A350
TECHNICAL TRAINING MANUAL
MAINTENANCE COURSE - T1+T2 - RR Trent XWB
Inert Gas System

This document must be used for training purposes only

Under no circumstances should this document be used as a reference

It will not be updated.

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INERT GAS SYSTEM

V2414251 - V00T0MM0

INERT GAS SYSTEM DESCRIPTION (2/3)

Presentation of the Inert Gas System

The function of the Inert Gas System (IGS) is to decrease the oxygen concentration in the fuel tanks for safety. The IGS includes the Inert Gas Generation System (IGGS) and the Inert Gas Distribution System (IGDS). The bleed air that goes into the IGGS comes from the Conditioned Service Air System (CSAS).
The IGGS, with the Air Separation Modules (ASMs) (4), generates Nitrogen Enriched Air (NEA) by the separation and release of Oxygen Enriched Air (OEA) overboard. Each ASM has an inlet chamber, an NEA outlet and an OEA exhaust. Pressurized air goes into the inlet chamber, through thousands of fibers. The inlet air is then divided by the fiber membranes:
- OEA goes through the fiber membranes radially and is released through the OEA port
- NEA goes through the fiber membranes axially and goes out of the ASM.

The function of the IGDS is to send the NEA to the three fuel tanks.

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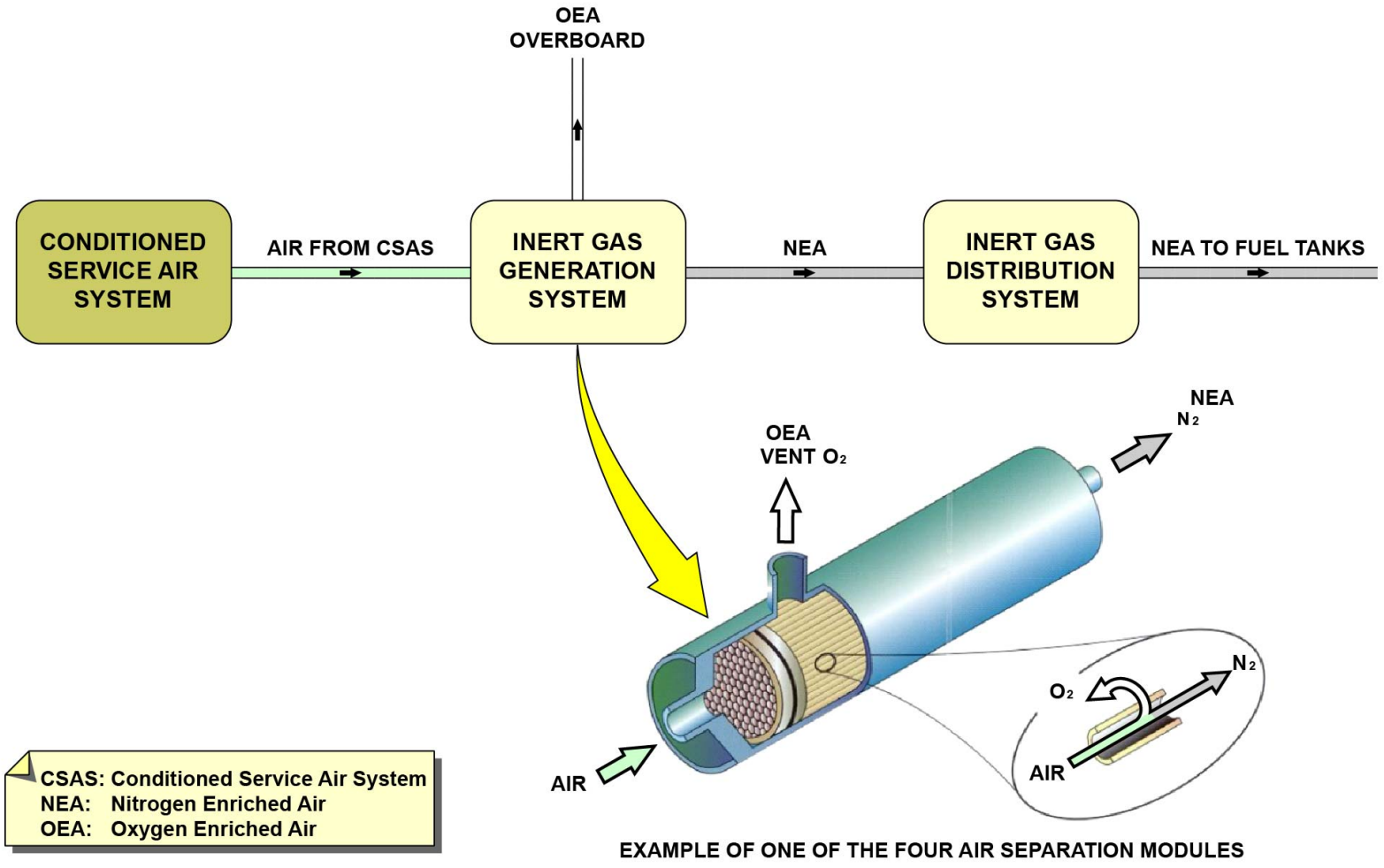


