A350
TECHNICAL TRAINING MANUAL
MAINTENANCE COURSE - T1+T2 - RR Trent XWB
Cargo and Accessory Compartments

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CARGO AND ACCESSORY COMPARTMENTS

V1813401 - V01T0M0

CARGO COMPARTMENTS PANELS DESCRIPTION (2/3)

Introduction

The Lower Deck Cargo Compartments (LDCC) are defined by physical boundaries consisting of:
- Vertical/inclined sidewall lining panels and partition walls (door panels, decompression protection devices)
- Ceiling panels
- Floor panels
- Additional access panels are installed for maintenance access to components installed behind the linings.

The basic function of these panels and walls are:
- To protect surrounding structures/systems against temperature and handling loads
- To seal the LDCC adequately to make a fully air tight compartment for fire containment and fire extinguishing purpose.

The design principle of sidewall, rapid decompression panels, partition and ceiling linings is a composite sandwich construction (Glass Fiber Reinforced Plastic (GFRP) fabrics with a honeycomb core).
The design of the floor panels is a composite sandwich construction (Carbon Fiber Reinforced Plastic (CFRP) fabrics with a honeycomb core).
The LDCC lining and floor panels are attached to the structure with quick release fasteners.
The panels are sealed, as this is necessary to guarantee a sufficient concentration of fire extinguishing agent after discharge for the safe continuation of the flight.

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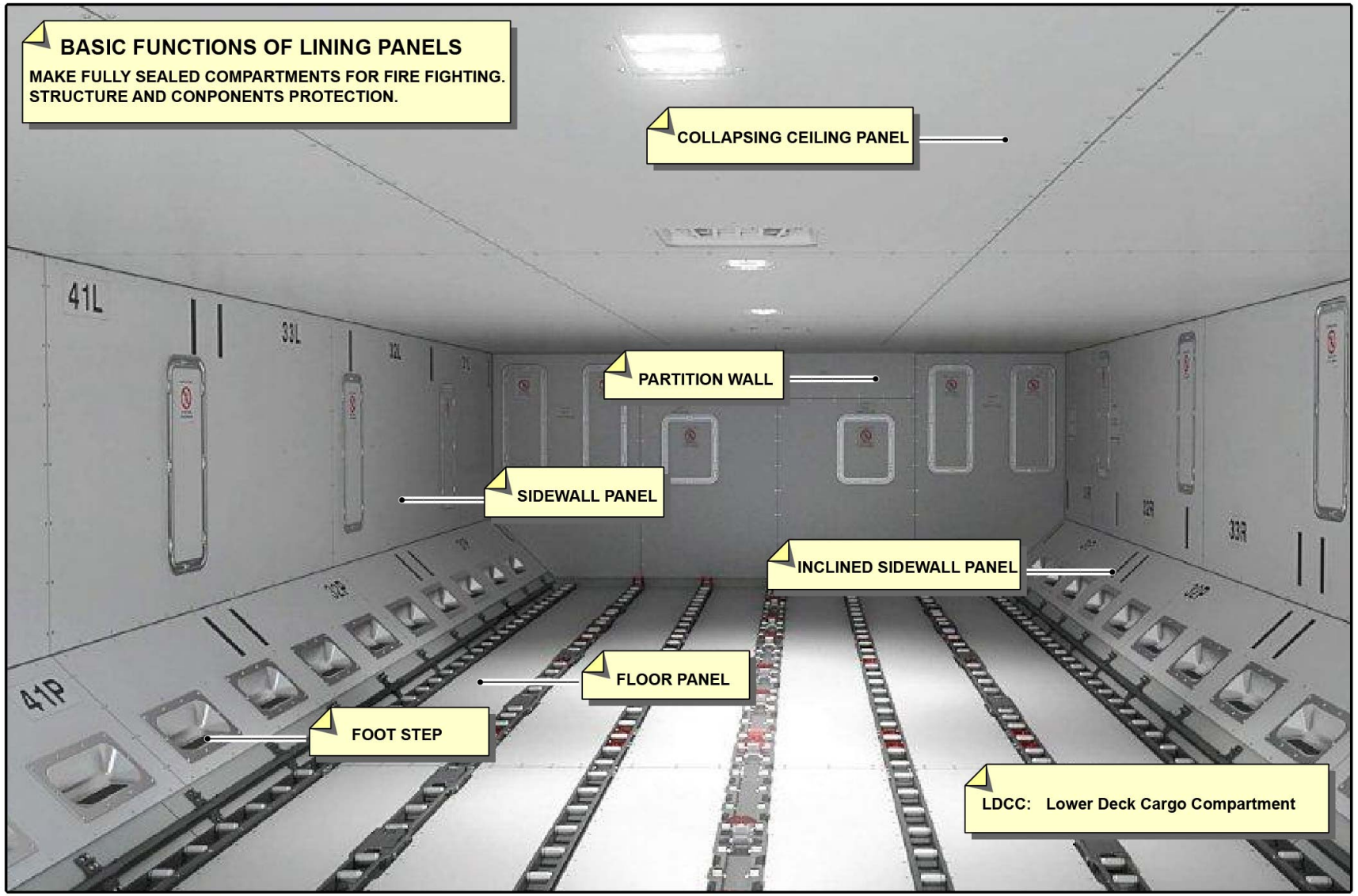

INTRODUCTION

CARGO COMPARTMENTS PANELS DESCRIPTION (2/3)

FWD Cargo Compartment

Vertical and inclined sidewall lining panels make the left and right limits of the cargo compartments. Partition walls make the FWD and aft limits, the ceiling panels the upper limit and floor panels the lower limit.
The FWD partition wall of the FWD cargo compartment is equipped with an access door to the main avionics compartment.
On the inclined sidewall lining panels, footsteps are installed providing an aisle when pallets are loaded.
Rapid decompression panels (blow-in and blow-out) are installed on the vertical lining of the cargo compartments.
To avoid damage to the cargo compartment lining caused by pressure difference during climb and descent flight phases, pressure compensation valves ensure pressure equalization between cabin and LDCCs.
There is one pressure compensation valve assembly installed per LDCC. Each assembly is composed of two spring-loaded relief valves that cover both blow-in and blow-out cases. If required, each valve may be pushed by air pressure in the opening direction against a spring. To protect the valve from damages which might occur during cargo loading, a protection grid is installed over the valve body (cargo compartment side only).
Direct access from either side of the partition walls is given for valves visual inspection.
The cargo compartments ceiling consists of several collapsing panels which are attached to the fuselage primary structure and secondary structure with quick release fasteners. They protect the structure against rapid decompression damages. In case of high pressure difference, the collapsing ceiling panels will open together with the decompression panels installed in the sidewall lining.

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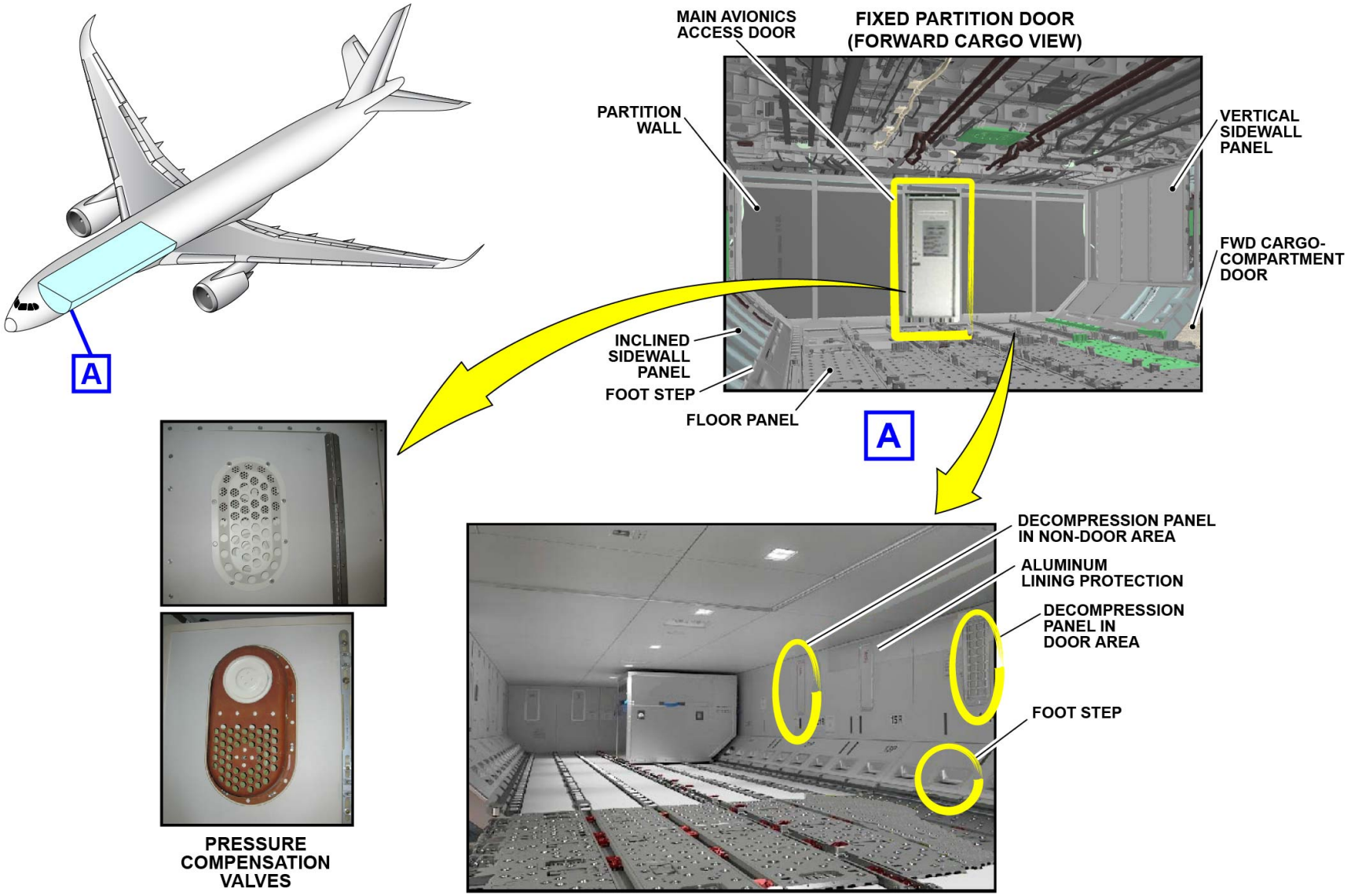

FWD CARGO COMPARTMENT

CARGO COMPARTMENTS PANELS DESCRIPTION (2/3)

Aft and Bulk Cargo Compartments

The aft LDCC lining panels and associated equipments are similar to the FWD LDCC ones, however there are some differences:
- Aft partition wall in the bulk cargo compartment is equipped with an access door to the rear part of the fuselage (maintenance access only)
- There is one pressure compensation valve assembly installed on the bulk compartment maintenance access door (aft partition wall of the aft cargo compartment)
- Rapid decompression panels installed in the bulk cargo compartment are equipped with a protection panel.

