

GE
Digital Energy

Product Description

Uninterruptible Power Supply

On-line VH Series UPS

700 – 1000 – 1500 – 2000 UL



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Contents

- 1 INTRODUCTION 3**
- 2 FUNCTIONAL EXPLANATION..... 3**
 - 2.1 PRINCIPLES OF OPERATION..... 3
 - 2.2 NORMAL CONDITIONS..... 3
 - 2.3 MAINS FAILURE..... 4
 - 2.4 BYPASS OPERATION..... 4
- 3 EXTERNAL DESCRIPTION..... 5**
 - 3.1 FRONT AND REAR PANEL..... **ERROR! BOOKMARK NOT DEFINED.**
 - 3.2 ENCLOSURE 5
 - 3.3 DIMENSIONS..... 5
 - 3.4 WEIGHT 5
- 4 ELECTRICAL SPECIFICATIONS..... 6**
 - 4.1 RATINGS..... 6
 - 4.2 INPUT CONVERTER..... 6
 - 4.3 OUTPUT CONVERTER 6
 - 4.4 BYPASS 6
 - 4.5 GENERAL DESIGN CRITERIA..... 6
- 5 PERFORMANCE CHARACTERISTICS 7**
 - 5.1 EFFICIENCY (BATTERY FULLY CHARGED)..... 7
 - 5.2 ENVIRONMENT 7
 - 5.3 RUNTIMES (RATINGS GIVEN FOR 25 °C)..... 7
 - 5.4 OVERLOAD CAPABILITY..... 7
 - 5.5 STANDARD FEATURES 8
- 6 COMMUNICATION PORTS 9**
 - 6.1 USB..... 9
 - 6.2 RJ 11 PORT..... 9
- 7 BATTERIES (RATINGS GIVEN FOR 25 °C)..... 9**
- 8 OPTIONS..... 10**
 - 8.1 USB / RS232 / RELAY INTERFACE CARD 10
 - 8.2 LONGER RUNTIMES (VH SERIES UL 1000 - 2000 VA) 10
- 9 TRANSPORT / STORAGE..... 11**

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1 INTRODUCTION

The **GE (General Electric) Digital Energy™ VH Series UPS** series is a compact, truly on-line system (VFI, Voltage and Frequency Independent) which incorporates the most advanced power electronics technology to provide exceptional protection for electrical equipment. The VH (Vertical-Horizontal) Series UPS may be used as an upright, floorstanding 'tower' model or mounted in a 19 inch rack. The operating panel can be easily rotated, and all required items for either use (support stands, rack mount brackets) are packed with the UPS.

Each GE Digital Energy UPS is thoroughly tested and conforms within tolerance to the following specifications. (Data are mean values and are subject to change without notice.) Information applies to all models unless otherwise specified.

2 FUNCTIONAL EXPLANATION

2.1 PRINCIPLES OF OPERATION

The UPS stores electric energy in batteries housed in the unit. This allows the UPS to supply output power even when the incoming mains power is cut off completely. Energy is stored as Direct Current (DC), while input and output energy are Alternating Current (AC) in sine wave form. Therefore the UPS contains an input converter (AC to DC) and an output converter (DC to AC) (See fig.1).

The VH Series UPS is a true on line double conversion UPS with:

- a capacitor bank in the DC line
- battery not in line with the DC link, resulting in:
 - enhanced battery life
 - optimal battery charging
- full wave input converter with power factor correction
- extremely wide input voltage and input frequency tolerance
- no inrush current at start up

