



Aeronautical Hydraulic Bench

Aeronautical Hydraulic Bench at a glance

> Highlights & Key Activities

- ✓ Hydraulic connections
- ✓ Implementation of hydraulic operating parts (aircraft landing gear, wing flaps, ailerons) with kinematics identical to reality
- ✓ Sub-assembly for cylinder test
- ✓ Hydraulic measurements (Temperature, Pressure)
- ✓ Data acquisition
- ✓ Hydraulic Hose Testing
- ✓ Manipulator control of servo jacks
- ✓ Maintenance (filter replacement)
- ✓ Wiring of hydraulic circuits
- ✓ Simulation of hydraulic supply failures (main circuit, emergency circuit, accumulator, hand pump)

> Composition of the bench

- ✓ 1 free-standing frame with secure enclosure
- ✓ 1 hydraulic unit with industrial oil and retention tank
- ✓ Manifolds with JIC fittings
- ✓ 1 measuring and control panel
- ✓ 1 electrical cabinet

> Features

- ✓ L/ W/ H: 2000 x 1350 x 1800 mm
- ✓ Energy: single-phase 230V power supply

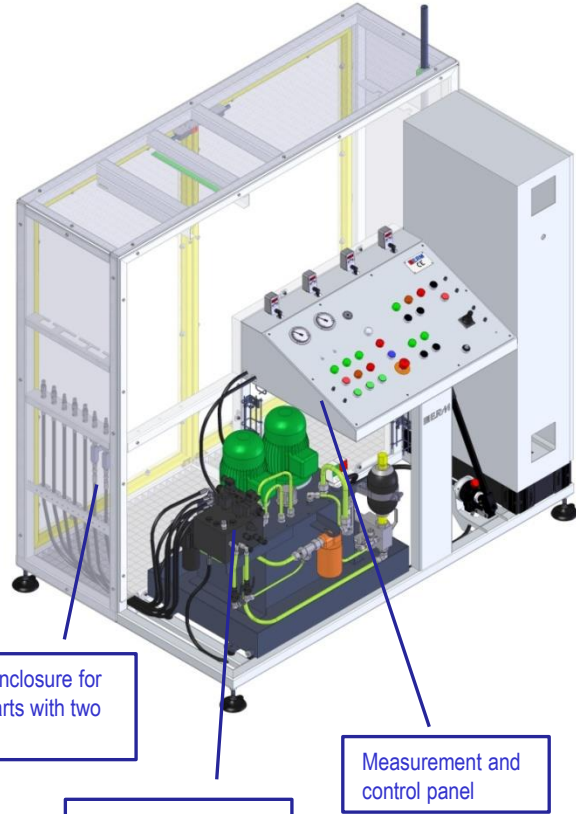
> This system is accompanied by a fully digital technical file (source and pdf files), with the following elements

- ✓ Safety, installation, commissioning and operating instructions
- ✓ Overall plan with mass and dimensions
- ✓ Nomenclatures (quantity / supplier / manufacturer / ref / designation)
- ✓ Manufacturer's documentation of all components
- ✓ Hydraulic and electrical diagrams
- ✓ 3D modelling of the chassis and operating parts in SolidWorks
- ✓ Manufacturer's documentation of the oil used with safety data.

References

- ✓ HA10 : Aeronautical Hydraulic Bench (With cylinder test sub-assembly only)
- ✓ HA11: Landing gear sub-assembly with TOR actuator
- ✓ HA12: Aileron subscale with servo
- ✓ HA13: Wing flap sub-assembly with hydraulic motor

Bac PRO MSPC
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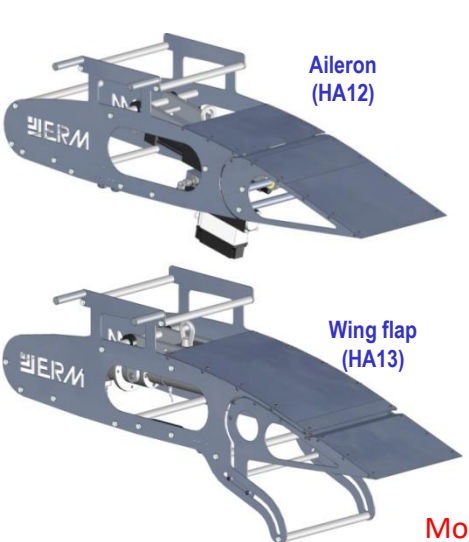


Reception enclosure for operating parts with two doors

Measurement and control panel

Hydraulic power plant

Reception enclosure for operating parts with two doors





General description

- ✓ Filter accessible for change by students
- ✓ The enclosure for receiving the operating parts is sized to receive the landing gear.
- ✓ The housing of the operating parts is equipped with elements for the attachment of different types of standard cylinders.