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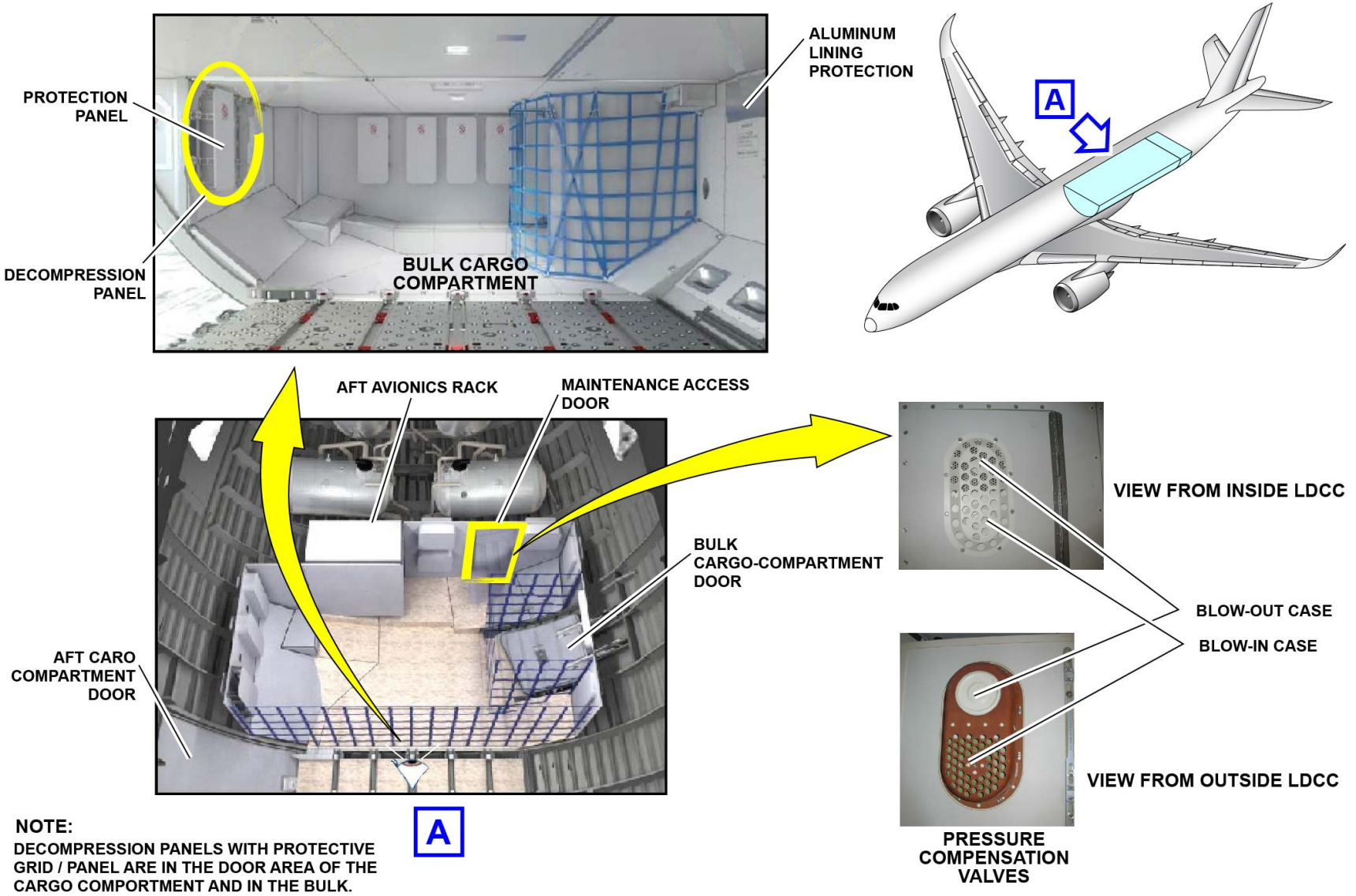

AFT AND BULK CARGO COMPARTMENTS

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CARGO COMPARTMENTS PANELS DESCRIPTION (2/3)

Rapid Decompression Panels D/O

Rapid decompression panels (blow-in and blow-out) are installed on the sidewall panels and on the fixed partition walls of the cargo compartments. In case of decompression in the cabin (blow-out case), or in the cargo compartment (blow-in case), they equalize the pressure in both sections, to avoid damage to the A/C structure.

The panels have a composite structure (made of a honeycomb core and a flame-retardant laminated-skin). Foam-tape makes a seal between the panel and the frame. The panel assemblies include a panel, a frame and fastener assemblies. The fastener assemblies are attached to the frames and include some latches, springs and catches. Those installed in the sensitive cargo handling areas are equipped with a protection grid or a protection panel.

If a rapid-decompression occurs in the cargo compartment, the cabin higher air pressure pushes the panel assemblies against their fasteners. This force will release the catches and the panel assemblies are blown inboard (blow-in). The higher air pressure can flow from the cabin to the cargo compartment.

If a rapid-decompression occurs in the cabin, the LDCC higher air pressure pushes the panel against their fasteners. This force will release the catches and the panels are blown outboard (blow-out). The higher air pressure can flow from the cargo compartment to the cabin.

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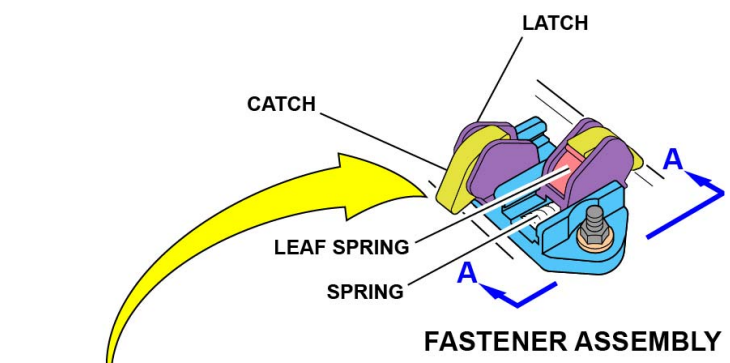
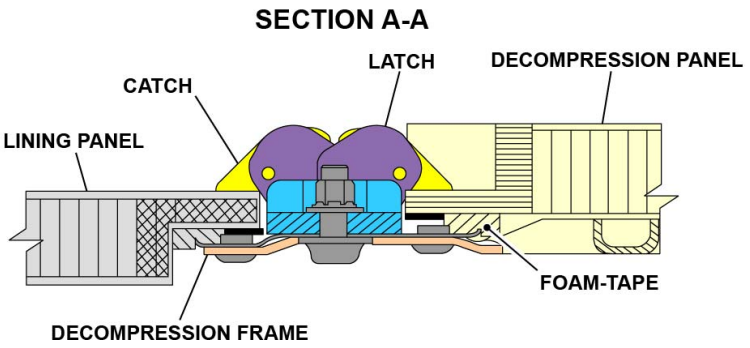
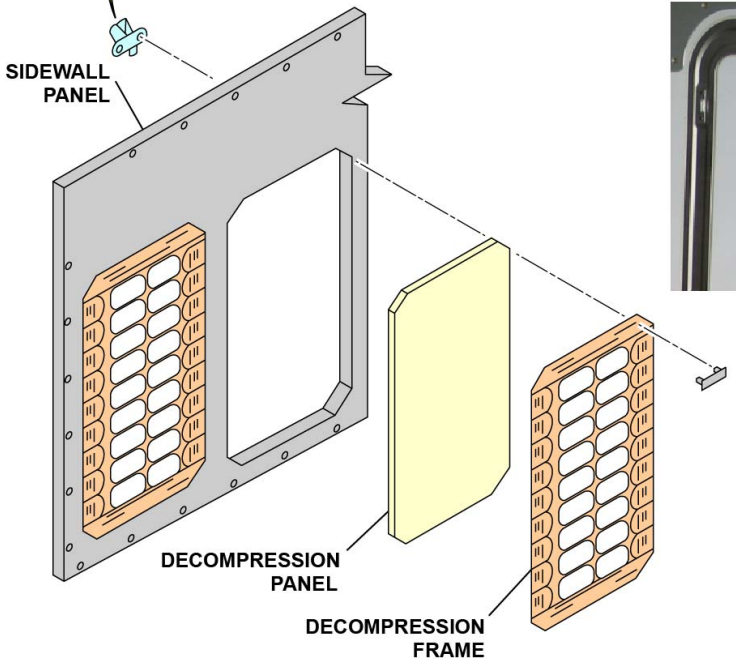
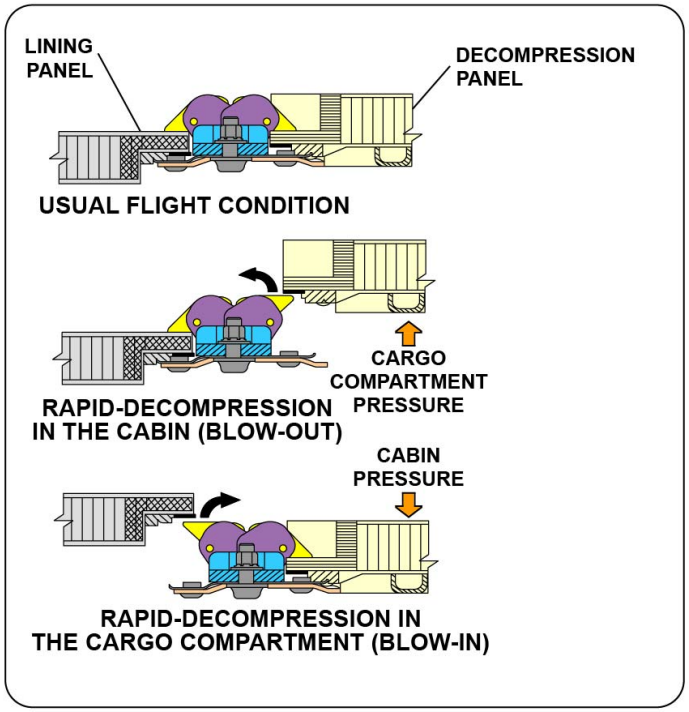


