H2 Multiple Elements Gas Container (MEGC)
143 cylinders x 153L x 300 bar



USERS MANUAL

CALVERA
Gas Technology

Calvera Maquinaria e instalaciones S.L.
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Index

1 DESCRIPTION OF COMPONENTS 3
2 MEGC TRANSPORT 3
3 CONNECTION BOARD 4
4 LOAD PROCEDURE / REFILLING OF THE MEGC 5
5 UNLOAD PROCEDURE 8
6 SAFETY VALVE AND BY-PASS VALVE 10
7 MAINTENANCE 11
8 SPARE PARTS 11
9 OPERATOR MANUAL CHECK LIST 12

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1 DESCRIPTION OF COMPONENTS

The MEGC includes the followings components:

- 143 composite cylinders at 300 barg working pressure.
- 1 manifold.
- 1 control board, on the rear side, including:
  - 6 x section ball valves (4 section with 3.366 water liters of volume, other with 4.131 and another one with 4.284 water liters of volume).
  - 2 x gauge valves with non-return valve (one for load, and the other one for unload, in serial with the former ones).
  - 1 x venting ball valve..
  - 1 x by-pass ball valve.
  - 1 x sampling collection valve.
  - 8 x manometers (one per section, other before the safety relief valve, and a general one).
  - 1 x Ground connection.
  - 1 x W30x2 RH (NEVOC), for load the gas.
  - 1 x W30x2 LH (NEVOC), for unload the gas.
  - 1 x 3/8" pneumatic male connection, to open safety valve.
  - 1 x Low pressure manometer (0-16 barg) for the pneumatic connection.
  - 1 x Ground connection.

2 MEGC TRANSPORT

The MEGC is transported over a 30 feet chassis trailer. The platform only has to be transported with a tractor unit, equipped with electrical and pneumatic connectors according to European standards.

Driver must be ADR approved.

During MEGC transport the all valves must be closed.

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It is necessary to depressurize the manifold through the vent valve.

It must be verified that the loading and unloading valves are fully closed.

The cabinet door must be closed and locked.

The identification plates must be verified.





3 CONNECTION BOARD

Before load or unload the MEGC, it is necessary to check the connection board.



The operator has to be sure that the tractor unit is disconnected from the chassis (electrical part).

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Prior to any operation the MEGC hast to be ground connected. For this it is equipped with a ground plate, to be connected at the appropriate ground point in the hydrogen installation (check Section 4).

4 LOAD PROCEDURE / REFILLING OF THE MEGC

During the load/MEGC refill procedure, the platform (chassis and MEGC) must be on an ATEX zone, and totally disconnected from the tractor unit.

Prior to any operation the MEGC hast to be ground connected. For this it is equipped with a plate under the control board, to connect a cable or a clamp, which must be connected at the appropriate ground point in the hydrogen installation. Ground plate can be observed on the picture below.



Before proceeding with the loading operation, a visual inspection of all components of the semi-trailer/MEGC is mandatory.

Special attention should be paid to load connector and valves.

If any abnormality is observed in the inspection, the operation must be stopped.

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Before loading, specially the first time, it is necessary to purge the MEGC with nitrogen the connections to avoid the presence of oxygen or other contaminants.

The pressure must be controlled in load operation to avoid exceeding the MEGC maximum allowable working pressure i.e. 300 barg.

The By-pass valve must be normally closed in normal operation. See 6 SAFETY VALVE AND BY-PASS VALVE for more information.

The pneumatic shut-off safety hose must also be connected during the load operation. This security system requires an inlet pressure of 10 barg pressure of air or nitrogen in order to open the pneumatic valve. The pressure on the compressed air line can be verified in the low-pressure manometer on the panel.

The load/unload hose has to be always connected prior to load procedures; check that load hose is clean and dry. According with the operation and the safety procedures the metal wire of the load/unload has to be fastened always prior to loading.

It is highly recommended that the load/unload hose has a venting system to relief pressure before disconnecting it.