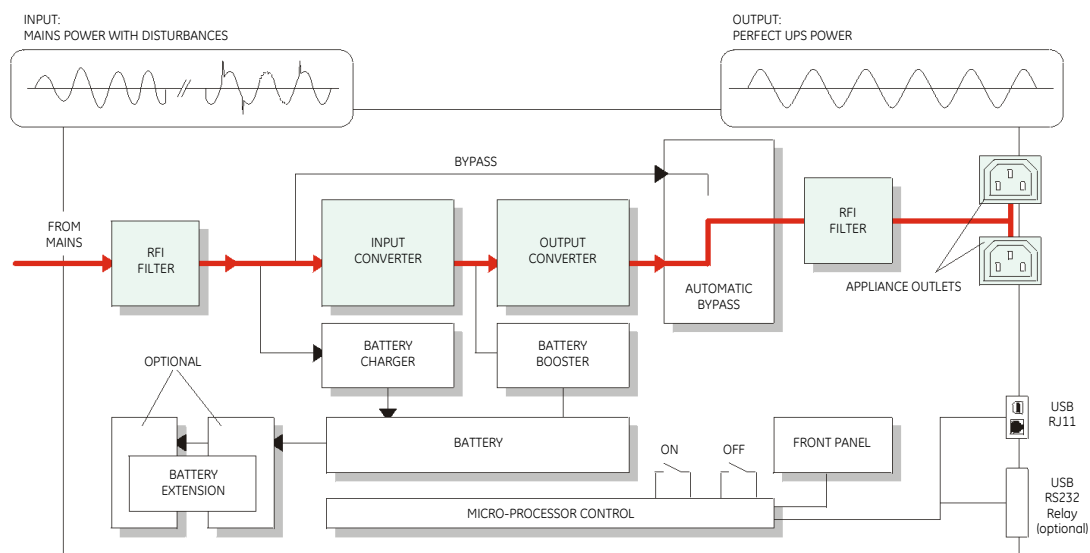


Figure 1 Block diagram of the VH - 700-2000 UPS, mains present

2.2 NORMAL CONDITIONS

Under normal input conditions (see section 4.2) energy from the mains is channeled through the input converter, which supplies the output converter and, together with the battery charger, keeps the battery fully charged. Surges and spikes are blocked completely at the input converter and very unstable mains can be supported. The output converter synthesizes a completely new AC output sine wave to supply the load (electrical equipment).

2.3 MAINS FAILURE

In the event of a mains power failure (i.e. mains absent or outside tolerance) the output converter uses the energy reserve stored in the battery to continue to produce AC power, ensuring unbroken output (fig. 2). No interruption or alteration will ever be noticed in the output power.

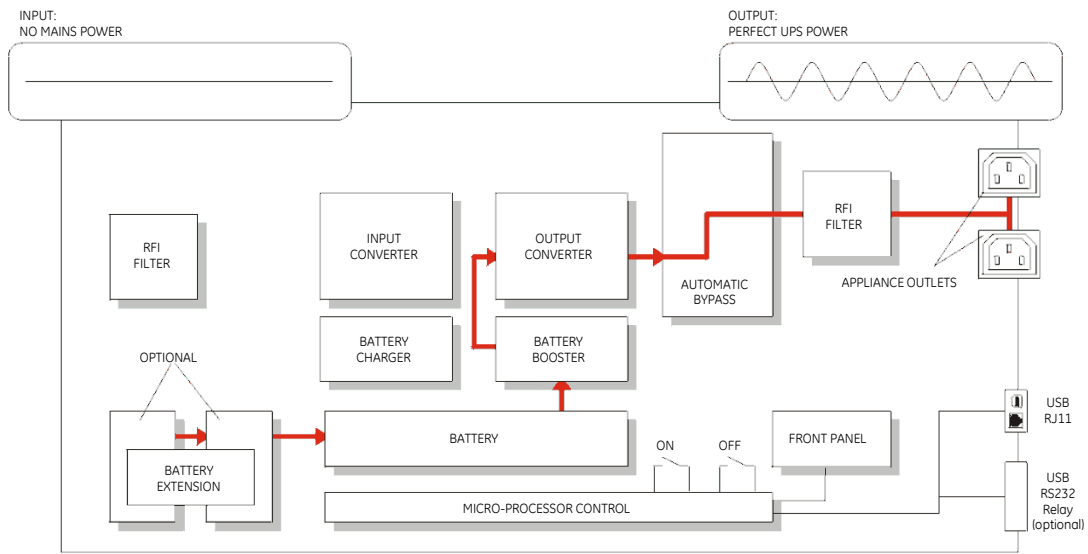


Figure 2 Block diagram of the VH - 700-2000 UPS, mains failure

In the event of an extended mains failure, the output converter will stop when the battery energy has been used up. At this point, the UPS is no longer able to power the connected equipment.

When the mains is re-established within tolerance, the input converter will be supplied again by the mains and the batteries will be recharged, making them ready to support future power failures.