FASTENER ASSEMBLY





PANEL ASSEMBLY

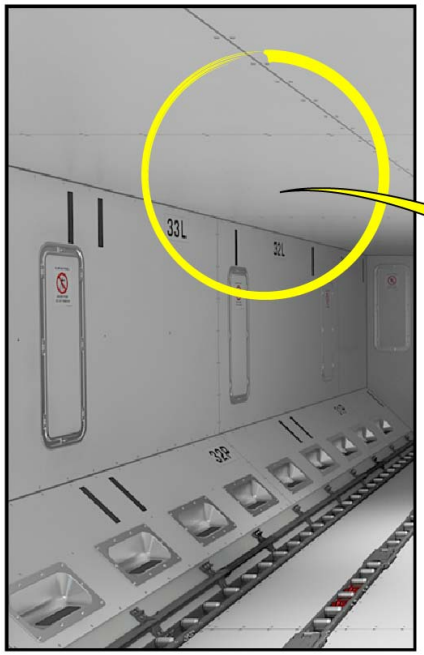


RAPID DECOMPRESSION PANELS D/O

CARGO COMPARTMENTS PANELS DESCRIPTION (2/3)

Lining Panels and Fasteners

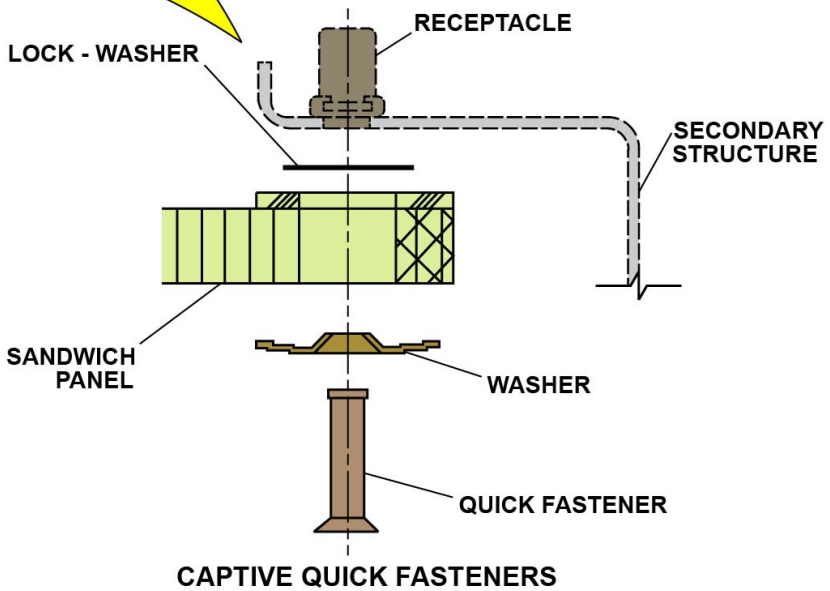
All lining panels are installed with quick-release fasteners into the A/C structure. As per regulations, all fasteners in the cargo compartments have no loose parts (only captive parts).



PANEL OR LINING

EXAMPLE OF CORRECTLY INSTALLED FASTENER ELEMENT

EXAMPLE OF LOOSENED FASTENER ELEMENT



CAPTIVE QUICK FASTENERS

LINING PANELS AND FASTENERS

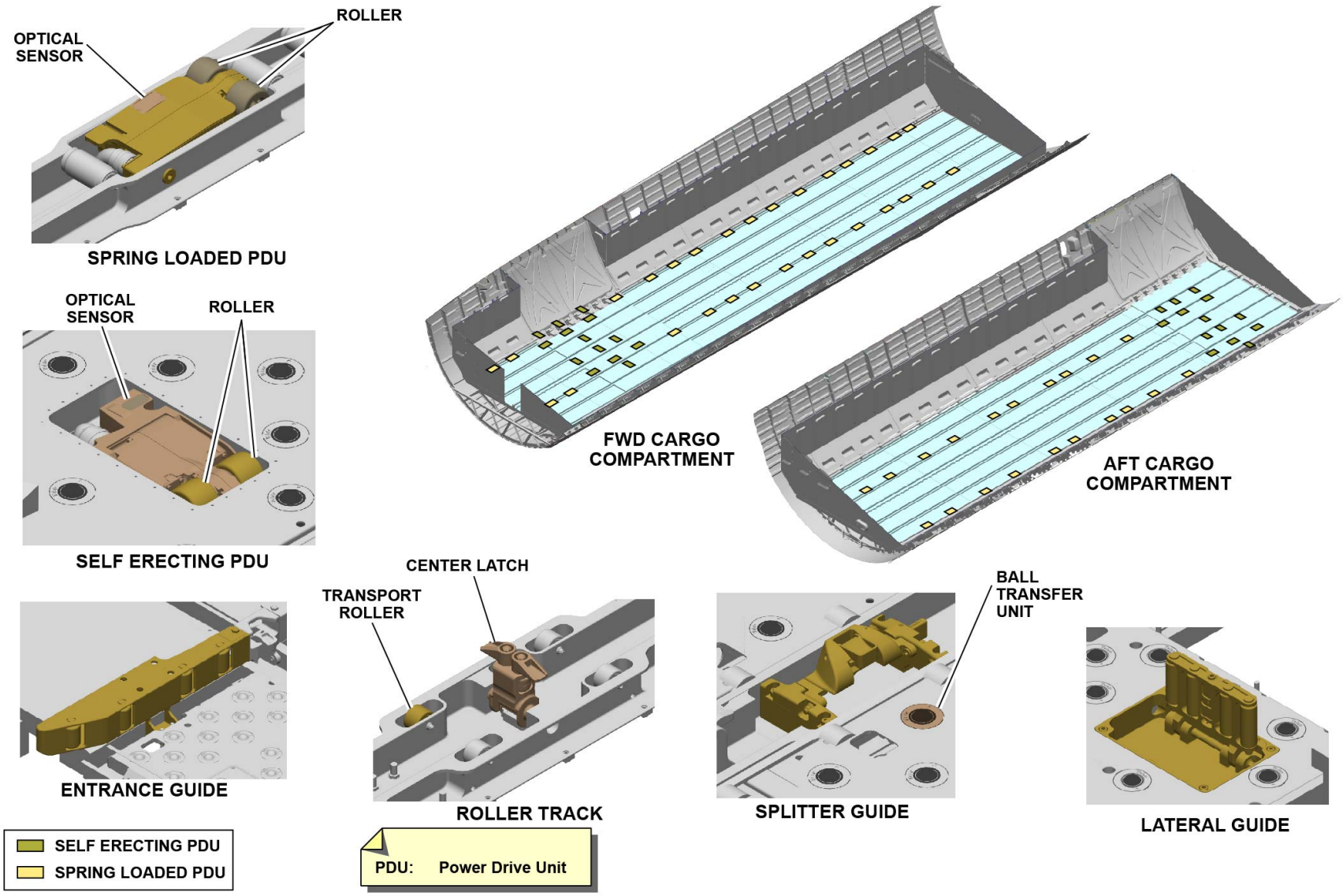
CARGO LOADING SYSTEM DESCRIPTION (2/3)

Components

Transport and Guiding

The FWD and the aft cargo compartments each have a lower deck CLS that operates independently when the A/C is on ground. Each CLS moves, holds and locks the ULDs on the A/C.
The ULDs are locked and unlocked manually.
The PDUs are the primary components of the CLS.
The PDUs move the ULDs in longitudinal and transversal directions (ball mat area only).
Each PDU detects the presence of an ULD through a built-in optical sensor.
Two types of PDUs are installed:
- The self erecting PDU (only installed in the ball mat area)
- The spring loaded PDU (installed in the longitudinal area).

When the self erecting PDU is in operation, two rollers touch the bottom of the ULD. The rollers turn and move the ULD.
The spring loaded PDU has two rollers to move the ULDs and a spring that holds the rollers against the bottom of the ULD. The rollers drive the ULDs but they can also operate as a brake if the PDUs are not in operation.
Seven roller tracks are installed longitudinally across the FWD and aft cargo compartments. The roller tracks have transport rollers for a proper movement of the ULDs.
The ball mat assemblies are installed in the cargo door area. They have ball transfer units that allow multi-directional movement of the ULDs.
The entrance guides are installed at the door area to guide the ULDs in the transversal and longitudinal directions, and prevent damages to A/C structure.
The splitter guides move the half-size ULDs into the right or left side of the cargo compartment.
The lateral guides are installed in the ball mat area of the FWD cargo compartment to make the loading and unloading procedure easier.
The lockable center latches are installed in the center roller track. They hold the half-size ULDs in the transversal and vertical directions.