Procedure:

- 1. Open section valves on the control board.
- 2. Verify the pressure in all section manometers.
- 3. Verify the pressure at the manometers before and after the safety relief valve. (must be equal or very similar to the pressure read on the section manometers).
- 4. Open main LOAD valve.
- 5. Start the load operation from the hydrogen installation into the MEGC.
- 6. Verify pressure in the manometers before and after the safety relief valve until they reach the maximum allowable working pressure (i.e. 300 barg)

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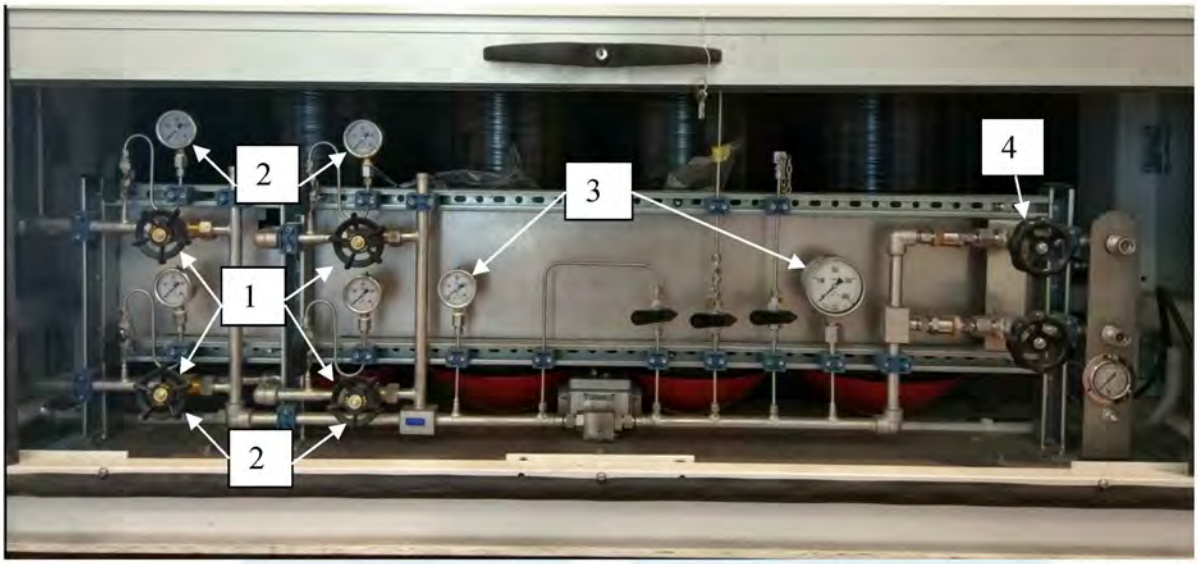
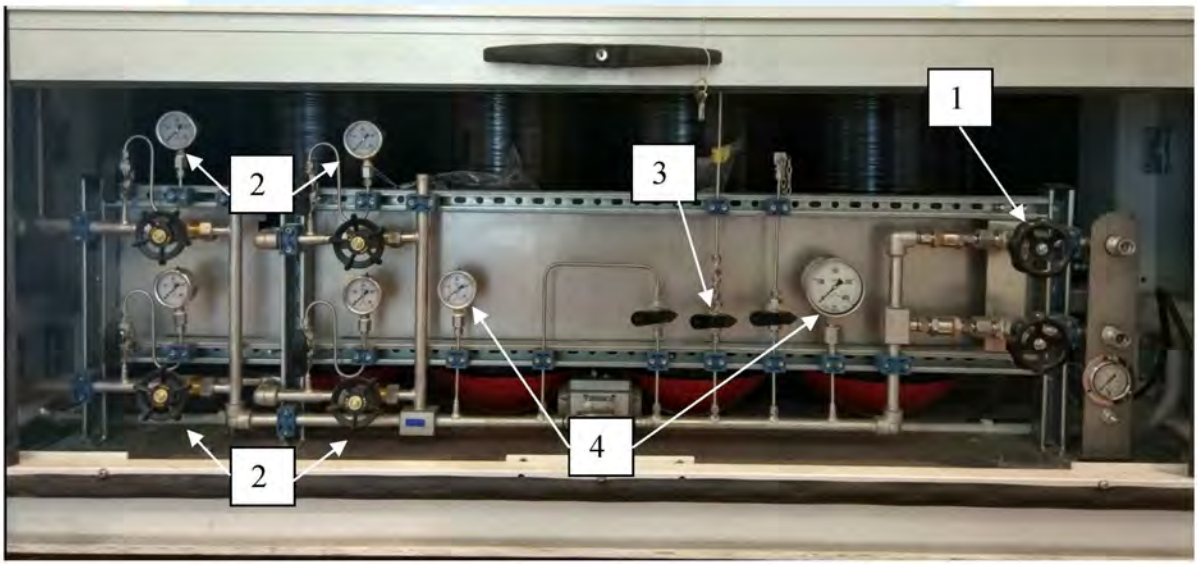