2.4 BYPASS OPERATION

If the output converter is unable to deliver the demanded output power (overload, over temperature) the bypass switch will automatically transfer the load to the mains. If bypass operation is caused by an overload situation, the UPS will try to switch back to output converter after 0.1 seconds, without generating any alarm. This way bypass alarms due to inrush currents, which normally last less than 0.1 seconds, are avoided. If the overload situation still exists after three switch-back attempts (i.e. the overload is not caused by inrush currents), the unit will remain in bypass mode, generating a bypass alarm. It will switch back to output converter when the overload has been removed. If bypass operation is caused by over temperature, the unit will switch back when the temperature has dropped below alarm level.

When the normal situation is restored, the load will be transferred back to the output converter.

The transfer time is typically less than 1 msec and is sufficiently short for modern computers, which can ride through 10-20 milliseconds.

If a power failure occurs during bypass operation, the UPS will switch back to inverter and eventually, when the batteries are depleted, output power is lost. If the UPS functions under overload conditions it may not be able to protect the load.

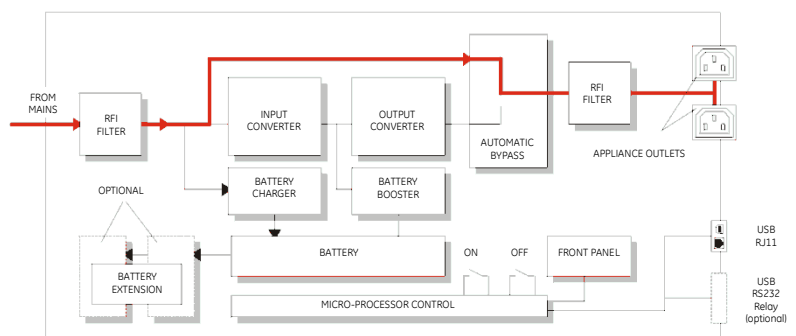


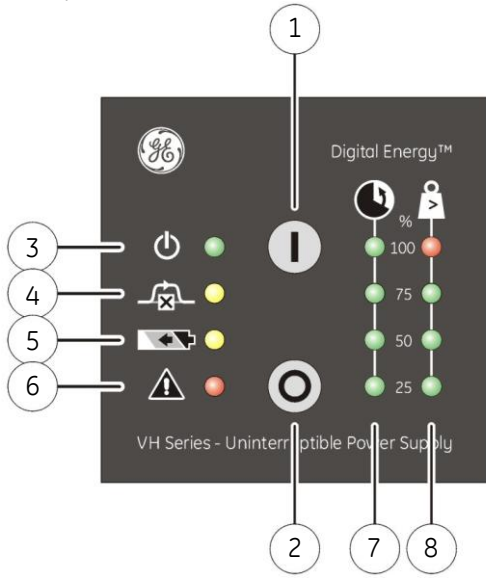
Figure 3 Bypass operation

3 EXTERNAL DESCRIPTION

Front panel details

- 1 'On' switch
- 2 'Off' switch
- 3 LED 'operation'
- 4 LED 'on bypass'
- 5 LED 'on battery'
- 6 LED 'alarm'
- 7 LED 'runtime capacity'
- 8 LED 'load'

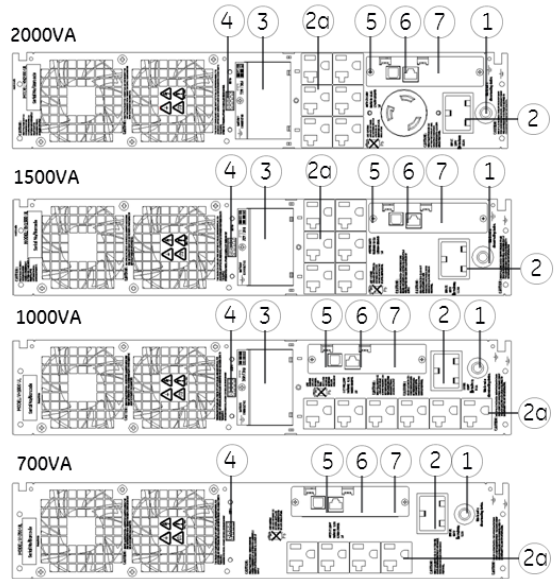
Front panel



Rear panel details

- 1 Input thermal circuit breaker
- 2 Input sockets
- 2a Output sockets
- 3 DC connector for batteries
- 4 Remote External Power Off Contacts (REPO)
- 5 USB interface card
- 6 USB/RS232/Relay Card (option)
- 7 SNMP Card (option)