COMPONENTS - TRANSPORT AND GUIDING

CARGO LOADING SYSTEM DESCRIPTION (2/3)

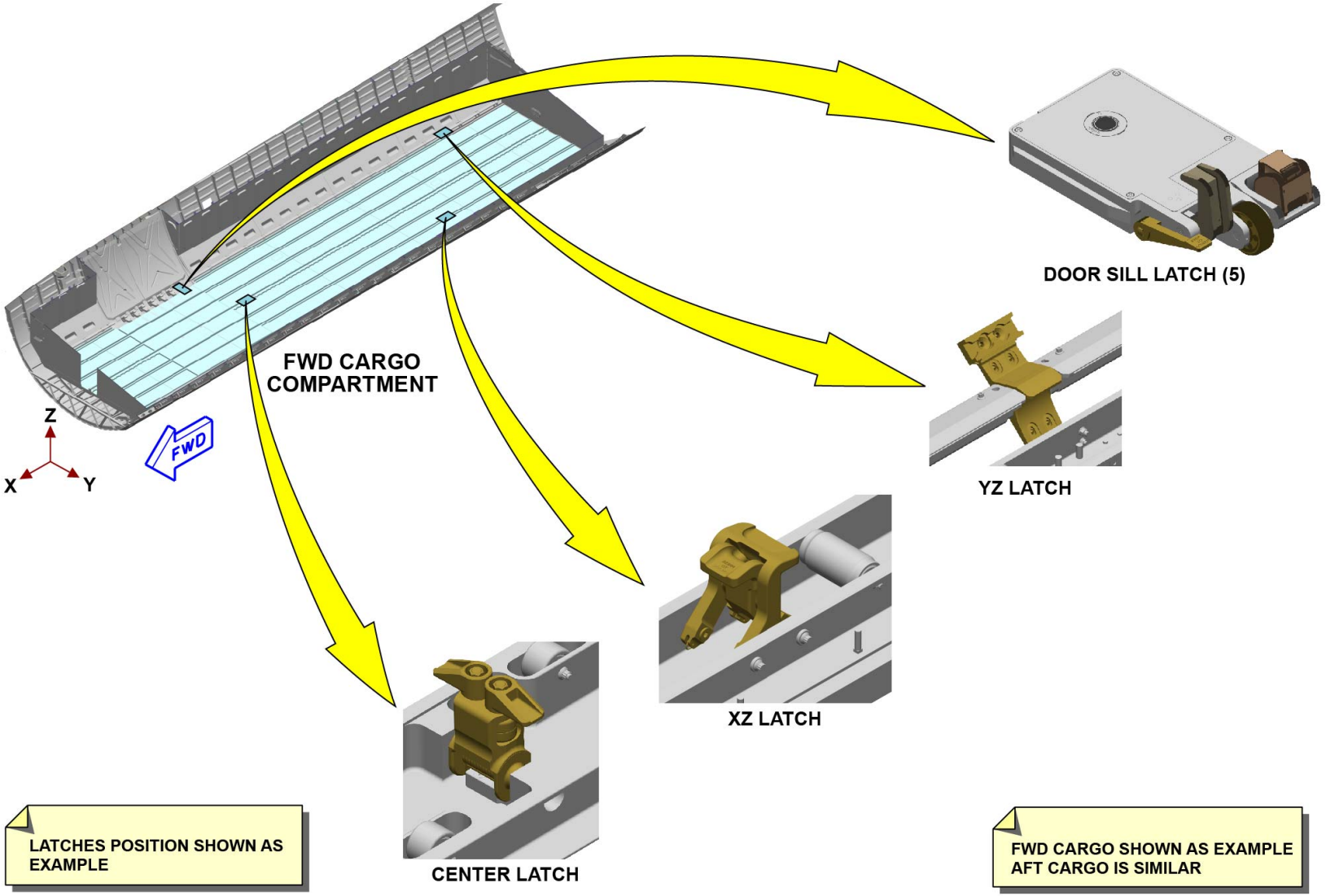
Components (continued)

Latching

Different types of latches hold and guide the ULDs in the X, Y and Z directions.
These types of latches are installed:
- XZ latch
- Lockable center latches
- YZ latch
- Door sill latch.

The XZ latches are installed in the roller tracks and hold the ULDs in the X and Z directions.
The XZ latches are manually operated.
The lockable center latches hold the half-size ULDs in the Y and Z directions. The lockable center latches are manually operated and overrideable. The lockable center latches retracts when a full-size ULD moves above it.
The YZ latches:
- Guide the ULDs during loading and unloading
- Hold the ULDs in the Y and Z directions (fixed latches)
- Make sure that no ULD can hit the compartment lining.

The door sill latches are installed on the door sill in the door area. The door sill latches hold the ULDs in the Y and Z directions. During loading and unloading operations the door sill latches are retracted to make the ULD movement possible.
The proximity switches are installed at the XZ latches, lockable center latches, and in the door sill latches. The proximity switches monitor the position of the latches.



COMPONENTS - LATCHING

CARGO LOADING SYSTEM DESCRIPTION (2/3)

Components (continued)

Door Sill Latch

Each door-sill latch unit has:
- A door sill latch
- A door-sill anti-roll-out device
- A door sill roller.

The door-sill latch unit is multifunctional:
- The basic component has a retractable door sill latch that holds the ULD in the Y and Z directions during flight
- The anti roll out device stops the ULD to go back out of the cargo compartment during loading procedure and split function
- The door sill roller operate as a load carrier for the ULDs.

Five door-sill latch units are installed in the FWD compartment door area and five door-sill latch units are installed in the aft cargo compartment door area.

The door sill latch can be manually operated. When the lowering lever is pushed down, the door-sill latch pawl lowers. To raise the door-sill latch pawl in locked position the pawl must be lifted up manually.

Two of the five door sill latches in the FWD cargo compartment have proximity switches. Also two of the five door sill latches in the aft cargo compartment have proximity switches. Those proximity switches are installed in the door-sill latch unit base. They detect the position of the door sill latches to inhibit cargo door closure, should one door sill latch be detected in the retracted position. The CLS is only supplied with electrical power when all door sill latches are lowered.

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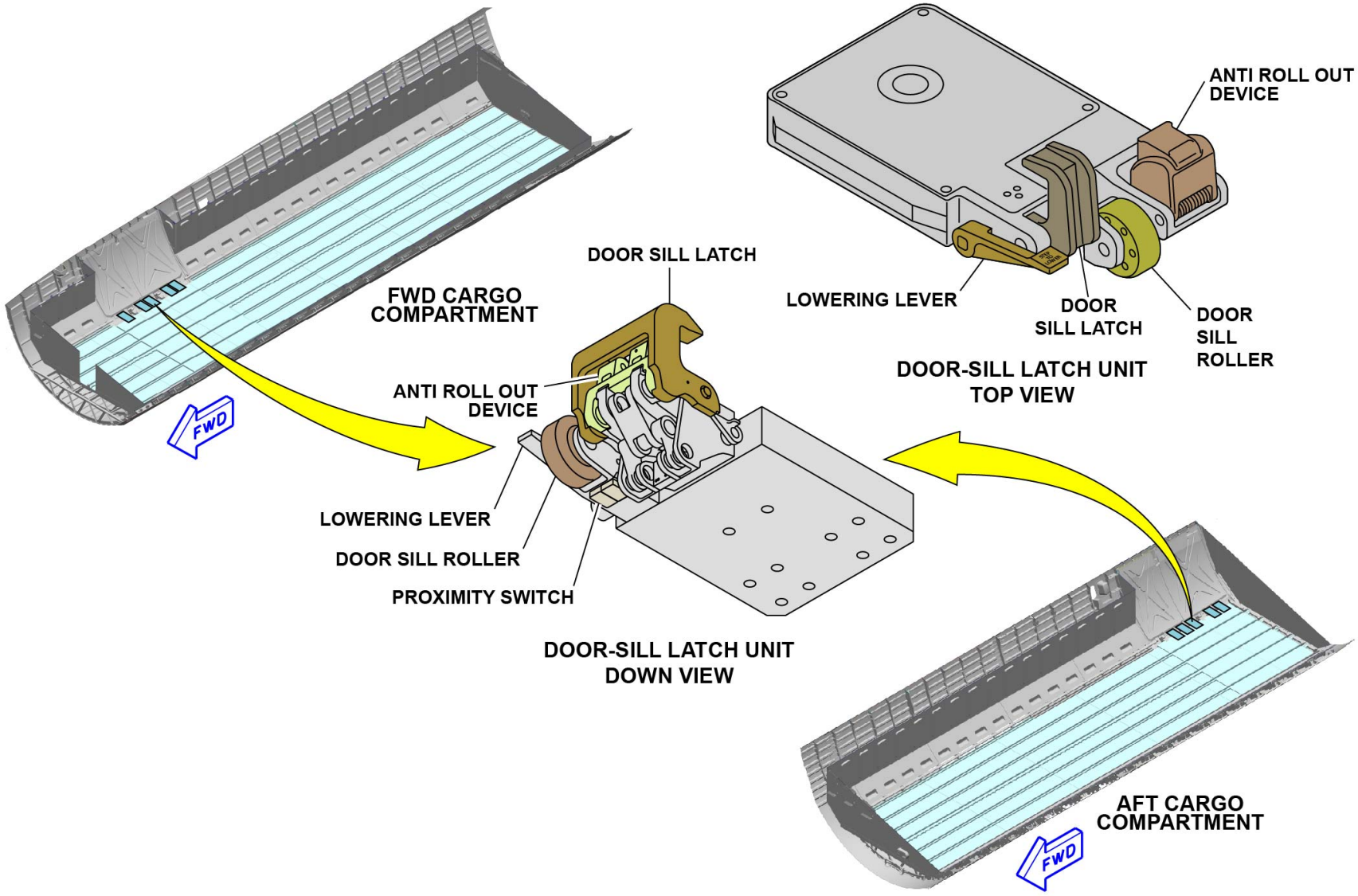

COMPONENTS - DOOR SILL LATCH

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CARGO LOADING SYSTEM DESCRIPTION (2/3)

