

# PAHO Smart Hospital Project

## HURRICANE SHUTTERS & WINDOWS

The Dos and Don'ts of Installation!



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## Acknowledgement of contributors to this document

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SAFE + GREEN = SMART

# CASE STUDY

## HURRICANE SHUTTERS & WINDOWS

The do's and don'ts of installation!

PAHO Smart Hospitals Projects started in 2013 and has been implemented across nine countries in the Caribbean Region. Lessons have been learnt from the retrofitting of facilities as the project progresses. The information being presented highlights our experiences.

Contractors retrofitting healthcare facilities in the Caribbean are recommended to purchase and install hurricane rated windows or shutters which are certified with a Notice of Acceptance (NoA) to Miami Dade Building Code. Miami Dade, which is an addition to the Florida Building Code for hurricane-prone zones, uses wind speeds in the testing of windows and shutters that are comparable to the wind speeds experienced in the Caribbean. The Florida Building Code uses a classification of high-velocity hurricane zones (HVHZ) for areas vulnerable to hurricanes.

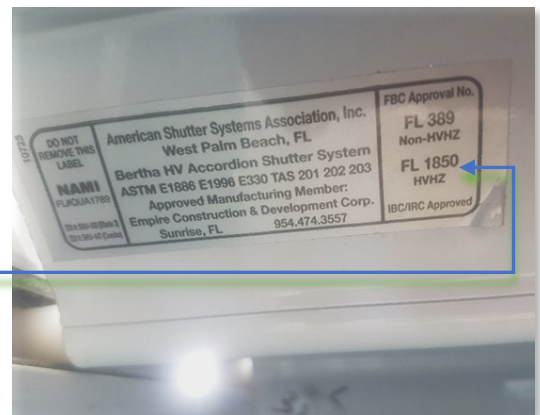


Image 1: Quality Assurance

Hurricane shutters that are installed according to the manufacturer's specifications can place a quality assurance label to the shutter or window.

### Hurricane Windows



Image 2: Hurricane resistant windows, La Plaine Health Centre

Windows should have an aluminium frame that is impact-resistant, durable against corrosion, and have impact-resistant glass. Hurricane rated windows are designed and tested to ensure that all components are resistant to damage from wind, water and flying debris up to a specific design category of hurricane. The components of the window include the frame, glass, connections and connecting materials such as structural grade silicone to seal around the glass.



*Image 3 - Glass louvre windows are high risk to falling, breaking and causing injury*

In retrofits, if most of the windows in the building are broken, inoperable or in poor condition then it may be more feasible to replace all the windows with hurricane rated windows.

## Hurricane Shutters

In the case where the existing windows in retrofits are in good condition and operable, then it is more cost-effective and less time consuming to install hurricane shutters over the windows.

Aluminium is the recommended material, ensuring that all components are equally corrosion resistant. The NOA rating is achieved through the same testing as previously mentioned.

There are four types of shutters. Their uses and advantages are listed below.



*Image 4: Accordion shutters installed at facility*

## Storm Panel Shutters

This type of shutter consists of rails that are permanently attached above and below windows and panels that are only used during the storm event. They can be aluminium, metal or polycarbonate material. These shutters are typically cheaper than other types, however, they are time-consuming to install, parts may be misplaced, and panel sizes need to be properly matched to the correct windows.

*Notes: (1) If a window or door has a transom or side lights, the area must be measured to ensure the shutter covers the whole area.*

*(2) Hurricane rated shutters and windows do not have to be installed together*

### Accordion Hurricane Shutter

Accordion shutters are permanently installed to the sides of windows. They are easily closed and locked before storms. These types of shutters require little maintenance and have minimal impact on the aesthetics of the facility.

Another advantage of accordion shutters is that it can fit many shapes and sizes, including curved, corners and geometric windows.



Image 5: Elongated Accordion shutter. Comfort Bav Home for the Elderly



Image 6: Wood Colonial Shutters, Dominica, post-Hurricane Maria

### Colonial Style Shutters

These were traditionally done out of wood. Now, contractors have the option of choosing wood, aluminium and polycarbonate. They are permanently fixed to the sides of windows (and doors). They add a classic aesthetic to the building such as being painted in various colours. These wood shutters proved to be very resilient to Hurricane Maria, which impacted Dominica in September 2017.

### Bahama Shutters

These shutters can be aluminium or wood. They are permanently installed and give a decorative appearance. They have the added advantage in tropical climates of providing solar shading and privacy. These shutters are used for limited styles and sizes of windows.



Image 7 – Bahama style shutter- Chateaubelair Hospital

*Note: If a door is taller than standard height, a custom shutter and rod must be sourced. Custom sizes are more expensive than standard sizes.*

## The Installation Process: Before – During – After Retrofitting

The structure that the hurricane rated windows or shutters are being connected to, must, at minimum meet the strength specified by the Manufacturers. Manufacturers indicate the type of timber, concrete, masonry or steel structure suitable to connect into, the type of screws or bolts to use and the maximum spacing of connectors.

Often in retrofits of masonry buildings, the perimeter wall around windows are hollow and do not meet these specifications. In this case, the walls need to be retrofitted with structurally reinforced beams or columns.

