of thermocouples) that Eaton should pre-install.

5 Fire Test proposal

5.1 Residential Version – day 1

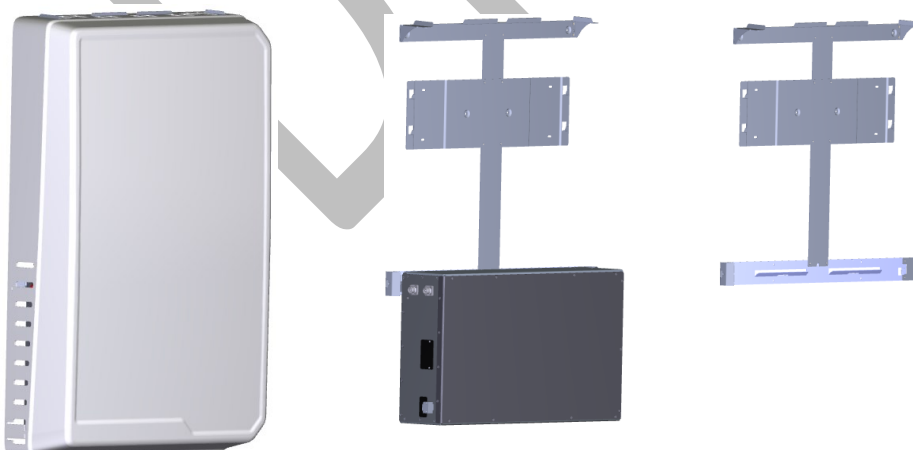
Eaton proposes to test the residential version in the installed configuration on a wall mounting frame with the plastic cover but without the inverter. It would help to estimate the risk that fire fighter may encounter in operation.

Eaton proposes to initiate the thermal runaway by overcharging one module in the pack. This the most credible scenario as battery thermal runaway may start from one cell and propagate to the rest of the battery in case of fire, overcharging, physical damage. For this purpose, Eaton will provide one residential battery pack specifically modified for the test with the possibility to connect one battery module not connected to the Battery Management System (BMS) nor to the contactor or breaker. The thermal runaway shall be initiated by applying a DC source to the dedicated module power cable. The DC source would ideally be able to deliver 1 C (=111.4 Ah). The graph below is an example of the thermal runaway caused by overcharging one module.



Below are the parts that will be delivered by Eaton for the testing purpose:

- 1 wall mounting frame kit
- 1 residential battery pack customized to connect DC source to initiate the thermal runaway of 1 module
- 1 plastic cover used in residential application



Required material to be provided at the test facility:

- DC source:
the dc source should ideally be able to deliver a constant current of 1C (=111.4 Ah).

The voltage may rise up to 50 V so the source would ideally be rated for 150 V minimum. If not possible we may use a lower charging current, it will just take more time to reach the thermal runaway.

- Power cable (by Eaton) and measurement
- Wall support
- Instrumentation

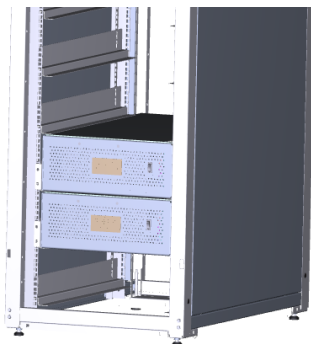
5.2 C&I Version – day 2

Eaton proposes to test the C&I version in the installed configuration using 2 battery pack on a rack.

Eaton proposes to initiate the thermal runaway using a flame directly on the installation to initiate the thermal runaway of the pack downstairs. The flame should be maintained until the battery located down starts the thermal runaway. Once the thermal runaway is initiated, the flame should be switch off and test shall confirm that the pack at the top do not ignite or enter in thermal runaway.

Below are the parts that will be delivered by Eaton for the testing purpose:

- 1 partial rack
- 2 C&I battery pack



Required material to be provided at the test facility:

- Directed flame (e.g. blowpipe) or resisting device (need to open the battery)
- Instrumentation



Technical specifications

xStorage Home single phase system combinations overview

Battery Capacity (nominal)	AC Inverter Power (nominal)			Recommended PV power range	Full system weight (appr.)	Full system dimensions (appr.) H x W x D
4.2 kWh	3.6 kW	4.6 kW	6 kW	from 3 kWp to 7 kWp	120 kg	1230 mm x 890 mm x 220 mm
6 kWh						
10.08 kWh						

Hybrid inverter	POWER RANGE		
	3.6 kW XSTH1P036P060V11	4.6 kW XSTH1P046P060V11	6 kW XSTH1P060P060V11

PV INPUT (DC)	
Recommended PV power range	from 3 kWp to 7 kWp for each MPPT Tracker
Max. DC voltage	550 V
Nominal DC operating voltage	100 V to 550 V
Max. input current per MPPT	20 A
Initial feeding voltage	150 V
Isc PV	35 A
Max inverter backfeed current to the array	0
Number of MPPT Trackers	2
DC insulation resistance	VDE0126 and VDE0126-1-1/A1: $R_{iso} > 1.5 M\Omega$, Others: $R_{iso} > 500 k\Omega$