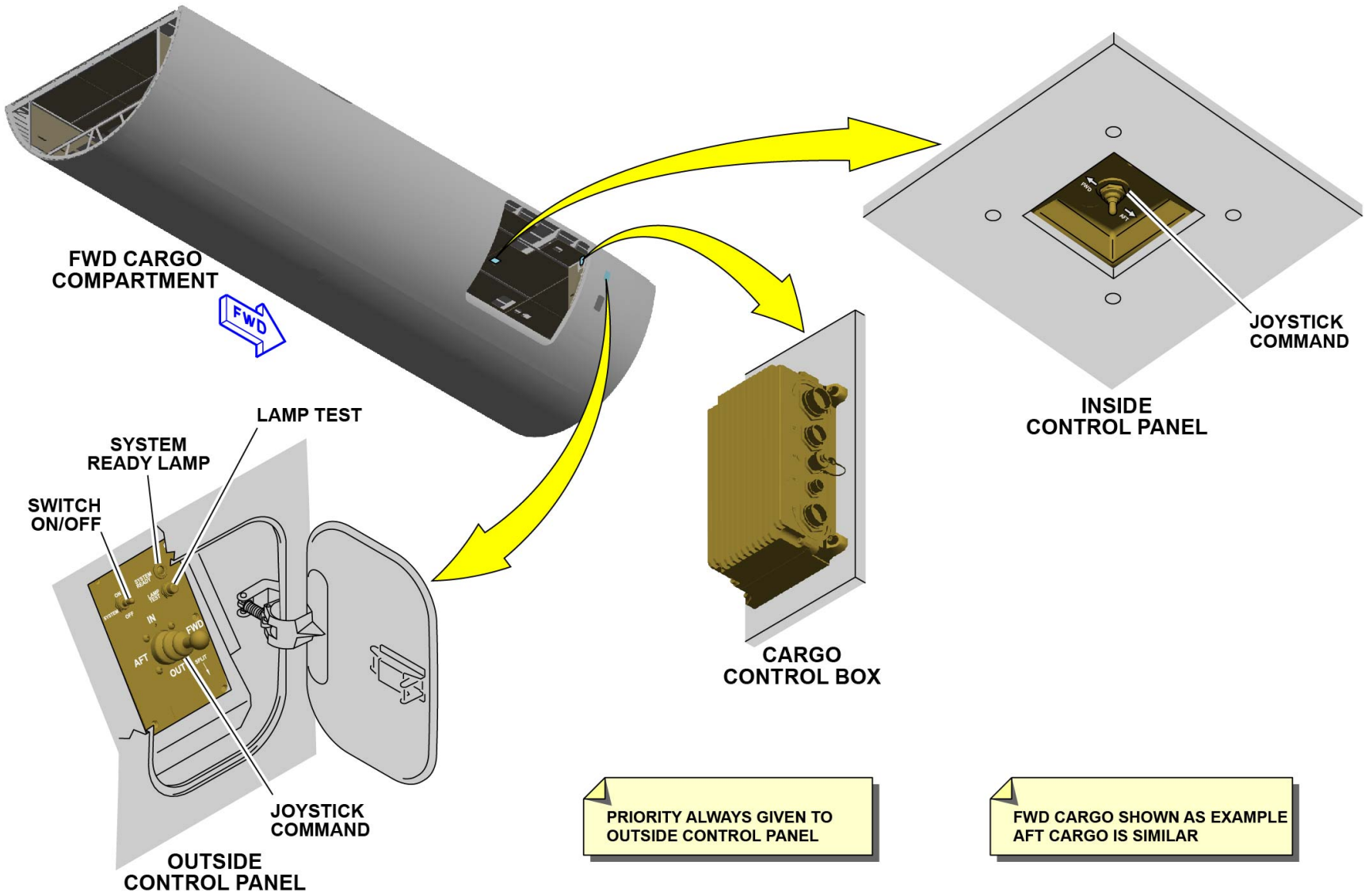
Components (continued)

Control Panels and Cargo Control Box

There is one cargo control box for each of the FWD and aft cargo compartments. The cargo control box receives commands from the outside control panel and the inside control panel.
The cargo control box controls and monitors directly the PDUs that are installed in the ball mat area and the longitudinal area of PDUs.
The outside control panel is the primary command interface for the operation of the electrical CLS.
The outside control panel has:
- A SYSTEM ON/OFF SW
- A joystick that gives the commands IN/OUT/FWD/AFT/SPLIT
- A SYSTEM READY green lamp
- A LAMP TEST P/B.

The inside control panel is the secondary command interface for the operation of the CLS. The joystick of the inside control panel only gives the aft and the FWD commands.
One single person can operate the CLS in two different modes:
- The electrical loading that is semi-automatic (ULD displacement is motorized, but ULD locking is manual)
- The manual loading that is fully manual.

Semi-automatic electrical CLS:
When the SYSTEM ON/OFF SW is set to ON the SYSTEM READY lamp starts to flash. The flashes stop after some seconds and the light of the SYSTEM READY becomes steady ON. This shows that the electrical CLS system is now ready to operate.
One person can move the ULD through the joystick of the outside control panel or the inside control panel (only used for the longitudinal area).
Note that simultaneous actions on the outside control panel and the inside control panel will cause a complete stop of PDUs operation; to resume electrical cargo loading, both joysticks first have to be returned to their zero position.
When the ULD is in position, the latches must be manually locked.
Manual loading:
For the manual loading, the SYSTEM ON/OFF SW must be in the OFF position. Then you can manually move the ULD in position and must lock the latches manually.



COMPONENTS - CONTROL PANELS AND CARGO CONTROL BOX

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CARGO LOADING SYSTEM DESCRIPTION (2/3)

Components (continued)

Door-Sill Proximity Switch

The door sill latches are connected independently to the cargo control box. If all the door sill latches are in the lowered position, the CLS is energized and the cargo compartment door closure operation is electrically isolated.
If all the door sill latches are in the locked position, the cargo compartment door operation is possible and the CLS is electrically isolated.
When the position of one door sill latch is different from the other ones, the CLS and the cargo compartment door operation are electrically isolated.

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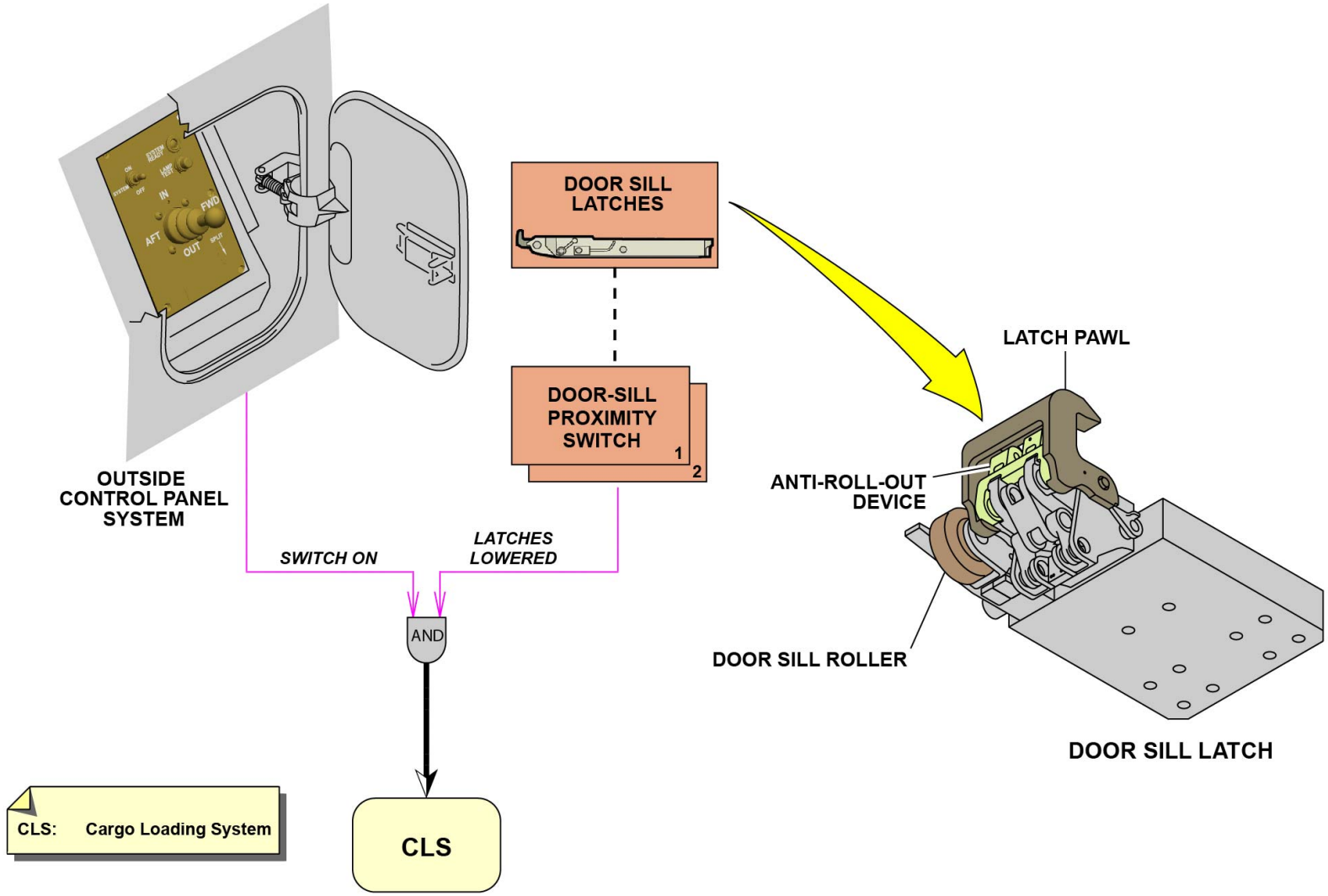


