Procedure For preparing and operating Gas handling systems.

All gas panels supplied for beam line and off line experiments must be prepared to the specifications laid out in this document and be in line with the current pressure regulations at the time of use.

Gas panels up to 200 Bar working pressure

Standard 200 bar Gas Panel

1. All panels can only be prepared and supplied for use by qualified technicians of the Pressure and Furnace Section.
2. All gas panels must be fitted with an appropriate over pressurisation safety device which should be no more than 1.1 x working pressure for relief valves or plus or minus 5% for rupture discs.
3. All relief valves that are installed on panels must be retested every 12 months.
4. All panels must be retested every 12 months.
5. All panels must be visually inspected by the technician for damage prior to setting up.
6. Once the panel is fully assembled it must be leak tested by evacuating the system and using a helium leak detector. The leak rate must be better than 2.0 x 10^{-8} mbar litres per second. This must be done every time the system is broken.
7. If the panel is to be used with Flammable, Explosive, Toxic, Harmful or Irritant gases it must have a second test by pressurising the panel to the working pressure of the system with an Inert gas and left for 15 mins to check for leaks in the system. This must be done every time the system is broken.

8. If the panel is to be used with Flammable, Explosive, Toxic, Harmful or Irritant gases all relief valves and rupture discs must be plumbed in so that if there is an over pressurisation the exhausted gas is exhausted into a spark proof extraction.
9. The gas panels can only be operated by visiting users or Scientists if a member of the Pressure and Furnace Section assesses they are competent to do so.
10. All panels must have an emergency shutdown procedure displayed clearly near the panel.
11. When using the panel any gas bottle connected to the system must remain isolated by the bottle valve and only open when taking gas from the bottle into the panel. Once the gas has been taken into the panel the bottle valve must be closed again. This removes the large volume of gas from the system.

High pressure Rigs up to 10Kbar (Inert gas)

High Pressure Intensifier System

1. All high pressure rigs can only be prepared and supplied for use by technicians of the Pressure and Furnace Section.
2. All high pressure rigs must be fitted with an appropriate over pressurisation safety device which should be no more than 1.1 x working pressure for relief valves or plus or minus 5% for rupture discs.
3. All relief valves that are installed on high pressure rigs must be retested every 12 months.
4. All high pressure rigs must be retested every 12 months.

5. All high pressure rigs must be visually inspected by the technician for damage prior to setting up.
6. All high pressure rigs must be tested by pressurising the panel to the working pressure of the system with an Inert gas and left for 15 mins to check for leaks in the system. This must be done every time the system is broken.
7. The high pressure rigs can only be operated by visiting users or Scientists if the Pressure and Furnace Section leader feels they are competent to do so.
8. All high pressure rigs must have an emergency shutdown procedure displayed clearly near the panel.
9. When using high pressure rigs any gas bottle connected to the system must remain isolated by the bottle valve and only open when taking gas from the bottle into the system. Once the gas has been taken into the panel the bottle valve must be closed again. This removes the large volume of gas from the system.

Operating Instructions for the 7 Kbar Hydrogen System in R55 Experimental Hall.

This rig should only be operated by trained members of the pressure and furnace section.

1. Ensure that the hazardous gas form has been filled out showing the emergency shutdown procedure and is clearly displayed with correct gas safety signs before starting any operation with this rig.

2. Before using the hydrogen rig it should be pressure tested to 100 bar above the experimental pressure but not above it's maximum working pressure of 7 Kbar. This should be carried out using helium gas.

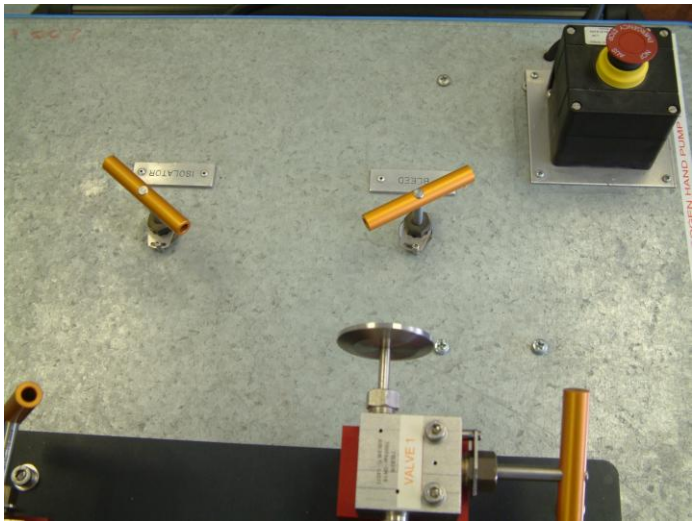

Fig 1

3. Connect the helium bottle to the gas inlet connection. Open the gas cylinder valve and let the helium into the system up to the closed isolator valve (see fig 1). Check that valve 1 (see Fig 2) is closed and that valve 2 is open and valve 3 is closed (see Fig 2). Then open the isolator valve slowly, this will allow the helium into the hand pump but not into the cell. Once this has stabilised you are now ready to use the diaphragm pump to increase the pressure.
4.

