Using the High Pressure Equipment at μE1

(If you read this manual for the first time you should
look at the warnings on the last page first)

In the μE1 area, before any action in the Studio A:

1. Close the `relief valve` behind the round hole in the "wood box" (turning clockwise= closing).

2. Open the He bottle (if you don't find a bottle: go shopping, the `Rohmateriallager` (WMSA) offers a 50 l He 4.6 bottle for approx. sfr 270.- ; don't forget to apply a tight binding approximation between bottle and wall). *Caution:* Use max. 80 bar as input for the HP pump, a reduction valve should be installed! Disregarding this can damage the first stage of the pump.

3. For any HP operation, the area (bunker door) has to be locked, even for tests without the beam! Sometimes you have to convince the people in the control room of that.

In the Studio A, green control panel on the left side:

A. Applying pressure

Situation: The green and the red (or orange) light is ON. Otherwise the pressure in the pumping unit is below 20-40 bar (see display, hopefully installed, if not use any multimeter and the "thick black cable with 2 bananas": 1 V = 1 GPa = 10 kbar). Possible reasons: The He bottle is not open or empty (i.e. pressure is below 40 bar), `relief valve` is not closed proberly, lamps are defect (all?). Check!

A1. Close the `valves` C and D (push green buttons, light=closed).

A2. Switch on the `membrane compressor` (push green button, light=on).

A3. Open the `valve` E (perhaps already open, the state when you start from ambient pressure).

A4. Pressure should increase slowly (after 3-5 min 1.5 kbar).

This procedure is suitable for pressures up to 1.5 kbar.

A5. Close the `valve` E when desired pressure is reached.

A6. Switch OFF the `membrane compressor`, you hear the noise of releasing "some" pressure; don't panic it seems to normal ;-) .

For higher pressure you have to use the additional `intensifier`, the second stage of the pumping unit, so after A4 continue with:

A5b. Set the `regulator` to 0 (turning anticlockwise completely). If the pressure exceeds 600 bar switch ON the `intensifier` (push green button, light=on). You can use the `intensifier` already with a pressure of about 300 bar. Since the cylinder of the `intensifier` is moved down by this pressure it takes longer if the pressure is lower.

A6b. Slightly open the `regulator`, i.e. set the `regulator` to 0.5...2.0. *Warning: Go only far beyond 2.5 with the* `regulator` *if the pressure, after several moves of the cylinder (orange light=cylinder going down, red light=cylinder going up=pumping), does not increase anymore. Increase the value of the* `regulator` *only in steps of 0.5 and keep your eyes on the pressure display! Two hand operation is useful: Left hand on the regulator and right hand on the switch of valve E.*

A7b. Close the `valve` E when the desired pressure is reached.

A8b. Set the `regulator` to 0. Switch OFF the `intensifier`.

A9b. Switch OFF the `membrane compressor`.

B. Releasing pressure

Situation: Cell under high pressure, `valves` C, D and E are closed.

Mind the order!

B1. Open the `valves` C and D (push red buttons), wait 10 sec.

B2. Close the `valves` C and D (push green buttons).

B3. Open the `valve` E. Wait 10 sec. Pressure should go down 200-800 bar.

B4. Close the `valve` E. If pressure $\geq$ 1 kbar then goto point B1 else

B5. Open the `valves` C and D (push red buttons). Open the valve E. The pressure should be in the range of the bottle pressure, i.e. 80 to 150 bar.

Now you can safely open the area door. If you are going to disconnect your pressure cell from the pumping unit first of all close the bottle and open the `relief valve`!

C. Increasing already applied pressure

Situation: Cell under pressure, `valves` C, D and E are closed. `Membrane compressor` and `intensifier` are switched OFF.

C1. Open the `valve` E. Pressure goes down approx. 200-800 bar.

C2. Switch ON the `membrane compressor`. If you want to reach a pressure below 1.5 kbar goto point A3.

C3. If you want reach a pressure above 1.5 kbar additionally switch on the `intensifier`. Continue with point A5b.

D. Warnings

1. Always be sure what you are doing. Trial an error is not the right stragety for dealing with the HP equipment.
2. If someone enters the area (μE1) during a high pressure experiment, the complete pressure will be released immediately due to safety regulations. This might damage your sample (expensive single crystals are good canditates).
3. We strongly recommend not to use home-made extension to increase the power of the pumps.
4. While using the `intensifier` and `regulator` the eyes should kept on the pressure display. 20 seconds are enough to pump 12 kbar into your pressure cell which you carefully constructed for 8 kbar!
5. Before any mechanical manipulation (e.g. fixing screws, removing the pressure cell, etc.) close the He bottle and open the `relief valve` (both in the μE1 area)!

No garanty can be given for this manual or the pump itself. According to my knowledge there exists no real manual for this pump. This manual should help you to run the pump unit safely. The high pressure equipment is owned and maintained by the μSR group at the TU München. Address: Technische Universität München, Department E15, D – 85748 Garching, Fax: 0049-89-3207 780.

23-08-1997, Alexander Röck, Max-Planck-Institut für Metallforschung, Stuttgart.