Main components

- Functional sub-assembly 1
 - Simplified landing gear, designed and supplied by ERM, allowing the use of an industrial hydraulic TOR cylinder.
 - This sub-assembly is based on the original kinematics of a landing gear.
 - The various mechanical parts are visually similar to the original train so that the student can identify them.
- Functional sub-assembly 2
 - Simplified wing flap, designed and supplied by ERM, allowing the use of a hydraulic motor without recopying associated with a worm gear system.
 - This sub-assembly takes over the original kinematics of the wing flap.
 - The various mechanical parts are visually similar to the original shutter so that the student can identify them.
- Functional sub-assembly 3
 - Simplified aileron, designed and supplied by ERM, set in motion by an electrically controlled servo jack (50mm travel) associated with a manipulator.
 - This sub-assembly takes over the original kinematics of the spoiler.
 - The various mechanical parts are visually similar to the original fin so that the student can identify them

Operative part



Hydraulic part

General description

- ✓ Operating pressure up to 100 bar, adjustable with pressure regulator
- ✓ Flow rate in the main circuit: approx. 2L/min
- ✓ Secondary circuit flow rate: approx. 1L/min
- ✓ The hydraulic components are of industrial type.
- ✓ JIC type fittings
- ✓ Accumulator with its management

Main components

- ✓ Hydraulic power plant with two fixed flow gear pumps (main and secondary supply)
- ✓ Two ¼ turn valves simulating a fault on the main and secondary supply circuits
- ✓ Pressure switch for switching on the secondary supply circuit (first redundancy)
- ✓ Accumulator large enough to allow a final operation (1L) with pressure switch controlled 2/2-way valve (second redundancy)
- ✓ Hand pump (third redundancy, only for landing gear and wing flap)
- ✓ 4/3 spool valve with on/off button
- ✓ Adjustable flow restrictor mounted in





Electrical part

General description

The cabinet is supplied from the single-phase 230V mains supply with TT neutral and 30 mA residual current protection

Main components

- ✓ A master disconnect switch
- ✓ An electrical protection package
- ✓ A 24 VDC power supply
- ✓ A preventa type safety relay associated with 2 door safety switches, 1 emergency stop push button and a contactor
- ✓ Two motor starters to start the two pumps, with a valve to regulate the speed of the pumps
- ✓ A programmable logic module
- ✓ A set of terminals for connecting the various components
- ✓ An analogue electronic module for hydraulic control

Control Panel

Main components

- ✓ Management of the hydraulic plant
- ✓ Landing gear management
- ✓ Wing flap management
- ✓ Aileron management
- ✓ Analogue outputs (via BNC) for data acquisition:
 - Central pressure (0-10V signal with 1V=10bars)
 - Accumulator pressure (0-10V signal with 1V=10bars)
 - Stem pressure (0-10V signal with 1V=10bars)
 - Pressure was (0-10V signal with 1V=10bars)
 - Aileron setpoint (0-10V signal)
 - Aileron position (0-10V signal)



Sub-assembly for cylinder test



Male coupling 1-4 BSPP (Parker code: H2-63-BSPP) (not supplied)

Upper jaw

Lower jaw

Support plate

Cylinder (not supplied)



Educational file

Educational activities

- ✓ Analysis of the hydraulic generation system on an aircraft
 - Energy chain analysis
 - Identification of the constituents of the generation part
 - Implementation of the material
 - Simulation of failures on the primary and secondary circuits
- ✓ Study of the "landing gear" hydraulic sub-assembly:
 - Hydraulic and electrical connection
 - Powering up, shunting and measuring
 - Identify the components in the information and energy chain and highlight the associated flows
- ✓ Study of the "aileron" hydraulic sub-assembly
 - Hydraulic and electrical connection
 - Power up, aileron manoeuvre and measurements
 - Identify the components in the information and energy chain and highlight the associated flows
- ✓ Analysis and diagnosis of a failure situation
 - Writing a breakdown report
 - Identification of potentially faulty components
 - Selection of components to be changed and refurbishment
 - Restarting, adjusting and testing
 - Writing a report of the intervention

✓ TP1 Analysis of hydraulic generation system

- Discovering the general structure of the generation circuit
- Highlighting of redundancy systems (main, secondary, accumulator and hand pump)
- Identification of the main hydraulic constituents