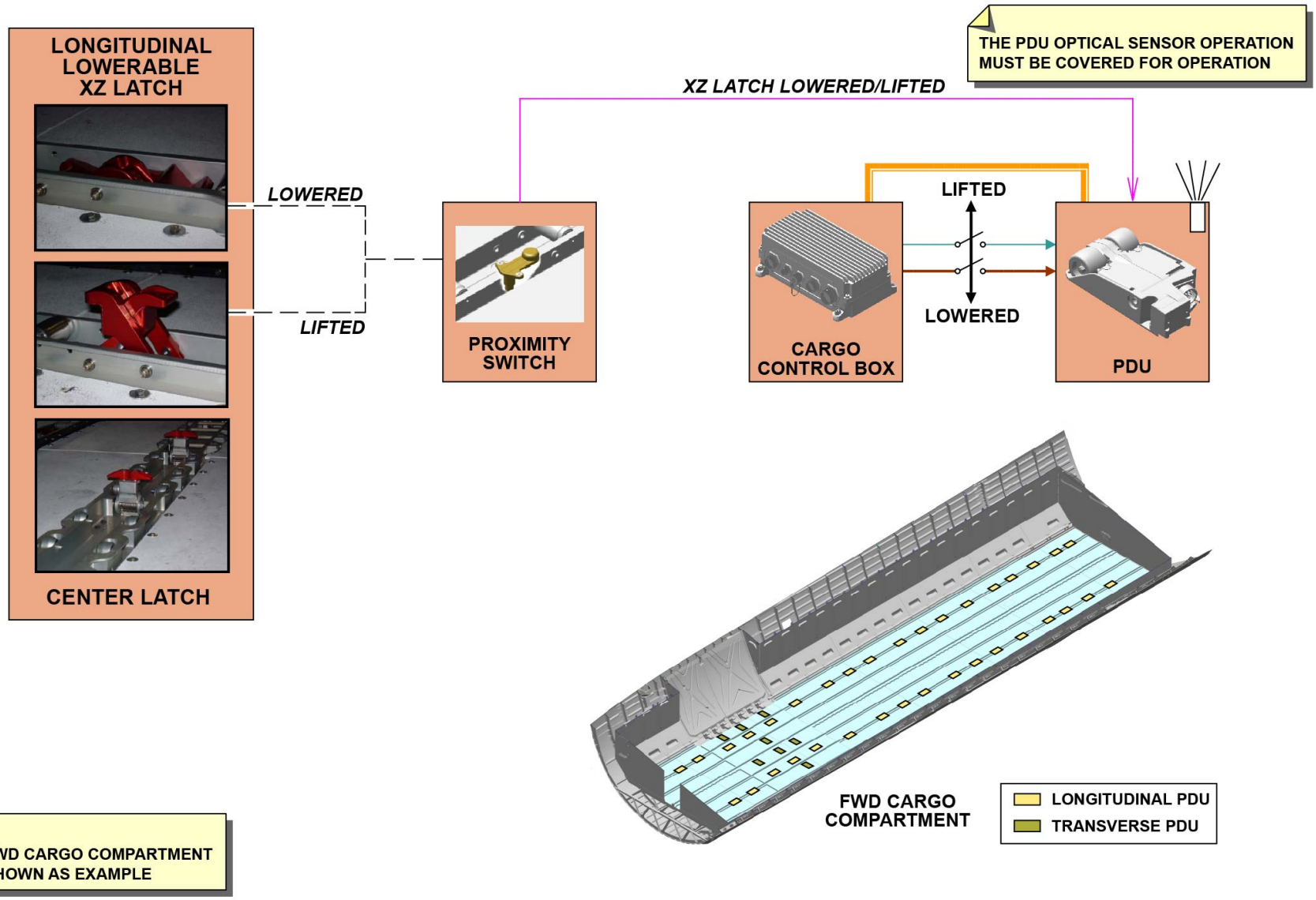
COMPONENTS - DOOR-SILL PROXIMITY SWITCH

CARGO LOADING SYSTEM DESCRIPTION (2/3)

Components (continued)

Conveyance Proximity Switches

The conveyance proximity switches are installed below the XZ latches, lockable center latches and detect if the latches are in the lift or lowered position.
If the latch is in the lifted position, the proximity switch sends a signal to the related PDU that will signal the cargo control box to cut-off the power supply to the PDU. As a result, all PDUs after a raised latch in load direction are inactive to drive ULDs.



COMPONENTS - CONVEYANCE PROXIMITY SWITCHES

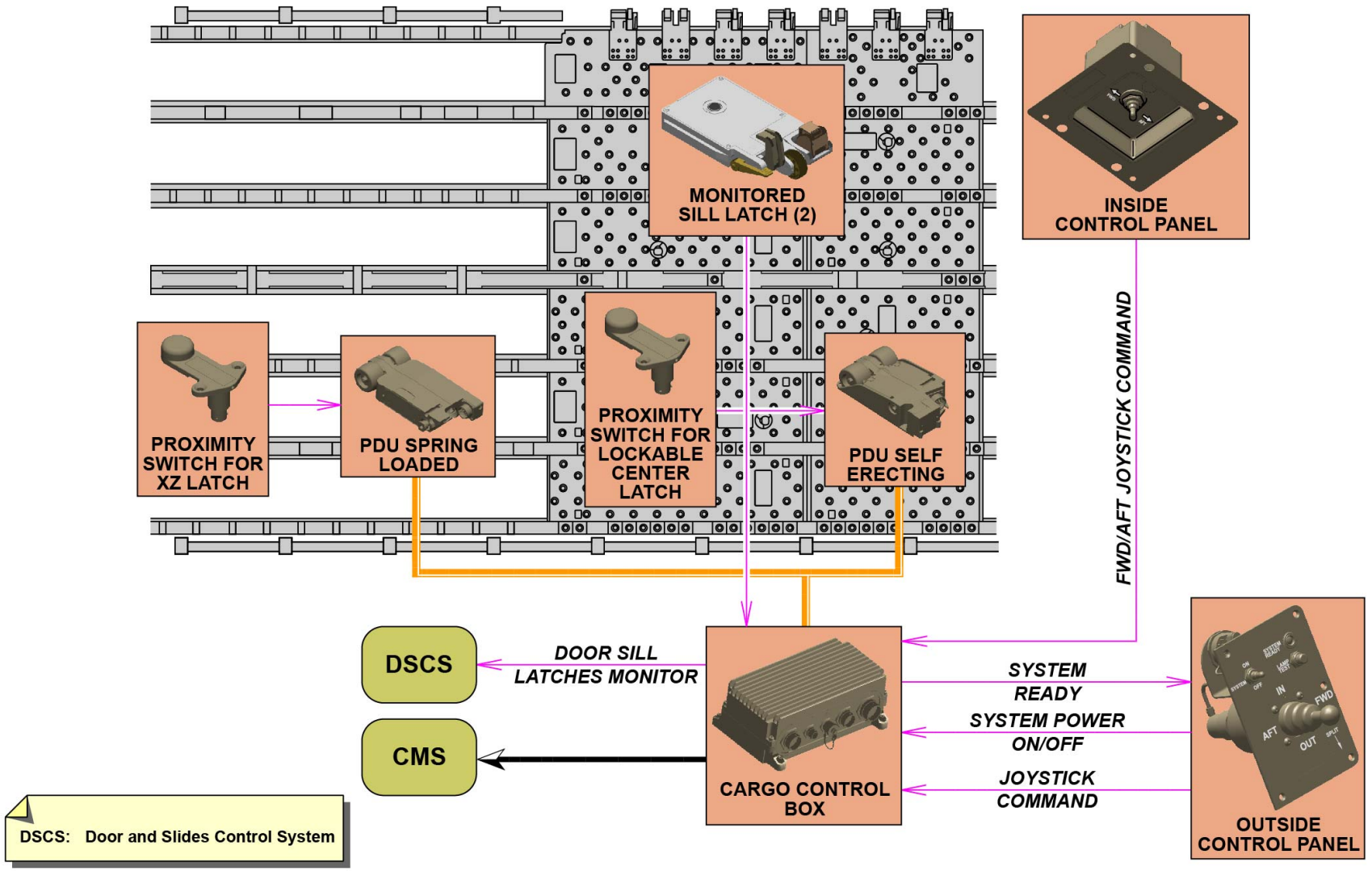
CARGO LOADING SYSTEM DESCRIPTION (2/3)

Components (continued)

Cargo Control Box Interfaces

The cargo control box receives signals from the proximity switches that are installed below the door sill latches through discrete wires. Those proximity switches monitor the status of the door sill latches and send this data through the cargo control box to the DSCS.
A discrete wire connects the cargo control box to the DSCS.
The cargo control box receives discrete signals from the inside control panel and the outside control panel. The cargo control box operates the SYSTEM READY lamp of the outside control panel that shows if the CLS is prepared for operation. The CLS starts to operate if there is no inhibition.
The cargo control box receives feedback from the proximity switches that are installed below the XZ and lockable center latches through a CAN data bus. The cargo control box then sends commands to the transverse and longitudinal PDUs through a CAN data bus.
These LRUs of the CLS have an internal BITE:
- The cargo control boxes (monitoring of the cargo control box itself, the inside and outside control panels, the door sill latches, and the PDUs)
- The PDUs (monitoring of the PDU itself, and the proximity switches of XZ latches and lockable center latches).

The LRUs send the internal failure data to the cargo control box through the CAN data bus and the discrete wires. The failure messages are stored in the cargo control box BITE memory. The cargo control box sends the messages to the CMS.



COMPONENTS - CARGO CONTROL BOX INTERFACES

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CARGO DRAINAGE SYSTEM DESCRIPTION (2/3)

Introduction

The A/C has three Lower Deck Cargo Compartments (LDCCs) equipped with a drainage system. They are:
- The FWD cargo compartment
- The aft cargo compartment
- The bulk cargo compartment.

A gravity-based drainage system collects all fluids spilled in the cargo compartments, and drains them into the bilge (standard unheated bilge drainage system) or to the drain masts (heated drainage system option). It operates both on ground (overboard evacuation) and in flight (but no overboard evacuation, except if heated drainage option installed).
The purpose of the drainage system is to prevent:
- Accumulation of fluids and ice in the cargo compartments or in the bilge
- Contamination of the A/C structure (corrosion prevention) and the systems which are installed above and below of the LDCCs floor.