BATTERY INPUT/OUTPUT (DC)	
Cell chemistry	LMO (Lithium Manganese Oxide) and NMC (Lithium Nickel Manganese Cobalt)
Max Charge/Discharge DC current	70 A
DC battery voltage range	74.4 V to 100.8 V
Battery nominal voltage rating	90 V
Max Charge/Discharge DC Power	3830 W

LOAD/GRID OUTPUT (AC)	
Nominal Output Power	3600 VA
Max. Critical Load Power	100 % of nominal output power
Nominal AC Grid Voltage	230 V (Grid-Tie), 230 V \pm 3 % (Off-Grid)
Nominal frequency	AC Synchronized operation 50 Hz / 60 Hz \pm 1 Hz
Nominal AC output current	15.6 A
Max. AC current	17.4 A ¹
AC wiring systems	Single phase/N/PE, TN, TT, IT (additional fuse or CB required)
Total Harmonic Distortion (THDi)	< 3 %
Power Factor	0.99 (Grid-Tie), 0.9 (ind) - 0.9 (cap) (Grid Tie-PF regulation, Off-Grid)
Metering capability	Power metering of critical loads and PV production
Min. Transfer Time (on-grid to off-grid)	< 20 ms

EFFICIENCY	
MPPT efficiency	> 99 %
Max. efficiency (battery to AC)	> 90 %
PV to grid max. efficiency	97 %

INTERFACE	
Communication	LAN, RS-485 (dedicated to meters), USB Host (with USB WIFI dongle)
	USB: Type B dedicated to firmware upgrade
	CAN BUS: Only for battery pack - inverter internal communications
Communications protocols	HTTP, REST API
LED indicators	Green (ON): Normal status; Red (ON): Fault status. Inverter is unable to connect to the grid; Green (Blinking): Communication activity
Display	LCM display: Character 16 words, 2 lines, 3 Function keys

STANDARDS	
EMC/EMI standard	Class A IEC 61000-3-2; IEC 61000-3-3 (XSTH1P036P060V11); IEC 61000-3-12; IEC 61000-3-11 (XSTH1P046P060V11 and XSTH1P060P060V11)
Standards	EN 62109 (part 1:2010, part 2:2011); DIN V VDE V0126-1:2013

PHYSICAL PROPERTIES	
Dimensions	515 mm x 730 mm x 182 mm (H x W x D)
Weight	40 kg

1. For UK installations, as per G98 certification of the product, Maximum AC current is below 16 A via the product firmware.

Battery pack	BATTERY TYPE		
	SECOND LIFE	NEW	
	XSTH1U12EV2	XSTH2N12EV2	XSTH4N6EV2
Nominal capacity	4.2 kWh	6 kWh	10.08 kWh
Cell chemistry	LMO (Lithium Manganese Oxide)		NMC (Lithium Nickel Manganese Cobalt)
DC battery voltage range	74.4 V to 99.6 V		74.4 V to 100.8 V
Battery nominal voltage rating	90 V		
Overcharge protection	DC breaker + contactor		
Depth of Discharge (DoD)	90 %		
Standards	EN 62619:2017; UN 34.81; UN 38.3; CE		
EMC/EMI standard	Class B (EN 61000-6-3:2007; EN 61000-6-1:2007)		
Physical properties			
Dimensions	442 mm x 781 mm x 175 mm (H x W x D)		
Weight	68 kg		