Rear panel



3.1 ENCLOSURE

VH Series UL model	:	700	1000	1500	2000
Construction	:	steel/plastic			
Colour	:	RAL 9005 (black)			
Protection	:	IP 20			

3.2 DIMENSIONS

Dimensions UPS tower <i>HxWxD, inch(mm)</i>	:	3.4x17.2x18.5 (87x438x470)		3.4x17.2x21.3(87x438x540)
Shipping dimensions <i>HxWxD, inch(mm)</i>	:	8.1x21.5x21.3 (205x545x540)		8.1x21.5x25.8 (205x545x655)
Dimension battery pack <i>HxWxD, inch(mm)</i>	:	36Vdc: 3.4x17.2x3.4x18.5(87x438x470)		72Vdc: 3.4x17.2x21.3(87x438x540)
Dimension battery pack <i>HxWxD, inch(mm)</i>	:	36Vdc: 8.1x21.5x21.3 (205x545x540)		72Vdc: 8.1x21.5x21.3 (205x545x540)

3.3 WEIGHT

Weight UPS lbs(kg)	:	35 (16)	37 (17)	64 (29)	71 (32)
Weight 36V / 72V battery pack lbs(kg)	:	60 (27) / 101 (46)			
Shipping weight UPS lbs(kg)	:	49 (22)	53 (23)	73 (33)	79 (36)
Shipping weight 36V / 72V Battery pack lbs(kg)	:	68 (31) / 10 (50)			

4 ELECTRICAL SPECIFICATIONS

4.1 RATINGS

VH Series UL model	700	1000	1500	2000
Voltage Amperes (VA)	700	1000	1500	2000
Watts (W)	630	900	1350	1740
Input thermal circuit breaker (A)	8	12	18	20
Input fuses (A)	15	15	30	30

4.2 INPUT CONVERTER

AC input voltage	: 120V			
AC input voltage range	: 80-138V			
at 100% load	: 80-138V	: 85-138V	: 85-138V	: 105-138V
at 70% load	: 80-138V	: 80-138V	: 80-138V	: 80-138V
Minimum start-up AC voltage (V)	: 85	: 85	: 85	: 105
High voltage protection	: above 150 Vac the UPS will disconnect the mains and switch to battery operation			
Input current (A), at nominal input voltage	: 6.6	: 9.1	: 13.9	: 16
Input current waveform	: sinusoidal			
Input power factor	: ≥ 0.99			
Input frequency range	: 45-66Hz			
Inrush current	: none			

4.3 OUTPUT CONVERTER

AC output voltage	: 120V nominal (100-110-115-120 & 127 user selectable)			
AC output voltage tolerance	: <1% (linear) <2% (non-linear)			
Output frequency	: 50 or 60 Hz (front selectable)			
Output frequency range	: nominal $\pm 0.15\%$ unless synchronized to the mains			
Output waveform	: sine wave			
Harmonic distortion	: <1% (linear load), <6% (non-linear load)			
Power factor	: 0.9			
Crest factor (peak to RMS current)	: up to 3:1			
Capacity appliance outlets	: 4x 5-20R	: 6x 5-20R	: 6x 5-20R	: 6x 5-20R
	: (Additional L5-20R in 2000 VA)			
Overload	: 110% 4 minutes, 150% 2 seconds			
Short circuit (A)	: 2.1 time's nominal current during app. 200ms			

4.4 BYPASS

AC input voltage range	: -15 to +10% of selected output voltage
Frequency tracking rate	: 2 Hz/sec
Frequency tracking range	: $\pm 10\%$ default ($\pm 2\%$ selectable) of selected output frequency
Phase difference	: < 1° typical (max. 7° during tracking frequency range)
Transfer time (ms)	: 1

4.5 GENERAL DESIGN CRITERIA

Safety	: - UL1778, 4th Edition
Electromagnetic compatibility	: EN 62040-2

Note : The VH Series UPS is intended for use in normal domestic and office situations (see Safety: EN 62040-1-1)