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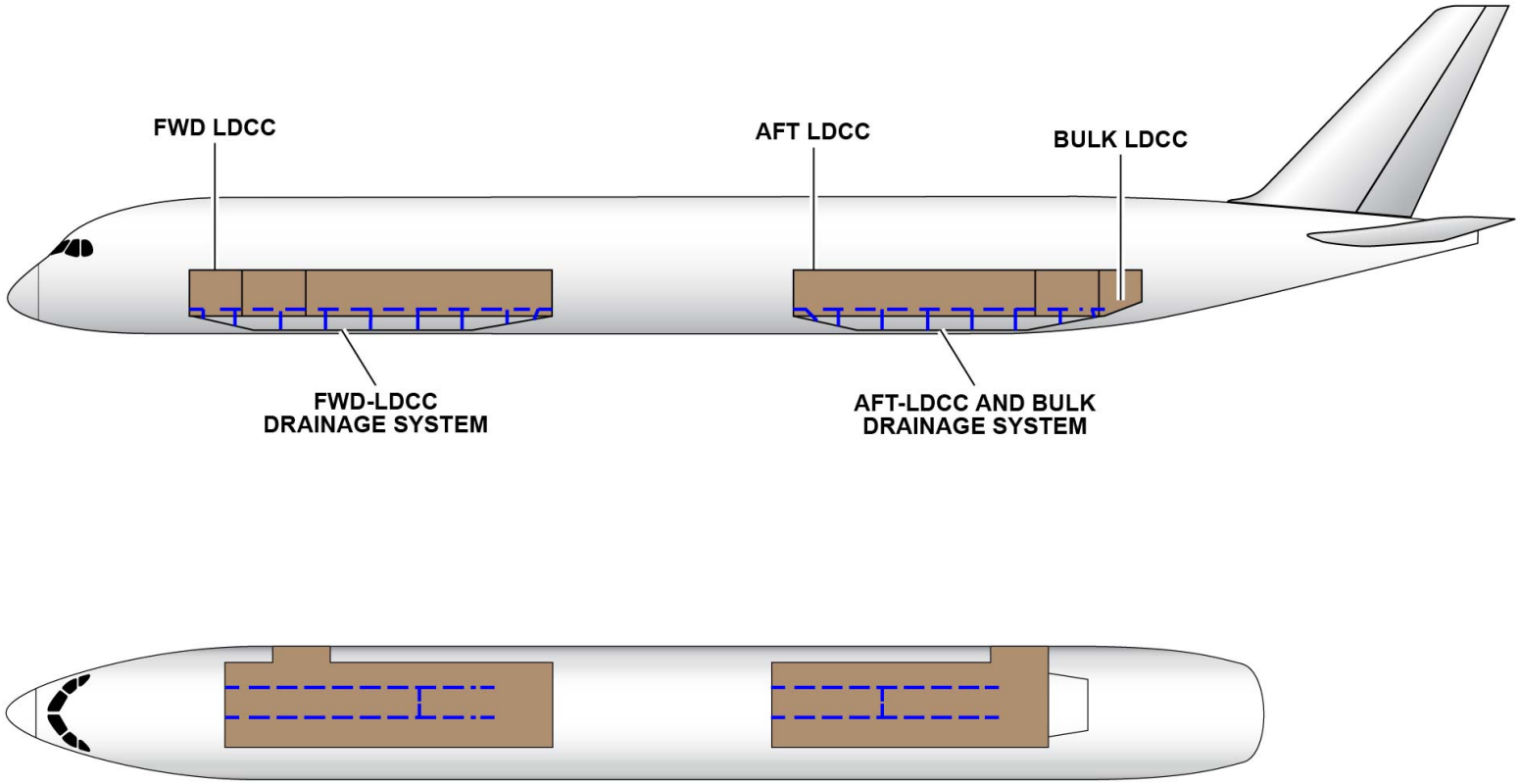

LDCC:Lower Deck Cargo Compartment

INTRODUCTION

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CARGO DRAINAGE SYSTEM DESCRIPTION (2/3)

Implementation

Fluid Collection Zones at Cargo Compartments Floor Level

The components of the drainage system which are installed at floor level in the LDCCs, collect the fluids spilled in the compartment. These fluids are then routed to a cross-connecting pipe system installed below the floor.

The components of the drainage system installed at the floor level are:

- Drain funnels fitted with filters installed in the roller tracks: center area and at the ends of each track
- Overflow holes in the roller tracks side walls
- FWD LDCC drainage pan (rear end) and aft LDCC drainage pan (front end) are installed to drain the cargo compartment floor panels; fluids are collected via filters
- Ball mat area: the PDU drain pans with funnels below each self erecting PDU
- Ball mat area: the ball transfer units fitted with filter cages and the filters that drain the fluids into drain pans (with funnels) installed below the ball mat.

Note that spring loaded PDUs installed in the longitudinal area are not equipped with drain pans: fluids flowing in the roller tracks by-pass them underneath.

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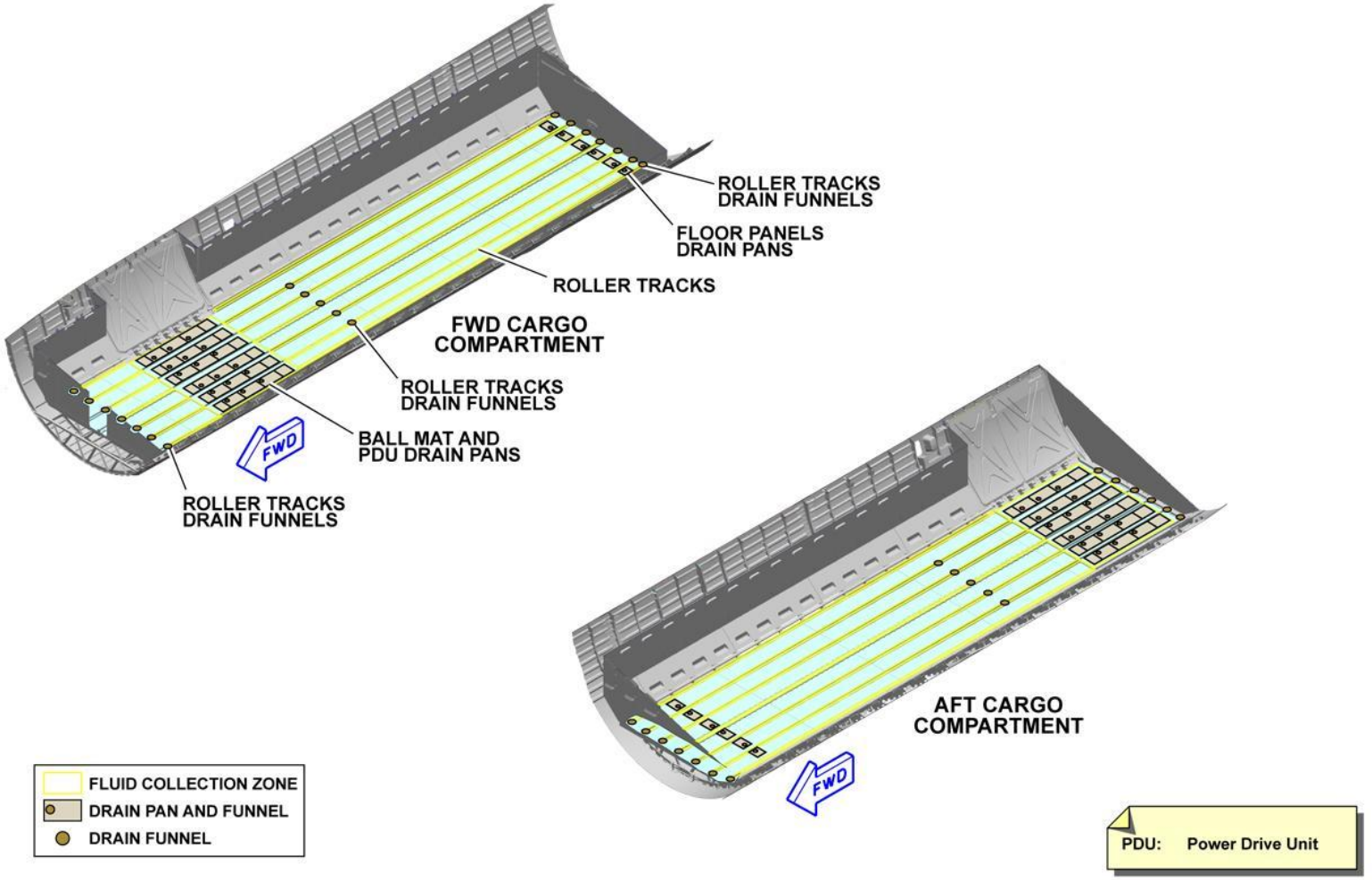


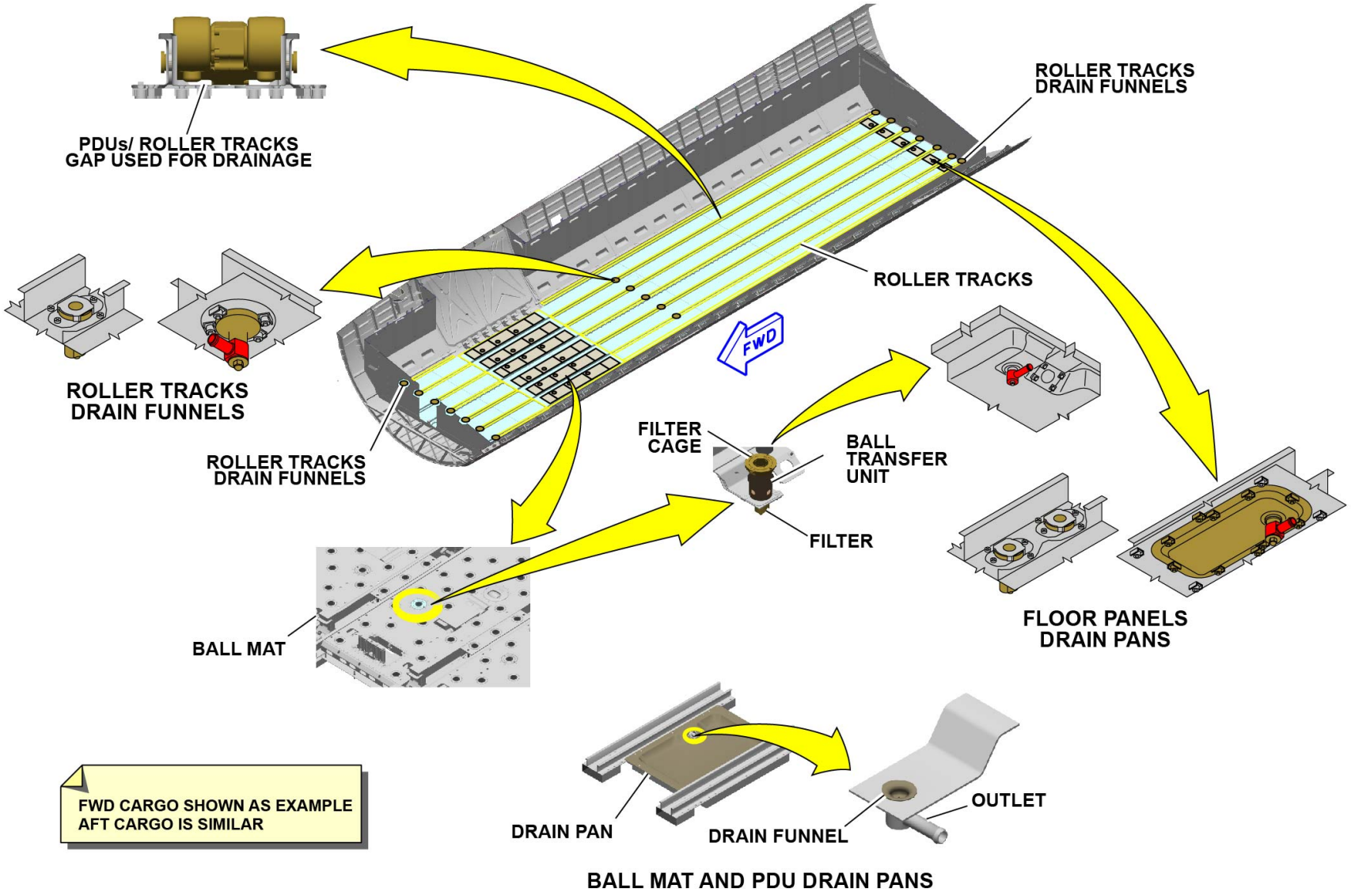
IMPLEMENTATION - FLUID COLLECTION ZONES AT CARGO COMPARTMENTS FLOOR LEVEL

CARGO DRAINAGE SYSTEM DESCRIPTION (2/3)

Implementation (continued)

Fluid Collection Components at Cargo Compartments Floor Level

The components in charge of fluids collection at the cargo compartments floor level are illustrated on this slide. The FWD cargo compartment is shown, and the aft cargo compartment is identical.