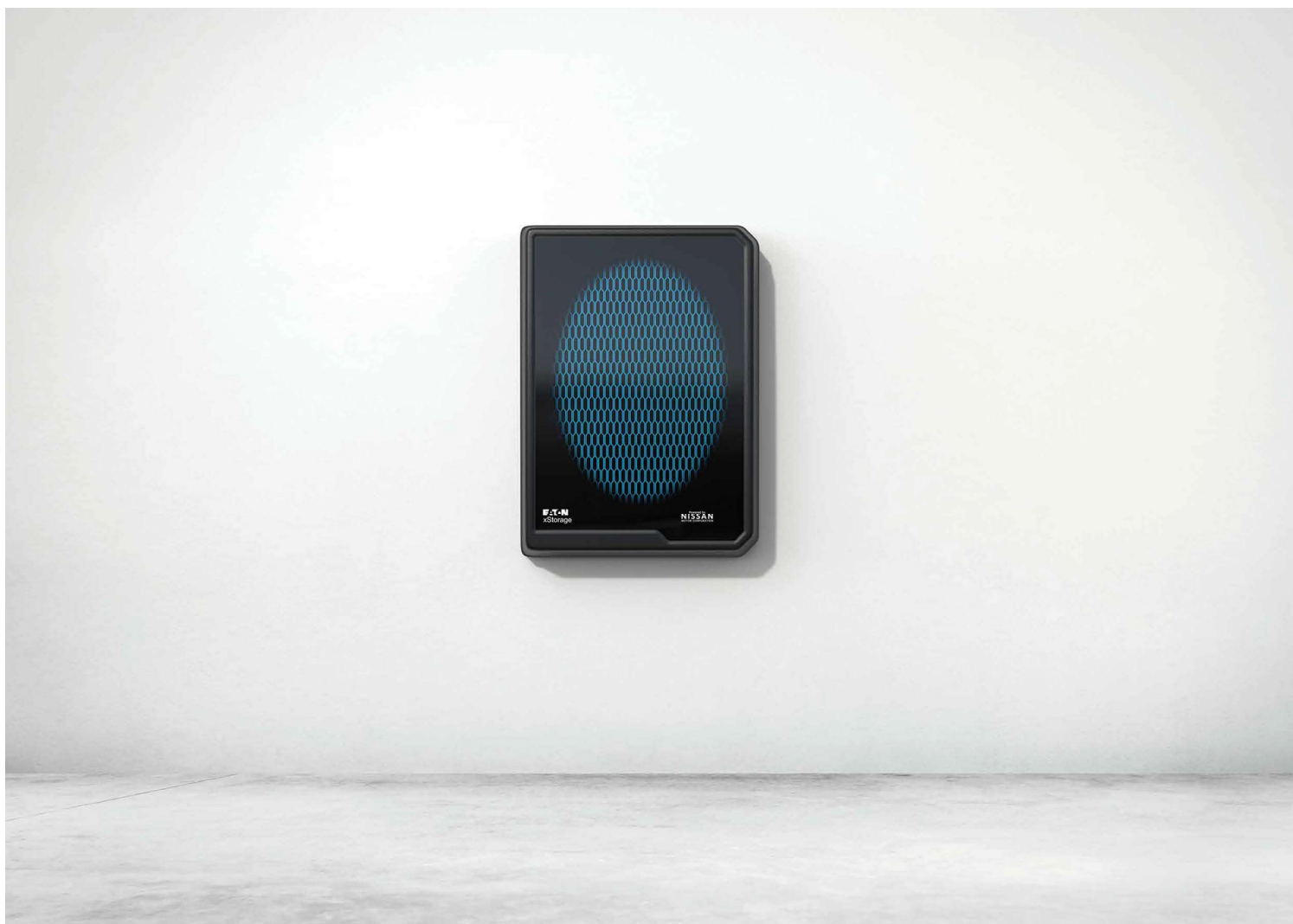
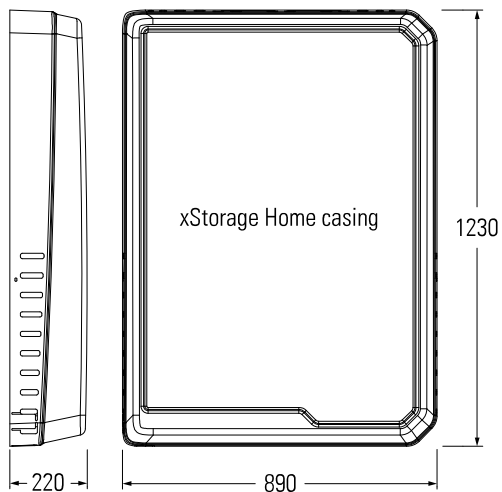
General system specifications	XSTORAGE HOME SYSTEM		
	Applicable for all system combinations		
SAFETY			
Degree of protection	IP20 ²		
Hazard substance restriction	Lead free, compliance with RoHS GP2		
Standards	CE - LVD: 2014/35/EU; EMC: 2014/30/EU (EN 61000-6-3:2007+A1:2011; EN 61000-6-2:2005); RoHS: 2011/65/EU (EN 50581:2012); EN 62109 (part 1: 2010, part 2: 2011)		
Protective Class	I		
OPERATING CONDITIONS			
Storage temperature range	from -10 °C to 40 °C		
Operating temperature	0 °C to 30 °C		
Humidity	5 % to 95 % Relative Humidity (Non condensing)		
Acoustic noise	35 dB (indoor application)		
Altitude	Elevation: max 2000 meters		
Cooling	Natural airflow		
OTHERS			
Solar DC Switch	Integrated		
Topology	Transformerless		
Grid integration	AC coupled		
Grid certificates	DE (VDE-AR-N 4105 : 2018.11; DIN VDE V 0124-100:2012-07); UK (G98, G99, G83/1-1 and G59/1/NI for Northern Ireland); FR (UTE C15-712-1, Enedis/ERDF-NOI-RES_13E-V6:2016.07, SEI REF04_V7 for non interconnected area); IT (CEI 0-21); BE (C10-11); SP (RD 1699:2011); EU (EN 50438:2013)		
Common use cases	Grid tie: self-consumption; Off-grid: backup		
OV category	OVC II (PV and Battery), OVC III (AC grid/load)		
Degree of pollution	2		

2. Indoor, with all power cables connected

Guarantee	3.6 kW	4.6 kW	6 kW
4.2 kWh	5 years ³		
6 kWh	10 years ³		
10 kWh			

3. full cycle per day i.e. one Charge/Discharge

xStorage Home casing dimensions



Eaton
EMEA Headquarters
Route de la Longeraie 7
1110 Morges, Switzerland
Eaton.com/xstorage

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