EXAMPLE OF ONE OF THE FOUR AIR SEPARATION MODULES

PRESENTATION OF THE INERT GAS SYSTEM

INERT GAS SYSTEM DESCRIPTION (2/3)

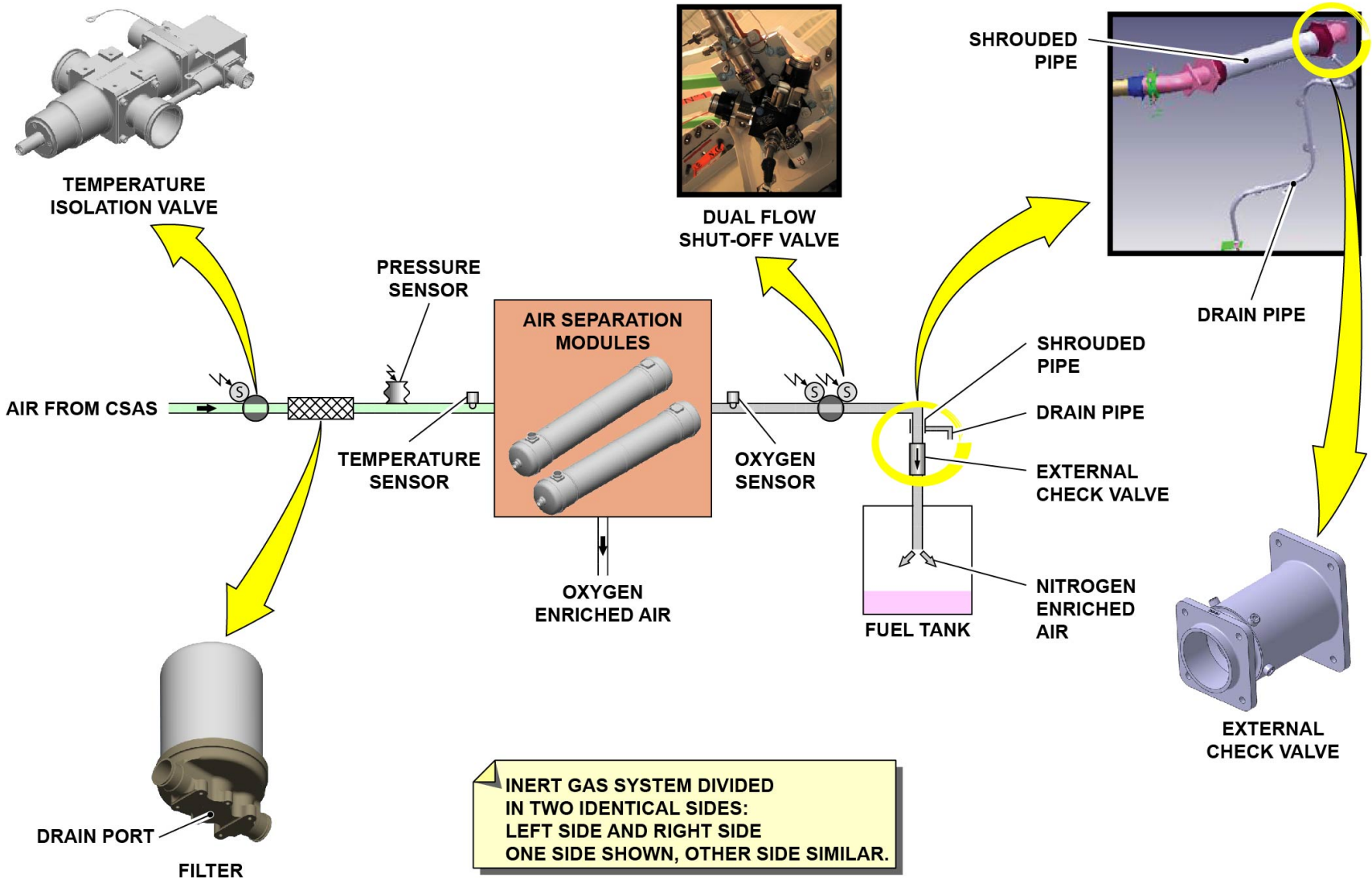
Inert Gas Generation System

Description of the IGGS

The IGGS is divided into two sides: left and right. Each side has:
- A Temperature Isolation Valve (TIV)
- A filter assembly
- An inlet temperature sensor of the ASM assembly
- An inlet pressure sensor of the ASM assembly
- An ASM assembly with several ASMs (2)
- An oxygen sensor
- A Dual Flow and Shut-Off Valve (DFSOV)
- An external check valve.

Description of the IGGS Components

The TIV is used to isolate the IGGS from the CSAS. The TIV is a solenoid-controlled, pneumatically-operated valve that closes when the solenoid is de-energized or when there is not sufficient inlet pressure. When an over-temperature or an over-pressure is sensed, a command sets this valve to CLOSED.
The filter assembly is used to make sure that only filtered, clean and dry air is supplied to the ASM inlet. The filter has a drain to remove all the filtered liquids.
The inlet pressure sensor of the ASM assembly (between the filter and the ASM) is used for health monitoring and over-pressure protection. When the sensor senses an over-pressure, the system shuts down.
The inlet temperature sensor of the ASM assembly is used for over-temperature detection. This detection operates independently of the over-temperature protection of the CSAS control system. When an over-temperature is sensed by the temperature sensor, the system shuts down.
There are two ASMs for each side, downstream of the filter assembly.
There is an oxygen sensor downstream of the ASMs. The oxygen sensor measures the oxygen concentration of the NEA flow that is supplied to the fuel tank through a sense line connected downstream of the ASM. The oxygen sensor is used for system health monitoring.
The DFSOV is downstream of the sensors and the ASMs. The DFSOV is used as a shut-off valve and to give the correct flow for the related flight phase. Solenoids are used to control the valve position.
The external check valve is used as a reverse flow barrier to make sure that fuel does not go into the IGGS. The pipe upstream of the external check valve is installed above a hot bleed air duct. In failure conditions, fuel and fuel vapor can be found in the pipe. The pipe above the hot bleed air duct is shrouded. This shroud is connected to a drain line, to prevent the leakage of vapor above this duct. The drain line and the drain port let ground personnel do a check for fuel leak upstream of the external check valve.