Once the MEGC is refilled, with pneumatic shut-off hose connected, and supplying the correct air pressure (i.e. 10 barg):

1. Close main LOAD valve
2. Close section valves.
3. Open venting valve.
4. Check pressure marked on manometers before and after pressure relief valve of control board reaches to 0 barg.
5. Close venting valve.
6. Disconnect the pneumatic shut-off safety hose.
7. Disconnect the load hose, once it is without pressure (check the general facility manual to follow the hose venting procedure.).



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5 UNLOAD PROCEDURE

During the unloading procedure, the platform (chassis and MEGC) must be on an ATEX zone, and totally disconnected from the tractor unit.

Before unloading, a visual inspection of all components of the semi-trailer/MEGC is mandatory.

Special attention should be paid to the unload connector and valves.

If any abnormality is observed in the inspection, the operation must be stopped.

By-pass valve must be normally closed in normal operation. See 6 SAFETY VALVE AND BY-PASS VALVE for more information.

The pneumatic shut-off safety hose must be connected. This security system requires an inlet pressure of 10 barg pressure of air or nitrogen in order to open the pneumatic valve. The pressure on the compressed air line can be verified in the low-pressure manometer on the panel.

The load/unload hose has to be always connected prior to unload procedures; check that load hose is clean and dry. According with the operation and the safety procedures the metal wire of the load/unload has to be fastened always prior to unloading.

It is highly recommended that the load/unload hose has a venting system to relief pressure before disconnecting it.

Procedure:

- 1. Open section valves.
- 2. Verify the pressure in all section manometers.
- 3. Verify the pressure at the manometers before and after the safety relief valve. (must be equal or very similar to the pressure read on the section manometers).
- 4. Open main UNLOAD valve.
- 5. Start the unload operation from the MEGC into the hydrogen installation.
- 7. Verify pressure in the manometers before and after pressure relief valve until it reaches the desired pressure