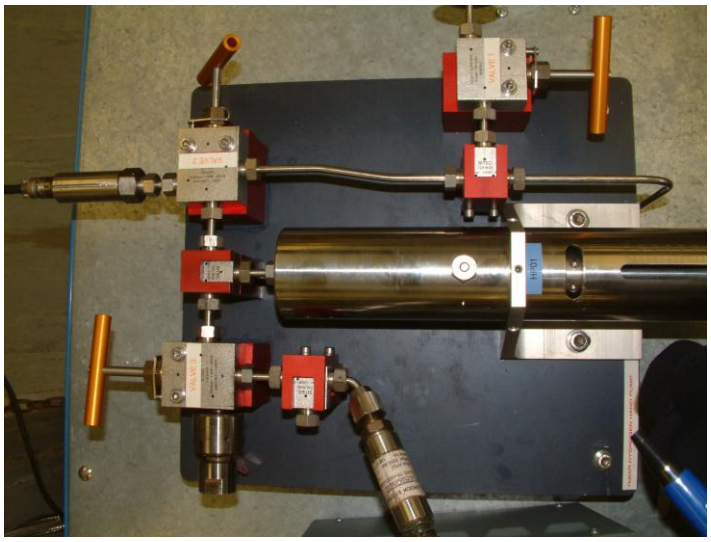

Fig 2

5. Start the diaphragm pump and watch the pressure gauges as the pressure increases. The Diaphragm pump can increase the pressure up to 2750 bar. Once this pressure has been reached stop the diaphragm pump and close valve 2 (see Fig 2), then close the cylinder bottle valve to cut off the helium supply as this is no longer required and leaves the low pressure side of the system in a safe state.

6. Now that valve 2 (see Fig 2) and the cylinder bottle valve are both closed it is safe to increase the pressure by using the hand pump. Slowly wind the hand pump in a clockwise direction to increase the pressure stopping every 500 bar to check the system is stable and leak tight. If the system is leak tight continue winding the hand pump until you reach the desired pressure

7. When depressurising the system firstly wind back the hand pump in an anti-clockwise direction until the pressure is dropped off to about 2750 bar. It is now safe to open valve 2 (see Fig 2) and to equalise the low and high pressure sides of the rig. Once the two sides have equalised slowly open valve 1 (see Fig 2) to vent the helium from the rig.

8. After the system has been tested and vented all the vent valves and rupture discs need to be connected to a spark proof extract system.

9. It is now safe to connect the hydrogen bottle which should be no larger than 10 litres. The system should be evacuated and vacuum leak tested to test the integrity of the hydrogen bottle connection.

10. Once the leak test has be carried out successfully the hydrogen can be let into the system up to the closed isolator valve (see Fig 1), then check the hydrogen bottle connection with snoop leak detection solution now the system is under bottle pressure as a secondary precaution (if you suspect the rig is leaking you must depressurise the system as stated in section 13 and re-pressure test with helium to find the leak).

11. Check that valve 1 (see Fig 2) is closed and that valves 2 and 3 are open (see Fig 2). Then open the isolator valve (see Fig 1) slowly, this will allow the hydrogen into the hand pump and into the cell. Once this has stabilised you are now ready to use the diaphragm pump to increase the pressure.

12. Start the diaphragm pump and watch the pressure gauges as the pressure increases. The Diaphragm pump can increase the pressure up to 2750 bar. Once this pressure has been reached stop the diaphragm pump and close valve 2 (see Fig 2), then close the cylinder bottle valve to cut off the hydrogen supply as this is no longer required and leaves the low pressure side of the system in a safe state.

13. Now that valve 2 (see Fig 2) and the cylinder bottle valve are both closed it is safe to increase the pressure by using the hand pump. Slowly wind the hand pump in a clockwise direction to increase the pressure stopping every 500 bar to check the system is stable and leak tight. If the system is leak tight continue winding the hand pump until you reach the desired pressure (if you suspect the rig is leaking you must depressurise the system as stated in section 13 and re-pressure test with helium to find the leak).

14. When depressurising the system firstly check that the extract system is still running, then ensure that the hydrogen bottle is isolated and then wind back the hand pump in an anti-clockwise direction until the pressure is dropped off to about 2750 bar. It is now safe to open valve 2 (see Fig 2) and to equalise the low and high pressure sides of the rig. Once the two sides have equalised slowly open valve 1 (see Fig 2) which should be connected to the spark proof extract system and vent the hydrogen from the rig at a controlled rate always checking that the extract system is still running.