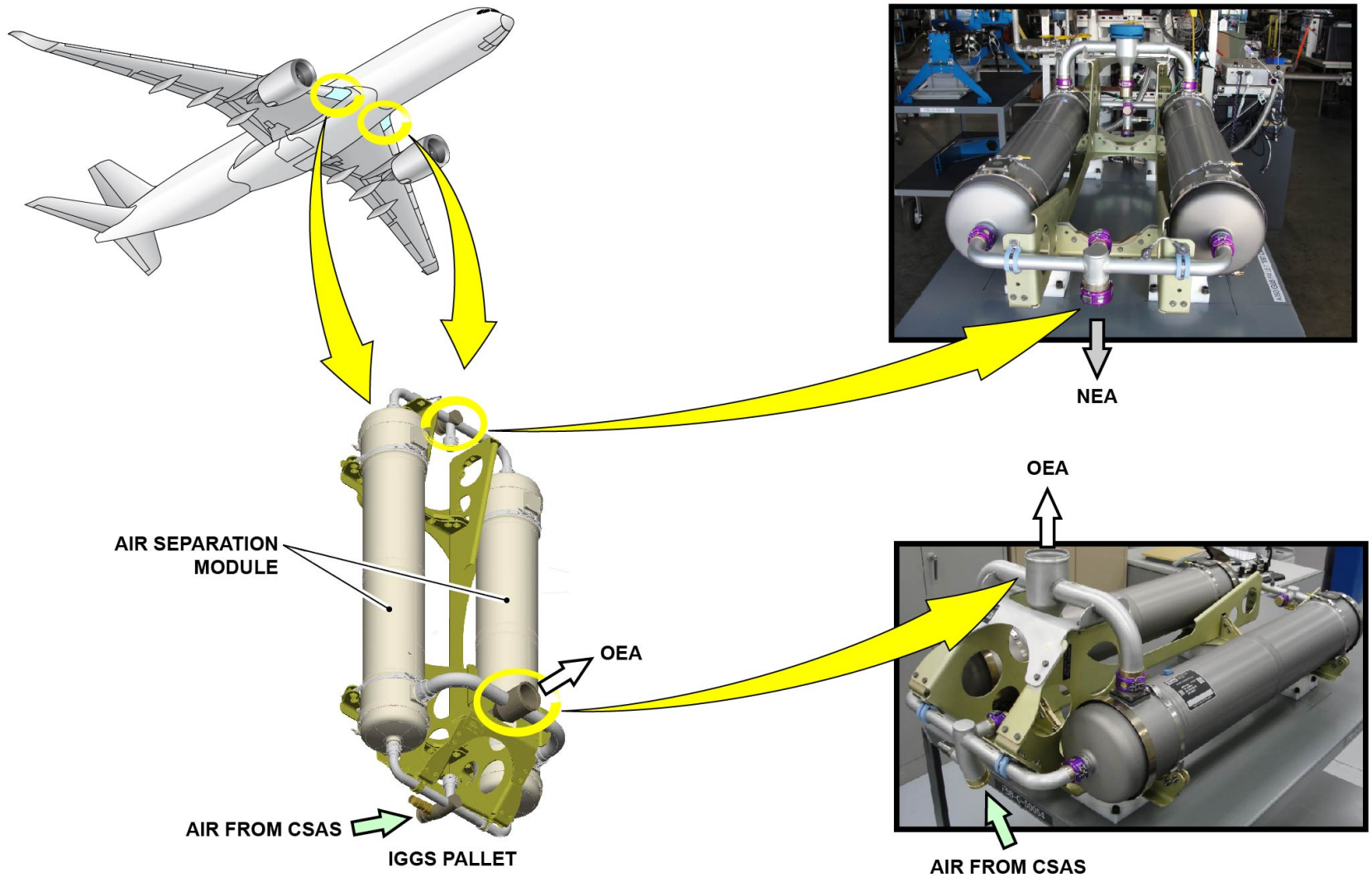
INERT GAS GENERATION SYSTEM - DESCRIPTION OF THE IGGS & DESCRIPTION OF THE IGGS COMPONENTS

INERT GAS SYSTEM DESCRIPTION (2/3)

Inert Gas Generation System (continued)

Description of the IGGS Component - IGGSPallet

There is one IGGS pallet in each wing leading edge. Each IGGS pallet has (2) ASMs, a temperature sensor, interconnect tubing and the structure to support all of these items.



INERT GAS GENERATION SYSTEM - DESCRIPTION OF THE IGGS COMPONENT - IGGSPALLET

INERT GAS SYSTEM DESCRIPTION (2/3)

Inert Gas Distribution System

Description of the IGDS

The IGDS has:
- Center fuel tank internal check valves
- Surge tank check valves
- Jet flow nozzles
- Pipes.

Description of the IGDS Components

The internal check valves of the center fuel tank are used as a reverse flow barrier to make sure that fuel does not go into the IGGS.
The surge-tank check valve is used as a flow path for the NEA into the wing fuel tanks. It prevents reverse flow from the wing fuel tanks to the center fuel tank.
The jet flow nozzles make the recirculation of the NEA in the center-fuel-tank cells better, to increase the homogeneity of the oxygen concentration. Gas comes from the right and left cells and is released into the middle cell.
The pipes send the NEA from the IGGS to the three fuel tanks. The pipe geometry has a continuous slope. Thus, no fuel is trapped in the pipes because the fuel is drained back by gravity to the fuel tanks for all the aircraft ground attitudes.