5 PERFORMANCE CHARACTERISTICS

5.1 EFFICIENCY (BATTERY FULLY CHARGED)

VH Series UL model	: 700	1000	1500	2000
Efficiency (%) on mains				
20% load	: 76	80	82	83
50% load	: 85	86	86	87
100% load	: 87	88	88	88

5.2 ENVIRONMENT

Ambient temperature	: 32 to 104°F (0 to +40°C)
Audible noise at 1 meter	: < 45dB(A), load and temperature dependent
Max. relative humidity	: 95% (non-condensing)

5.3 RUNTIMES (RATINGS GIVEN FOR 25 °C)

Runtime in minutes
at typical load (75%)

VA/Watts				
250/225	: 22	35	85	70
500/450	: 12	18	28	36
700/630	: 8	12	21	27
1000/900	:	8	13	20
1500/1350	:		7	12
1920/1740	:			8

VH Series 1000-2000 VA units connected to battery cabinets will have longer runtimes. See section 8.2.

5.4 OVERLOAD CAPABILITY

Overload protection	: Fully protected against overload and short circuits.
Overload behaviour	
- battery operation	: 110% during 4 minutes, 150% during 2 seconds
- bypass operation	: depends on rating of thermal circuit breaker; typical 125% of TCB value: for 200 seconds 200% of TCB value: for 10 seconds 300% of TCB value: for 4 seconds

5.5 STANDARD FEATURES

Wide AC input voltage window

Minimises need for battery operation

High voltage protection

Above the maximum input voltage (150Vac), the VH Series UPS will protect itself and the load by disconnecting the mains and switching to battery operation. Reducing the mains voltage will recover the normal situation. If the mains voltage rises above 150Vac the UPS shuts down immediately and must be restarted manually.

Power factor one input

The AC input current drawn by the UPS is less than that supplied to the load. Contrary to UPS and computers without this feature, no disturbances which may cause problems to other electrical equipment are fed back to the mains. This feature will become mandatory within a few years.

Bypass operation enable/disable

In case of an unstable bypass voltage and/or frequency you may not wish the load to be transferred to the bypass. Front selectable.

No UPS inrush current

When switching on, the UPS causes no inrush current. Inrush currents result in voltage dips on the mains which can disturb other equipment or even blow the fuse of the distribution board.

No load inrush current (Soft start of the connected load)

Also when switching on, the bypass is disabled for a short while, avoiding high inrush currents of the load through the bypass, which also can cause the distribution fuse to trip.

Battery start (cold start)

Allows you to switch on the unit while the mains input is absent.

Superior battery management for maximum battery life and reliability:

- **Automatic (quick) battery test**
The VH Series UPS conducts automatic battery tests to ensure that the batteries and the wiring are healthy and able to support power failures. The tests are executed 5 hours after starting up or return of mains, and every 30 days. The tests can also be initiated via the front panel and through UPS monitoring software.
- **Deep battery calibration test**
The actual battery capacity can be tested by the UPS monitoring software, ensuring accurate runtime prediction. During a deep battery test the batteries will be discharged until 'battery low' alarm level. Please refer to the manual of the appropriate monitoring software package.
- **Temperature compensated battery charging**
This feature reduces the battery charge voltage with increasing temperature. As a result poor charging of the batteries under low temperature conditions and overcharging of the batteries under high temperature conditions are prevented.
- **Load dependent battery-end voltage**
The allowable final battery voltage depends on the discharge current: the higher the current, the lower the 'end-of-discharge' battery voltage. This gives maximum capacity without overdischarging. Overdischarging results in failure to recover normal capacity.
- **Automatic boost charge**
Reduces the recharge time to 3 hours for approx. 90% capacity without overcharging the batteries.
- **No-load shutdown**
Whenever a load of <5% of the UPS maximum load is registered and no mains power is present, the UPS will switch off automatically. Load sensing during battery mode prevents unnecessary discharging of the batteries. The function is default activated (front selectable) to avoid accidentally switching on during transport.

6 COMMUNICATION PORTS

6.1 USB

The USB port is a plug-in interface port which enables advanced communication between the UPS and the computer (UPS software required). The interface port is operative as soon as the mains power cord is plugged into a live wall outlet, even if the UPS is switched off.

For more information please refer to the user manual that comes with the interface software. We strongly recommend to use only original GE Digital Energy software products in combination with the interface port.