✓ TP2 Landing gear sub-assembly

- Discovery of the material structure of the landing gear.
- Identification of the hydraulic components associated with the train (pre-actuator, actuator and connecting hoses)
- Discover the functioning of a hydraulic circuit

✓ TP3 Wing flap sub-assembly

- Discovery of the material structure of a wing flap (Function, architecture and kinematics)
- Functional modelling of the whole
- Identification of the hydraulic components associated with the damper (pre-actuator, actuator and connection hoses)

✓ TP4 Aileron Sub-Assembly

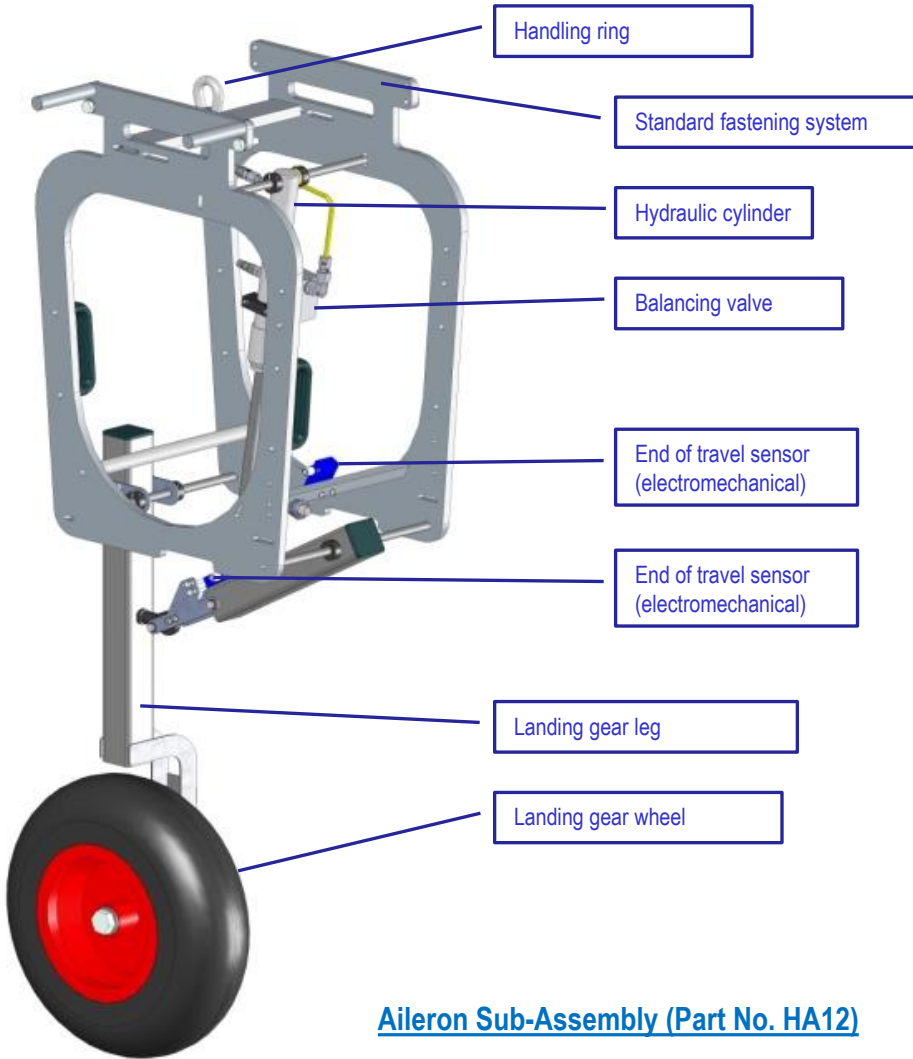
- Discovering the fin
- Identification of the components that enable the fin to move
- Electrical measurements of setpoint signals and measurement