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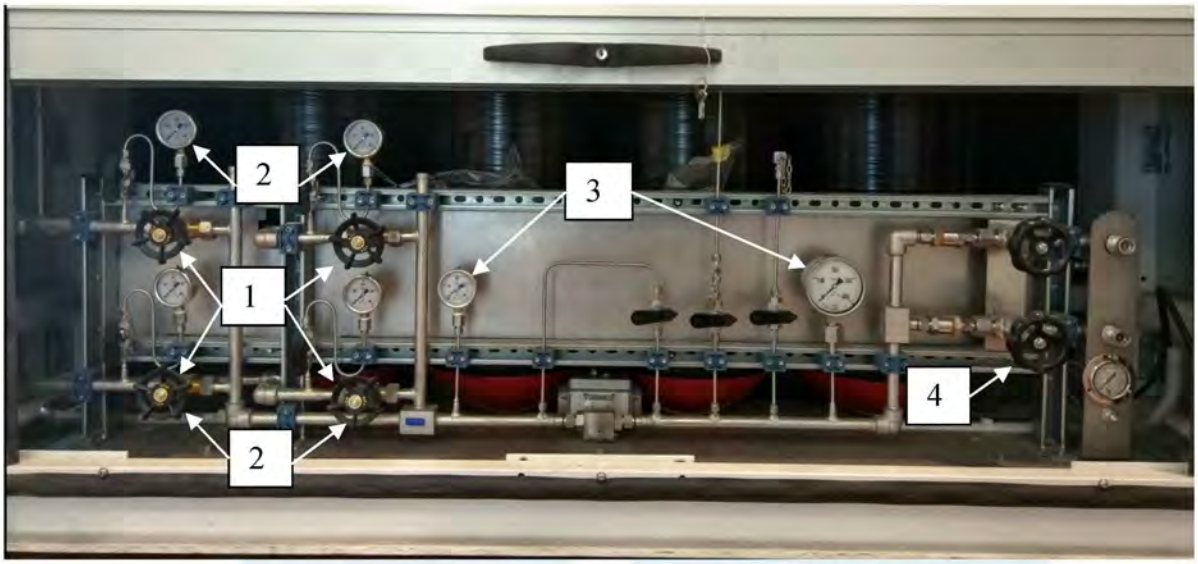
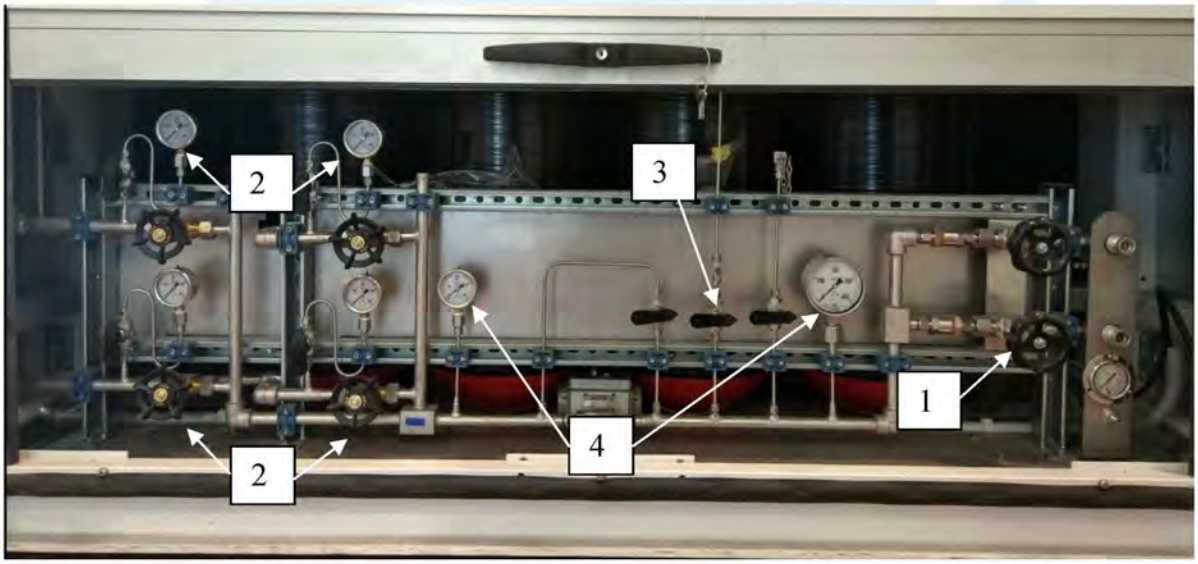


Once the MEGC is refilled, with pneumatic shut-off hose connected, and supplying the correct air pressure (i.e. 10 barg):

1. Close main UNLOAD valve
2. Close section valves.
3. Open venting valve.
4. Check pressure marked on manometers before and after pressure relief valve of control board reaches to 0 barg.
5. Close venting valve.
6. Disconnect the pneumatic shut-off safety hose.
7. Disconnect the load hose, once it is without pressure (check the general facility manual to follow the hose venting procedure.).