6.2 RJ 11 PORT

The RJ 11 port is a plug-in contact interface port.

Pin #	Function
1	Mains failure
2	General alarm *)
3	Battery low
4	On bypass
5	Remote UPS shutdown
6	GND

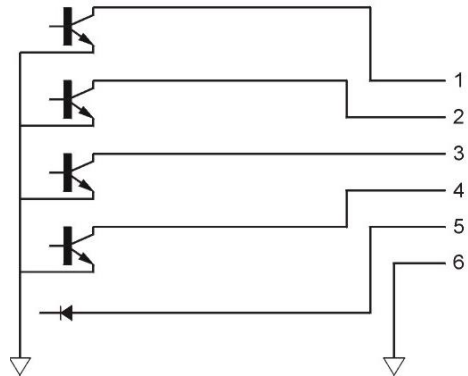


fig. 6.2

*) Active if the output voltage of the UPS is no longer guaranteed due to other circumstances than already indicated by pin 1-3-4:

- General fault
- Overload
- Overtemperature
- Output out of tolerance
- Charger failure
- Bypass out of limits
- Replace battery

For further details, please read the Operating Manual.

7 BATTERIES (RATINGS GIVEN FOR 25 °C)

VH Series UL model	: 700	1000	1500	2000
Nominal voltage (V)	: 36	36	72	72
Number / Ah batteries	: 3 / 7	3 / 9	6 / 7	6 / 9
Type	: sealed and maintenance free			
Service life	: up to 6 years (depending on operating conditions)			
Runtime	: see section 5.3, Runtimes			
Battery recharge current	: 1.5 A			
Battery recharge time	: 3 hours for 90% capacity			
Automatic (quick) battery test	: 5 hours after return of mains 5 hours after manual switch on, and 30 days from last battery test			
Long term storage	: see chapter 9.			

8 OPTIONS

8.1 USB / RS232 / RELAY INTERFACE CARD

The card is equipped with

- USB port as described in 6.1
- RS232 port
- Potential free change-over relay contacts for the following alarms:
 - Mains failure
 - General alarm
 - Battery low
 - Bypass active

8.2 LONGER RUNTIMES (VH SERIES UL 1000 - 2000 VA)

By adding extra battery packs the runtime of the VH Series UPS models 1000-2000VA can be extended.

Battery packs are available in 36V/14Ah (for VH1000 UL) and 72V/14Ah (for VH 1500-2000 UL).

The battery pack has the same dimensions as the UPS 1000 & 2000 VA models (see 3.3) and in case of floor-standing use one battery pack can be mounted together with the UPS in one set of support stands.

	Battery extension Voltage/capacity V/Ah	Total capacity Ah	Typical runtime 100% / 50% load minutes
1000 VA			
Std. UPS	: 36 / 9	9	8 / 19
1 pack	: 36 / 14	23	26 / 52
2 packs	: 36 / 14 + 14	37	48 / 88
3 packs	: 36 / 14 + 14 + 14	51	66 / 128
1500 VA			
Std. UPS	: 72 / 7	7	7 / 19
1 pack	: 72 / 14	21	35 / 70
2 packs	: 72 / 14 + 14	35	63 / 120
3 packs	: 72 / 14 + 14 + 14	49	88 / 200
2000 VA			
Std. UPS	: 72 / 9	9	8 / 19
1 pack	: 72 / 14	23	26 / 54
2 packs	: 72 / 14 + 14	37	50 / 90
3 packs	: 72 / 14 + 14 + 14	51	74 / 135

9 TRANSPORT / STORAGE

No liability can be accepted for any transport damage when the equipment is shipped in non-original packaging.

Store the UPS in a dry location with the batteries in a fully charged state.

Storage temperature must be within -4 to 122° F (-20 to +50 °C). If the unit is stored for a period exceeding 3 months, optimal battery lifetime is obtained if the storage temperature does not exceed 86°F (30°C).

If the unit is stored for an extended period of time, the batteries must be recharged periodically. Be sure that the batteries are connected to the UPS. Subsequently connect the unit to a wall outlet and recharge the batteries for 24 hours:

- if the storage temperature is within -4 and 86°F (-20 and +30°C:) every 12 months,
- if the storage temperature is within -4 and 122°F (-20 and +50°C:) every 3 months.

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