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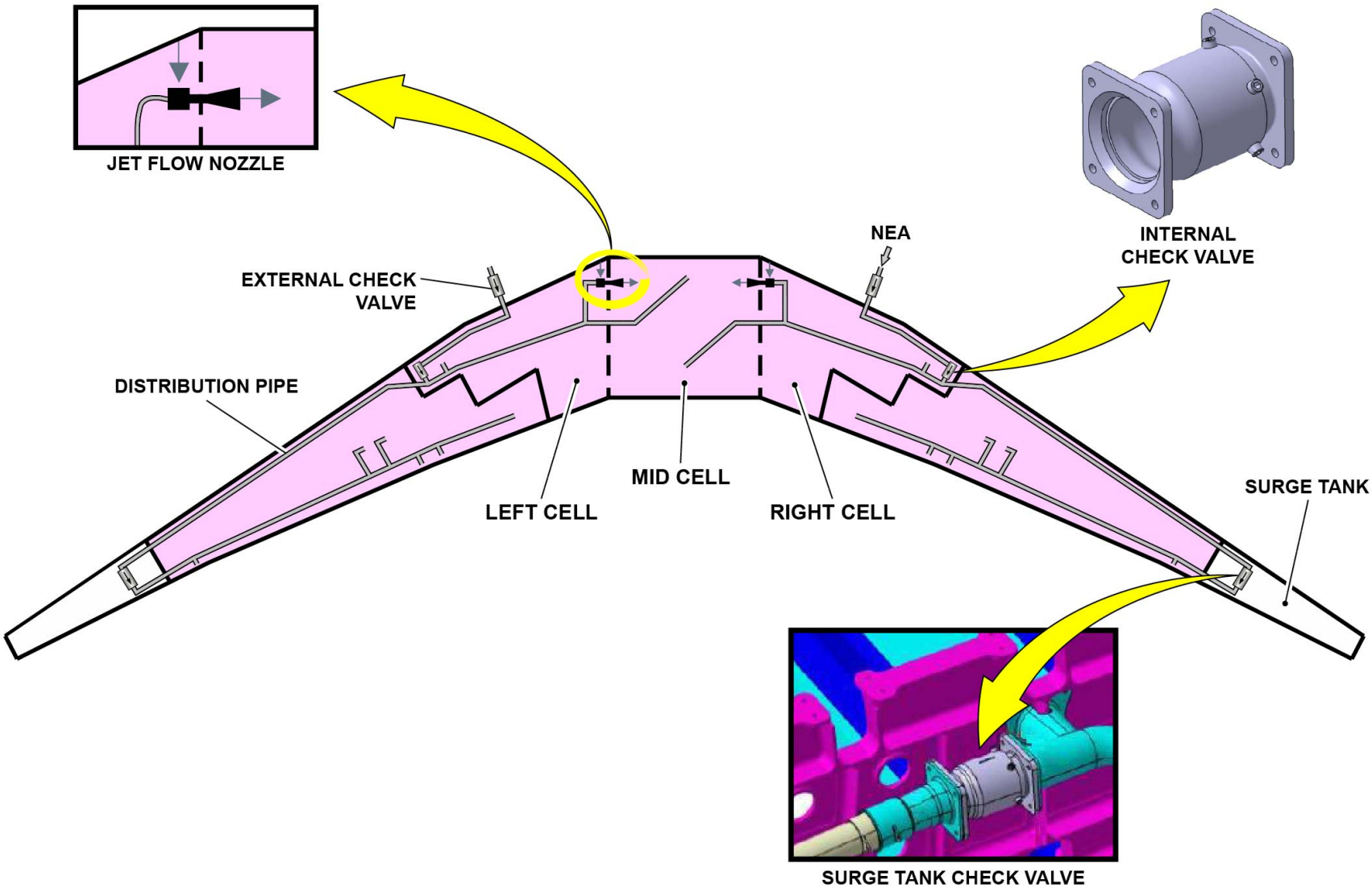

INERT GAS DISTRIBUTION SYSTEM - DESCRIPTION OF THE IGDS & DESCRIPTION OF THE IGDS COMPONENTS

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INERT GAS SYSTEM DESCRIPTION (2/3)

Control of the Inert Gas System

The IGGS only operates in flight. On the ground, the IGGS is in standby mode. The IGGS can be used on the ground, for example to test the system, for 60 seconds maximum. All the sensors and valves of the IGGS are connected to CRDCs with discrete and/or analog signals (hard-wired). The CRDCs change all the signals into AFDX messages and send them to the CPIOM IGGS application through the AFDX network. An IGGS application, hosted in a CPIOM, automatically controls the inert gas system.

Through the AFDX network, the inert gas system has an interface with other aircraft systems, specially the CSAS, the LGERS and the Air Data/Inertial Reference System (ADIRS). The CSAS application gives data about the CSAS status and receives data about the IGGS status. The IGGS cannot operate without data from the CSAS.

The LGERS and the ADIRS give data about the aircraft on the ground or in flight.