There is also the case of crown moulding and other building elements which encroach on the area around windows. These elements need to be removed to allow rails and brackets of hurricane shutters to be fixed flat against the walls.

*Note: Failure will occur at the weakest link. Ensure that the structure and connections meet the Manufacturers' specifications.*

The images below incapsulate a brief timeline of pre and post retrofitting at La Plaine Health Centre, Dominica.

### Before



*Image 8: 'Before retrofitting' – glass louvres, vent blocks, wood doors*

### During



*Image 9: 'During retrofitting'*

### After



*Image 10: 'After retrofitting' – Hurricane rated windows and doors installed*

## The Installation Process: Preparations - Reinforcements – Specifications

The next set of images highlight critical structural and some installation specifications that must be completed before the installation of hurricane shutters/windows. Comfort Bay Home for the Elderly in Saint Lucia, presents a step by step process of the removal, replacement and finishing touches on applying hurricane resistant windows and shutters.

### What's being done?

#### Step 1

Hollow blocks removed and replaced with reinforced beams



Image 11: Reinforcements

#### Step 2

Windowsill and Crown moulding trim removed



Image 12: wall mount preparation

#### Step 3

Spacing of screws checked to meet manufacturer's specifications



Image 13: Meeting specifications

## Common Mistakes and Solutions

The following pictures highlight common mistakes made during installation as well as after. Overlooked details such as the distance from the underside of the roof to the window or the incorrect placement of the lock on the shutter should be documented before installation.

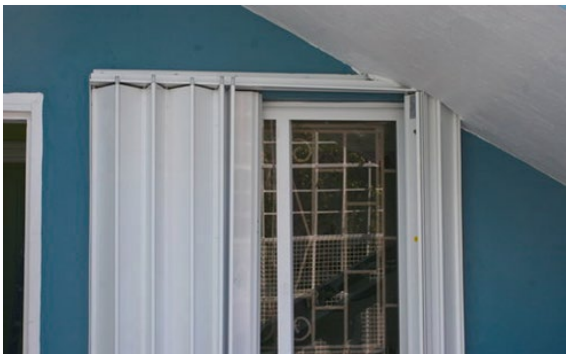


Image 14: measuring workable space

### Too close for comfort

The existing staircase was too close to the window. A portion of the staircase had to be removed to install the shutter while ensuring enough space to open and close.



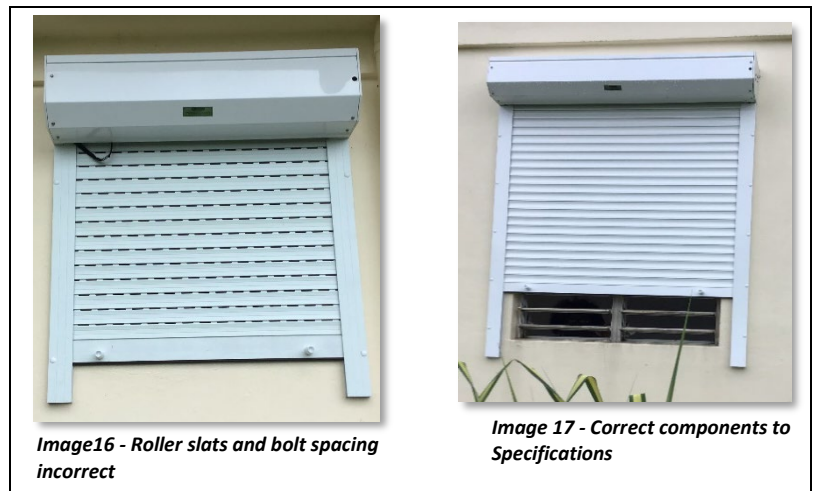
*Image 15: correct lock placement*

### Operability of the shutters

The accordion shutter lock is located on the inside so that users can secure the shutters easily from inside the facility. During installation, some of the shutters were installed the wrong way, with the locks on the side of the fixed windowpane. These shutters had to be flipped to allow accessibility.

### Correct components

*Image 16* of the Roller Shutter shows the installed shutter that used the incorrect slats and screw spacing. After quality control checks, which included fully opening and closing every single shutter, the discrepancy between the correct slats were identified and corrected, as shown in *image 17*.



*Image16 - Roller slats and bolt spacing incorrect*

*Image 17 - Correct components to Specifications*



*Image 18: Shutters in various stages of open and fully closed*

### Final look

Roller shutters covering the windows and transoms at Princess Alice Hospital, Grenada.



## Quality Control

Below are some of the quality assurance checks to be carried out before completion of a retrofitted project. Adhering to the manufacturers' specifications for installation of a hurricane shutter ensures correct installation.

### Key Things to Check

Quantify and measure existing dimensions before purchase

Doors and windows with a transom or side lights are fully covered with the shutter

Check that existing walls and structure meet manufacturers' specifications

Retrofit the existing structure by strengthening walls and removing encroachments where necessary

Install the correct components, including storm bars, per manufacturers specifications

Use correct screws, tools and spacing per manufacturers specifications

Operating levers, handles or locks should be accessible and functional

Ensure shutters and windows can fully open and close without difficulty