✓ TP5 Failure Analysis and Diagnosis

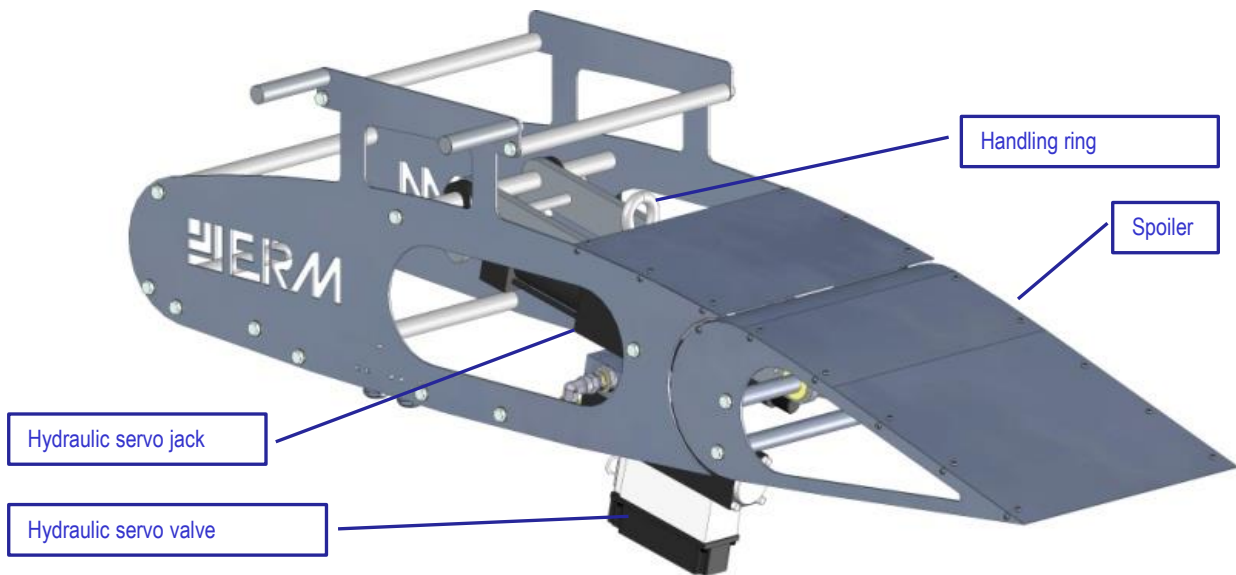
- Powering up, operating the gear or wing flap and identifying the fault
- Analysis of the situation based on the hydraulic diagram
- Identification of potentially faulty components
- Restarting, adjusting and testing
- Drafting of an intervention report



Landing gear sub-assembly (Part number HA11)

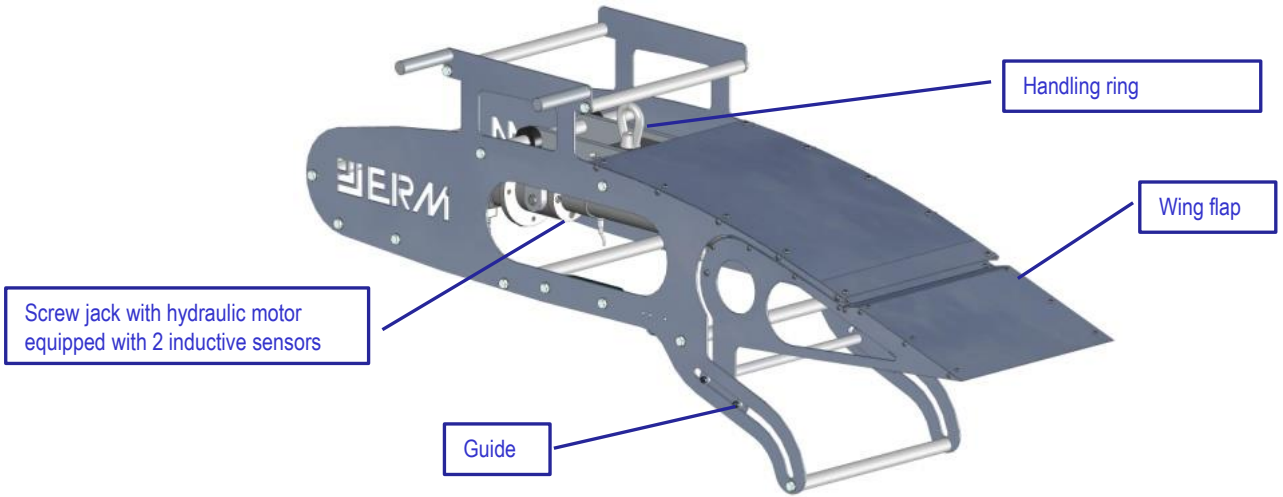


Aileron Sub-Assembly (Part No. HA12)