To change the position of the DFSOV, to adjust the flow of NEA sent to the fuel tanks, the IGGS system receives inputs from:

- The ADIRS: for the altitude
- The FWS: for the flight phases.

To test the IGGS (to sense and isolate failures), the operator can use BITE tests with bleed air from the CSAS and without bleed air. To do the BITE tests, the IGGS must receive inputs from the Fuel Quantity and Management System (FQMS).

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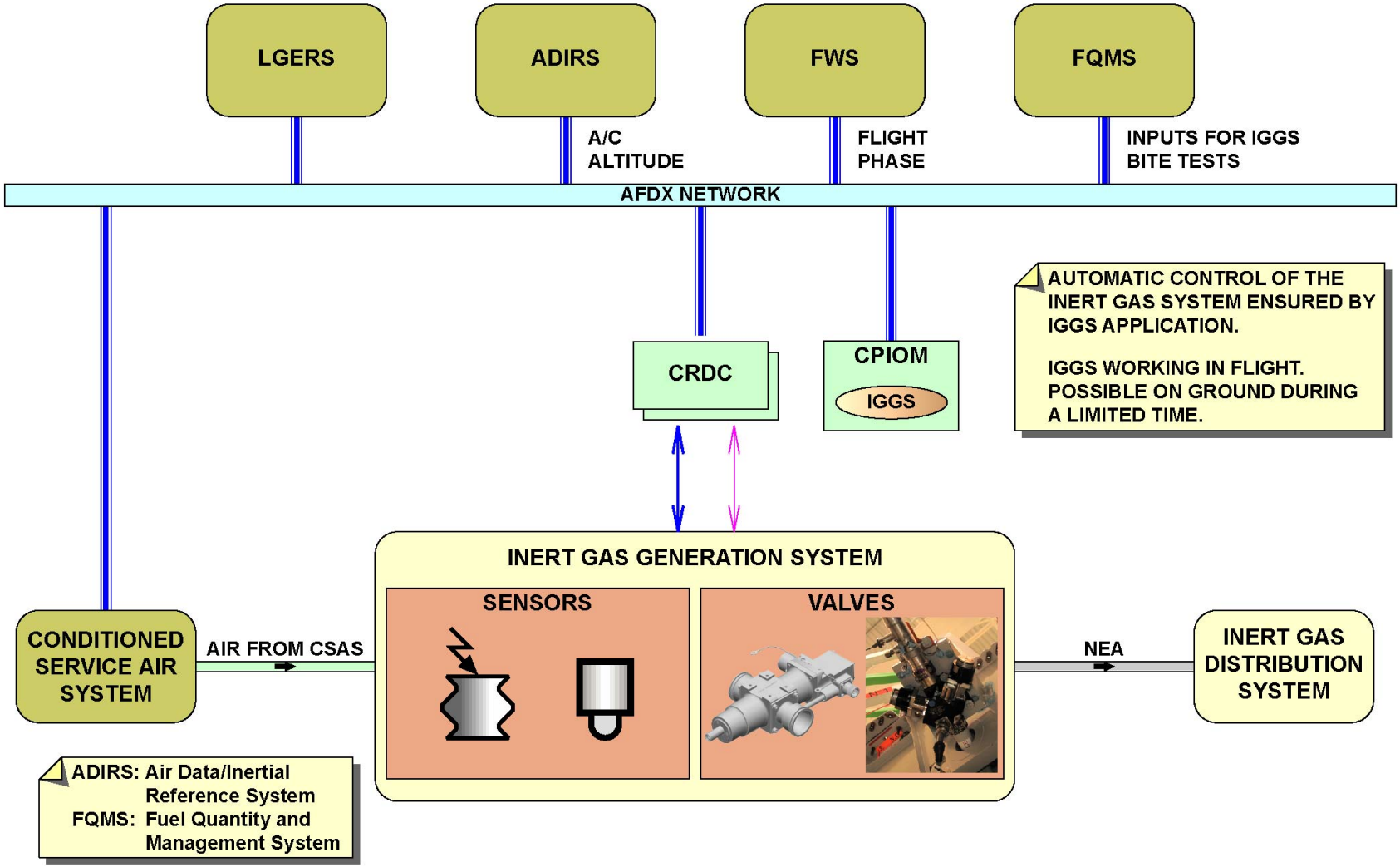

CONTROL OF THE INERT GAS SYSTEM

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