IMPLEMENTATION - FLUID COLLECTION COMPONENTS AT CARGO COMPARTMENTS FLOOR LEVEL

CARGO DRAINAGE SYSTEM DESCRIPTION (2/3)

Implementation (continued)

Fluid Collection Under Cargo Compartments Floor (Unheated System)

The standard drainage system is an unheated bilge drainage system. The fluids collected at the cargo compartments floor level will be led into the bilge via a pipe system. The fluids, which are collected in the bilge, drain out of the A/C via bilge drain valves.

The bilge drain valves, installed at the back of the fuselage panels, are used for the evacuation of fluids overboard. The drain valves are spring loaded open on ground (or close to the ground), and will be closed by the cabin differential pressure in flight. Therefore no fluid can flow out of the A/C unless the cabin differential pressure drops below a set value.

As said above none of these drainage components are heated, therefore ice accumulation in the A/C belly is possible in flight.

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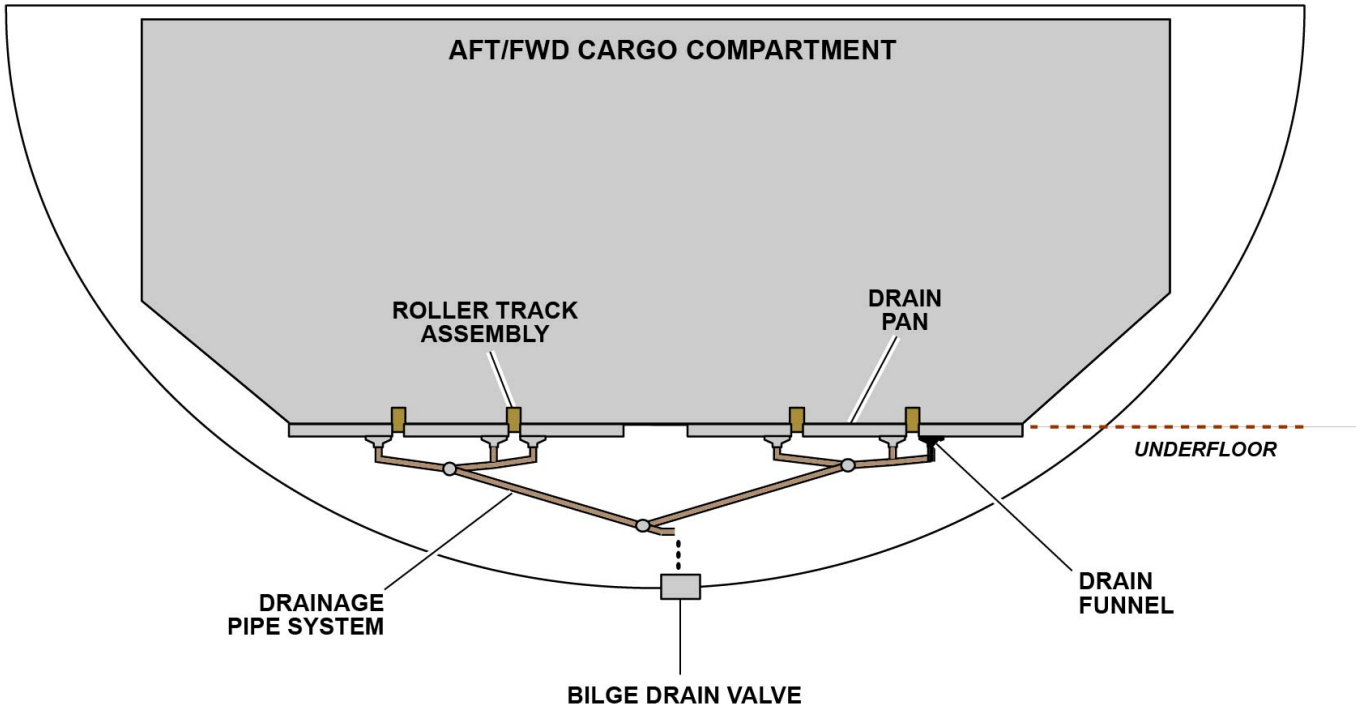
TYPICAL LAYOUT FOR UNDERFLOOR
DRAINAGE SYSTEM (UNHEATED)



IMPLEMENTATION - FLUID COLLECTION UNDER CARGO COMPARTMENTS FLOOR (UNHEATED SYSTEM)

CARGO DRAINAGE SYSTEM DESCRIPTION (2/3)

Implementation (continued)

Fluid Collection Under Cargo Compartments Floor (Optional Heated System)

The optional drainage system is heated.

The fluids which are collected at the cargo compartments floor level will be led to the ATA 38 FWD or aft heated drain masts via a heated piping system.

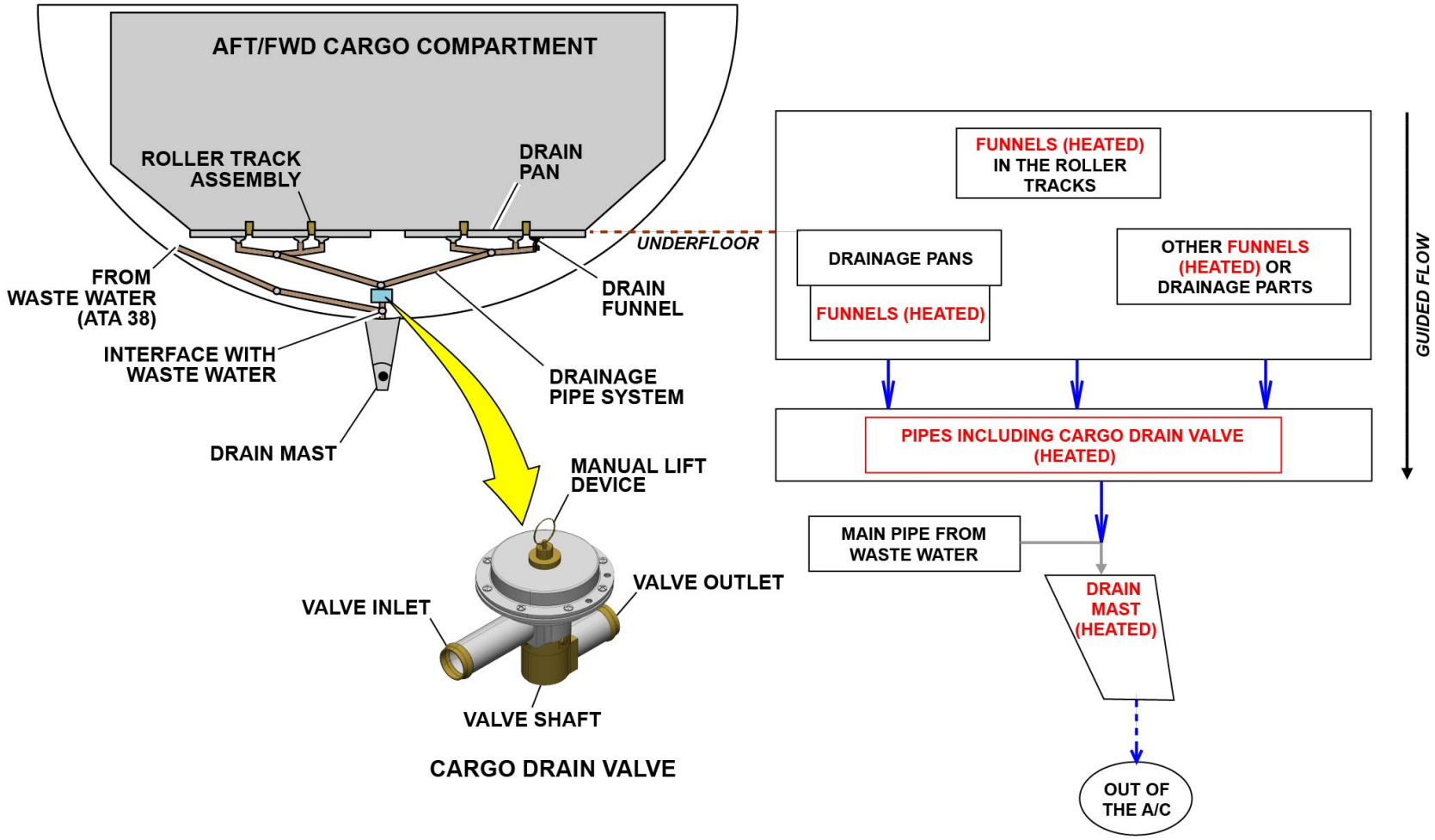
The pipes, the cargo drain valves, and the drain masts are equipped with heater elements and insulation, to prevent freezing of fluids inside the drainage system, on ground and in flight under cold weather conditions.

The cargo drain valve is installed within the cargo drain piping system upstream of the drain mast. The valve functions automatically, depending on the level of water in the piping. If no water (or other fluids) are to be drained out, the valve will remain closed. If water accumulates in the drain piping, the hydrostatic pressure of the water column will force the valve to the open position and the water will be released overboard.

This design of the valve prevents pressurization losses from the fuselage.

The drain valve is equipped with a manual lift facility to enable draining if the valve interior is blocked.

TYPICAL LAYOUT FOR OPTIONAL UNDERFLOOR
DRAINAGE SYSTEM (HEATED) AND CONNECTED TO DRAIN MAST



IMPLEMENTATION - FLUID COLLECTION UNDER CARGO COMPARTMENTS FLOOR (OPTIONAL HEATED SYSTEM)

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