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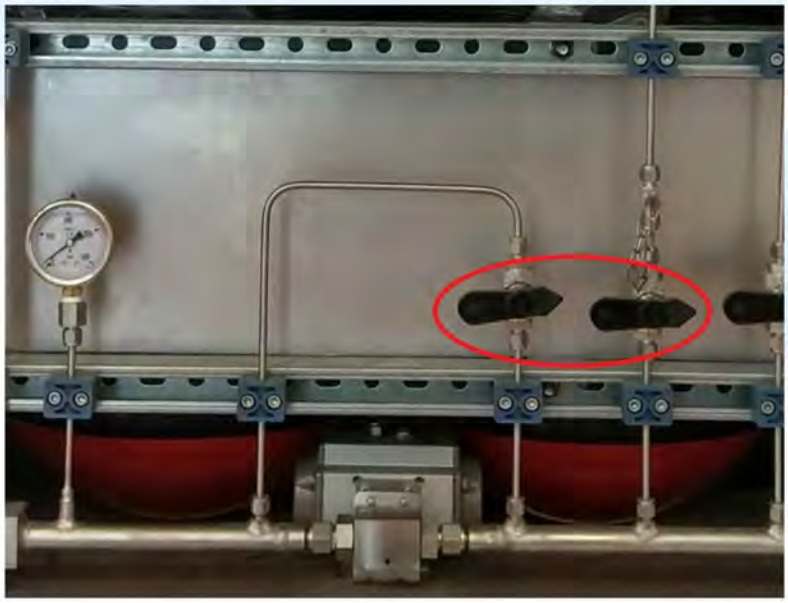
6 SAFETY VALVE AND BY-PASS VALVE

A pneumatic shut off valve stops any flow of hydrogen gas if the pneumatic shut-off safety hose is not connected and supplying the correct air pressure (i.e. 10 barg) or if the emergency button is pressed.





In case the pneumatic shut off valve closes during the load/unload procedures and it is necessary to vent the MEGC or the control board, this can be done by opening both the bypass valve as well as the venting valve.



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7 MAINTENANCE

About maintenance tasks, see Maintenance Manual provided by CALVERA.

8 SPARE PARTS

Description	Reference	Manufacturer
Cylinder Type 2 153L 300 Bar	BOT153.H2.300	5.1, 2, e
Gauge Valve	D605	
Gauge Valve	05349934ZZ00F0	
Safety Valve	SS-AFSS8RT-A30C4	
Manometer Glycerin Ø100 0-400 bar	9021035	

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9 OPERATOR MANUAL CHECK LIST

OPERATING MANUAL-Check list

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1) BEFORE ANY MANIPULATION IN THE CONTROL CABINET, ENSURE THE TRAILER IS GROUNDED.

2) CONNECT THE PNEUMATIC SHUT-OFF SAFETY HOSE.

3) VERIFY THE PRESSURE IN THE LOW PRESSURE MANOMETER

4) VERIFY VENTING VALVE AND BYPASS VALVE ARE BOTH CLOSED.

LOAD / REFILLING OF THE MEGC:

- 1. CONNECT THE PNEUMATIC SHUT-OFF SAFETY HOSE AND SUPPLY THE CORRECT AIR PRESSURE (10 BARG).
- 2. CONNECT THE LOAD/UNLOAD HOSE PRIOR TO LOAD PROCEDURES, AND FASTEN THE METAL WIRE.
- 3. OPEN SECTION VALVES ON THE CONTROL BOARD.
- 4. VERIFY THE PRESSURE IN ALL SECTION MANOMETERS.
- 5. VERIFY THE PRESSURE AT THE MANOMETERS BEFORE AND AFTER THE SAFETY RELIEF VALVE. (MUST BE EQUAL OR VERY SIMILAR TO THE PRESSURE READ ON THE SECTION MANOMETERS).
- 6. OPEN MAIN LOAD VALVE.
- 7. START THE LOAD OPERATION FROM THE HYDROGEN INSTALLATION INTO THE MEGC.
- 8. VERIFY PRESSURE IN THE MANOMETERS BEFORE AND AFTER THE SAFETY RELIEF VALVE UNTIL THEY REACH THE MAXIMUM ALLOWABLE WORKING PRESSURE (I.E. 300 BARG)
- 9. CLOSE MAIN LOAD VALVE
- 10. CLOSE SECTION VALVES.
- 11. OPEN VENTING VALVE.
- 12. CHECK PRESSURE MARKED ON MANOMETERS BEFORE AND AFTER PRESSURE RELIEF VALVE OF CONTROL BOARD REACHES TO 0 BARG.
- 13. CLOSE VENTING VALVE.
- 14. DISCONNECT THE PNEUMATIC SHUT-OFF SAFETY HOSE.
- 15. DISCONNECT THE LOAD HOSE, ONCE IT IS WITHOUT PRESSURE (CHECK THE GENERAL FACILITY MANUAL TO FOLLOW THE HOSE VENTING PROCEDURE).

UNLOADTHE GAS FROM THE MEGC:

- 1. CONNECT THE PNEUMATIC SHUT-OFF SAFETY HOSE AND SUPPLY THE CORRECT AIR PRESSURE (10 BARG).
- 2. CONNECT THE LOAD/UNLOAD HOSE PRIOR TO LOAD PROCEDURES, AND FASTEN THE METAL WIRE.
- 3. OPEN SECTION VALVES.
- 4. VERIFY THE PRESSURE IN ALL SECTION MANOMETERS.
- 5. VERIFY THE PRESSURE AT THE MANOMETERS BEFORE AND AFTER THE SAFETY RELIEF VALVE. (MUST BE EQUAL OR VERY SIMILAR TO THE PRESSURE READ ON THE SECTION MANOMETERS).
- 6. OPEN MAIN UNLOAD VALVE.
- 7. START THE UNLOAD OPERATION FROM THE MEGC INTO THE HYDROGEN INSTALLATION.
- 8. VERIFY PRESSURE IN THE MANOMETERS BEFORE AND AFTER PRESSURE RELIEF VALVE UNTIL IT REACHES THE DESIRED PRESSURE.
- 9. CLOSE MAIN UNLOAD VALVE
- 10. CLOSE SECTION VALVES.
- 11. OPEN VENTING VALVE.
- 12. CHECK PRESSURE MARKED ON MANOMETERS BEFORE AND AFTER PRESSURE RELIEF VALVE OF CONTROL BOARD REACHES TO 0 BARG.
- 13. CLOSE VENTING VALVE.
- 14. DISCONNECT THE PNEUMATIC SHUT-OFF SAFETY HOSE.
- 15. DISCONNECT THE LOAD HOSE, ONCE IT IS WITHOUT PRESSURE (CHECK THE GENERAL FACILITY MANUAL TO FOLLOW THE HOSE VENTING PROCEDURE).

SAFETY VALVE AND BY PASS VALVE:

- A PNEUMATIC SHUT OFF VALVE STOPS ANY FLOW OF HYDROGEN GAS IF THE PNEUMATIC SHUT-OFF SAFETY HOSE IS NOT CONNECTED AND SUPPLYING THE CORRECT AIR PRESSURE (I.E. 10 BARG) OR IF THE EMERGENCY BUTTON IS PRESSED.
- IN CASE THE PNEUMATIC SHUT OFF VALVE CLOSES DURING THE LOAD/UNLOAD PROCEDURES AND IT IS NECESSARY TO VENT THE MEGC OR THE CONTROL BOARD, THIS CAN BE DONE BY OPENING BOTH THE BYPASS VALVE AS WELL AS THE VENTING VALVE.

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