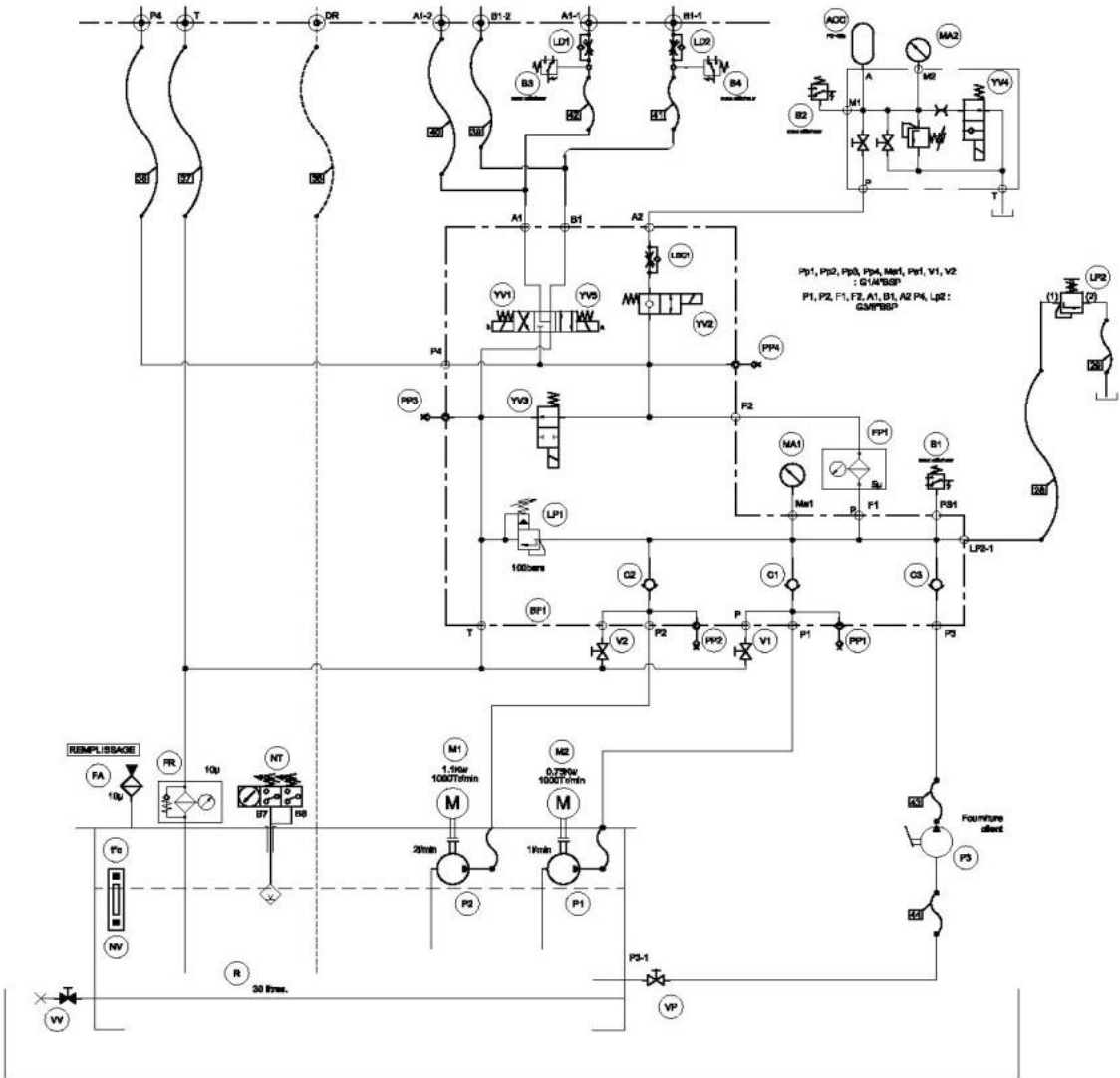




Wing flap sub-assembly (Part number HA13)



Hydraulic schematic diagram





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Oil analysis case



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Oil Filtration Group



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Hydraulic measurement case

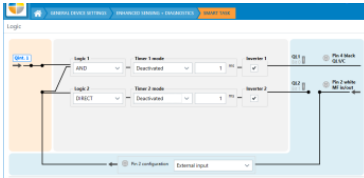
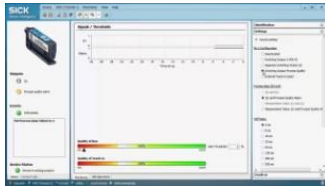


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Smart IoT Sick TDCE & Smart Sensors Case (SK00)

The Smart IoT Sick TDCE Gateway & Smart Sensors Toolkit contains several industrial smart sensor application cases.

In each case, in addition to its measured value, the sensor transmits control information to the Sick TDCE Smart IoT Gateway to allow visualisation of this data from a cloud or locally from the Node-RED interface.



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